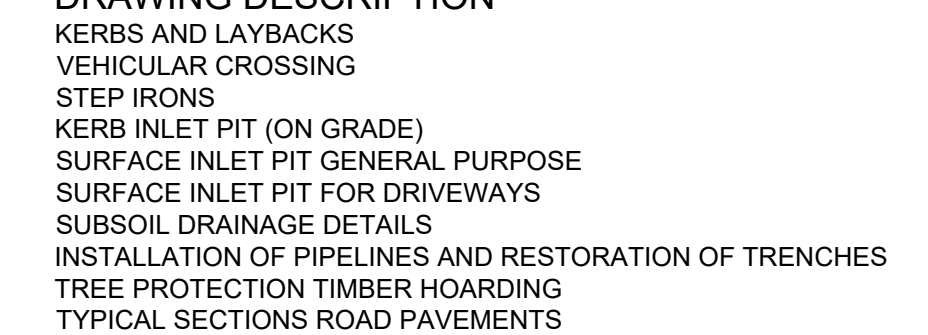


GENERAL NOTES

1. THESE DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL OTHER ENGINEERING AND ARCHITECTURAL DRAWINGS.
2. ANY OBSERVED DISCREPANCY IS TO BE REFERRED TO THE SUPERINTENDENT PRIOR TO COMMENCING WORKS.
3. THESE DRAWINGS SHALL ALSO BE READ IN CONJUNCTION WITH THE CIVIL SPECIFICATION.
4. DO NOT SCALE FROM THE DRAWINGS.
5. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED.
6. ALL LEVELS ARE EXPRESSED TO THE AUSTRALIAN HEIGHT DATUM (AHD).
7. THE CONTRACTOR SHALL SEEK APPROVAL FROM THE SUPERINTENDENT FOR ANY SUBSTITUTIONS OF PRODUCTS AND MATERIALS NOTED IN THE DRAWINGS.

SURVEY AND SERVICES INFORMATION

SURVEY

ORIGIN OF LEVELS : CONTACT THE SURVEYOR

DATUM OF LEVELS: CONTACT THE SURVEYOR

COORDINATE SYSTEM: MGA 2020

SURVEY PREPARED BY : LTS

SETOUT POINTS: CONTACT THE SURVEYOR

TTW DOES NOT GUARANTEE THAT THE SURVEY INFORMATION SHOWN ON THESE DRAWINGS IS ACCURATE AND WILL ACCEPT NO LIABILITY FOR ANY INACCURACIES IN THE SURVEY INFORMATION PROVIDED TO US FROM ANY CAUSE WHATSOEVER.

THE CONTRACTOR IS TO GET APPROVAL FROM THE RELEVANT STATE SURVEY DEPARTMENT, TO REMOVE/ADJUST ANY SURVEY MARK. THIS INCLUDES BUT IS NOT LIMITED TO: STATE SURVEY MARKS (SSM), PERMANENT MARKS (PM), CADASTRAL REFERENCE MARKS OR ANY OTHER SURVEY MARK WHICH IS TO BE REMOVED OR ADJUSTED IN ANY WAY.

TTW PLANS DO NOT INDICATE THE PRESENCE OF ANY SURVEY MARK. THE CONTRACTOR IS TO UNDERTAKE THEIR OWN SEARCH.

UNDERGROUND SERVICES - WARNING

THE LOCATIONS OF UNDERGROUND SERVICES SHOWN ON TTW'S DRAWINGS HAVE BEEN PLOTTED FROM DIAGRAMS PROVIDED BY SERVICE AUTHORITIES. THIS INFORMATION HAS BEEN PREPARED SOLELY FOR THE AUTHORITIES OWN USE AND MAY NOT NECESSARILY BE UPDATED OR ACCURATE.

THE POSITION OF SERVICES AS RECORDED BY THE AUTHORITY AT THE TIME OF INSTALLATION MAY NOT REFLECT CHANGES IN THE PHYSICAL ENVIRONMENT SUBSEQUENT TO INSTALLATION.

TTW DOES NOT GUARANTEE THAT THE SERVICES INFORMATION SHOWN ON THESE DRAWINGS SHOWS MORE THAN THE PRESENCE OR ABSENCE OF SERVICES, AND WILL ACCEPT NO LIABILITY FOR INACCURACIES IN THE SERVICES INFORMATION SHOWN FROM ANY CAUSE WHATSOEVER.

THE CONTRACTOR MUST CONFIRM THE EXACT LOCATION AND EXTENT OF SERVICES PRIOR TO CONSTRUCTION AND NOTIFY ANY CONFLICT WITH THE DRAWINGS IMMEDIATELY TO THE ENGINEER/SUPERINTENDENT.

THE CONTRACTOR SHALL NOTIFY THE RELEVANT SERVICE AUTHORITY FOR ANY REQUIRED MODIFICATION WORKS TO THEIR ASSETS. ALL SERVICE MODIFICATION WORKS SHALL BE UNDERTAKEN IN STRICT ACCORDANCE WITH THE REQUIREMENTS OF THE RELEVANT SERVICE AUTHORITY. THE CONTRACTOR SHALL PROVIDE ALL NECESSARY PROTECTION MEASURES TO EXISTING SERVICES THAT ARE TO BE RETAINED. THE CONTRACTOR IS LIABLE FOR RECTIFICATION/REINSTATEMENT COSTS FOR DAMAGE TO EXISTING SERVICES.

BOUNDARY AND EASEMENT NOTE

THE PROPERTY BOUNDARY AND EASEMENT LOCATIONS SHOWN ON TTW'S DRAWINGS HAVE BEEN BASED FROM INFORMATION RECEIVED FROM : LTS

TTW MAKES NO GUARANTEES THAT THE BOUNDARY OR EASEMENTINFORMATION SHOWN IS CORRECT. TTW WILL ACCEPT NO LIABILITIES FOR BOUNDARY INACCURACIES. THE CONTRACTOR/BUILDER IS ADVISED TO CHECK/CONFIRM ALL BOUNDARIES IN RELATION TO ALL PROPOSED WORK PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. BOUNDARY INACCURACIES FOUND ARE TO BE REPORTED TO THE SUPERINTENDENT PRIOR TO CONSTRUCTION STARTING.

KERBING NOTES

INCLUDES ALL KERBS, CHANNELS, SPOON DRAINS, CROSSINGS AND EDGES.

1. CONCRETE KERBS SHALL BE CONSTRUCTED USING GRADE 32MPA CONCRETE U.N.O.
2. ALL KERBS, CHANNELS, SPOON DRAINS AND CROSSINGS TO BE CONSTRUCTED ON MINIMUM 75MM GRANULAR BASECOURSE COMPACTED TO MINIMUM 98% MODIFIED MAXIMUM DRY DENSITY IN ACCORDANCE WITH AS 1289 5.2.1.

3. EXPANSION JOINTS (EJ) TO BE FORMED FROM 10MM COMPRESSIBLE FILLER BOARD FOR THE FULL DEPTH OF THE SECTION AND CUT TO PROFILE
- EXPANSION JOINTS TO BE LOCATED AT DRAINAGE PITS, ON TANGENT POINTS OF CURVES AND ELSEWHERE AT 12M CENTRES EXCEPT FOR INTEGRAL KERBS WHERE THE EXPANSION JOINTS ARE TO MATCH THE JOINT LOCATIONS IN SLABS.
4. SAW CUT JOINTS TO BE MIN 3MM WIDE AND LOCATED AT 3M CENTRES EXCEPT FOR INTEGRAL KERBS WHERE WEAKENED PLANE JOINTS ARE TO MATCH THE JOINT LOCATIONS IN SLABS.
5. BROOM FINISHED TO ALL RAMPED AND VEHICULAR CROSSINGS, ALL OTHER KERBING OR DISH DRAINS TO BE STEEL FLOAT FINISHED.
6. IN THE REPLACEMENT OF KERBS - EXISTING ROAD PAVEMENT IS TO BE SAWCUT 350MM FROM LIP OF UPON COMPLETION OF NEW KERBS, NEW BASECOURSE AND SURFACE IS TO BE LAID 350MM WIDE TO MATCH EXISTING MATERIALS AND THICKNESSES. EXISTING ALLOTMENT DRAINAGE PIPES ARE TO BE BUILT INTO THE NEW KERB WITH A 100MM DIA HOLE. EXISTING KERBS ARE TO BE COMPLETELY REMOVED WHERE NEW KERBS ARE SHOWN.

STORMWATER DRAINAGE NOTES

1. ALL NEW DRAINAGE PIPES EQUAL TO OR GREATER THAN 450Ø TO BE RUBBER RING JOINTED RCP UNLESS NOTED OTHERWISE IN DRAWINGS
- 1.1. RCP PIPES SUBJECT TO PEDESTRIAN LOADING ONLY TO BE CLASS 3 UNLESS NOTED OTHERWISE.
- 1.2. RCP PIPES SUBJECT TO TRAFFIC LOADING TO BE MIN. CLASS 4 UNLESS NOTED OTHERWISE
2. PIPES UP TO 375Ø SHALL BE HDPE OR SEWER GRADE UPVC WITH SOLVENT WELDED JOINTS UNLESS NOTED OTHERWISE IN DRAWINGS. SOME OF OUR PIPES ARE CPP. IN AREAS OF EXPANSIVE SOILS, UPVC PIPES MUST BE RUBBER RING JOINTED.
3. EQUIVALENT STRENGTH VCP OR FRP PIPES MAY BE USED SUBJECT TO APPROVAL.
4. PRECAST PITS MAY BE USED EXTERNAL TO THE BUILDING SUBJECT TO APPROVAL BY THE SUPERINTENDENT.
5. ENLARGERS, CONNECTIONS AND JUNCTIONS TO BE MANUFACTURED FITTINGS WHERE PIPES ARE LESS THAN 300 DIA.
6. SUBSOIL DRAINS TO BE SLOTTED FLEXIBLE 100DIA UPVC U.N.O.
7. WHERE SUBSOIL DRAINS ARE SHOWN AS UNSLOTTED, UNSLOTTED 100DIA UPVC SEWER GRADE PIPE IS TO BE USED.
8. SUBSOIL DRAINS TO BE LOCATED BEHIND ALL RETAINING WALLS AND NEW KERBING SHALL BE CONNECTED TO NEAREST STORMWATER PIT.
9. GRATES AND COVERS SHALL CONFORM WITH AS 3996-2006, AND AS 1428.1 FOR ACCESS REQUIREMENTS. ALL PITS WITHIN FOOT TRAFFIABLE AREA TO HAVE MINIMUM SLIP RESISTANCE OF R10 OR R11.
10. CONCRETE PIPES ARE TO BE INSTALLED IN ACCORDANCE WITH AS 3725. ALL BEDDING TO BE TYPE H2 U.N.O.
11. CARE IS TO BE TAKEN WITH LEVELS OF STORMWATER LINES. GRADES SHOWN ARE NOT TO BE REDUCED WITHOUT APPROVAL.
12. ALL STORMWATER PIPES TO BE 150 DIA AT 1 IN 100 MIN FALL U.N.O.
13. ADOPT INVERT LEVELS FOR PIPE INSTALLATION (GRADES SHOWN ARE ONLY NOMINAL).
14. ALL DRAINS AND OTHER SERVICE INFRASTRUCTURE TRENCHES BENEATH ROAD PAVEMENTS, DRIVEWAYS, FOOTPATHS OR CONCRETE STRUCTURES SLABS, OR WITHIN 1.0M OF CONCRETE STRUCTURES OR OTHER COUNCIL ASSETS, INCLUDING KERB, FOOTPATH, DRAINS, ETC MUST BE BACKFILLED WITH CLASS 2 FCR, COMPACTED AND TESTED TO THE SATISFACTION OF THE SUPERINTENDENT.
15. LITTER TRAPS TO BE INSTALLED IN ALL NEW GRATED PITS WITHIN LANDSCAPE AREAS.
16. ALL GRATED PITS WITHIN PAVED PEDESTRIAN AREAS TO BE HEEL GUARD BOLT DOWN COVER UNLESS SPECIFIED OTHERWISE ON PLANS.
17. ALL DOWNPIPES TO BE CONNECTED TO ADJACENT INGROUND STORMWATER DRAINAGE INFRASTRUCTURE. REFER TO HYDRAULIC DRAWINGS FOR DOWN PIPE LOCATION IF NOT DETAILED ON CIVIL PLANS.
18. ALL EXISTING ACTIVE DOWNPIPES, WHERE INGROUND STORMWATER HAS BEEN ABANDONED, TO BE CONNECTED TO NEW INGROUND STORMWATER DRAINAGE NETWORK.
19. PRIOR TO COMMENCING ANY STORMWATER DRAINAGE WORKS ON SITE THE CONTRACTOR MUST CONFIRM THE CONNECTION TO THE LEGAL POINT OF DISCHARGE AUTHORITY DRAIN AS DOCUMENTED BY:
- 19.1. VERIFICATION OF THE EXISTING INVERT LEVEL OF THE LEGAL POINT OF DISCHARGE TO COUNCIL DRAIN.
- 19.2. VERIFICATION THAT THE PROPOSED STORMWATER DRAIN INVERT LEVELS CAN ACHIEVE THE COUNCIL STANDARD CONNECTION DETAIL IN ACCORDANCE WITH COUNCIL STANDARDS
- 19.3. VERIFICATION THAT THE ROUTE IS CLEAR OF ALL OBSTRUCTIONS AND EXISTING SERVICES.
- THE CONTRACTOR SHALL NOTIFY THE SUPERINTENDENT IF ANY OF THE ABOVE CANNOT BE ACHIEVED PRIOR TO COMMENCING WORKS ON SITE.
20. THE INTERNAL BASE OF ALL DRAINAGE PITS SHALL BE BENCHED AND SHAPED TO ALLOW FREE FLOW OF WATER THROUGH TO THE PIT OUTLET PIPE.
21. PITS DEEPER THAN 1.0M SHALL BE FITTED WITH STEP IRONS.

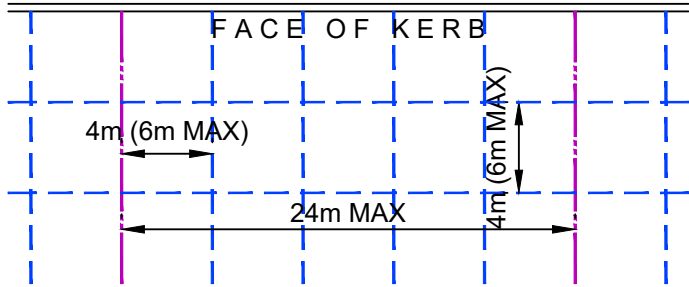
CONCRETE FINISHING NOTES

1. ALL EXPOSED CONCRETE PAVEMENTS ARE TO BE BROOMED FINISHED U.N.O REFER ARCHITECTURAL / LANDSCAPE DRAWINGS FOR PAVEMENT FINISHES.
2. ALL EDGES OF THE CONCRETE PAVEMENT INCLUDING KEYED AND DOWELLED JOINTS ARE TO BE FINISHED WITH AN EDGING TOOL.
3. CONCRETE PAVEMENTS WITH GRADES GREATER THAN 1:10 SHALL BE HEAVILY BROOM FINISHED.
4. CARBORUNDUM TO BE ADDED TO ALL STAIR TREADS AND RAMPED CROSSINGS U.N.O.

JOINTING NOTES

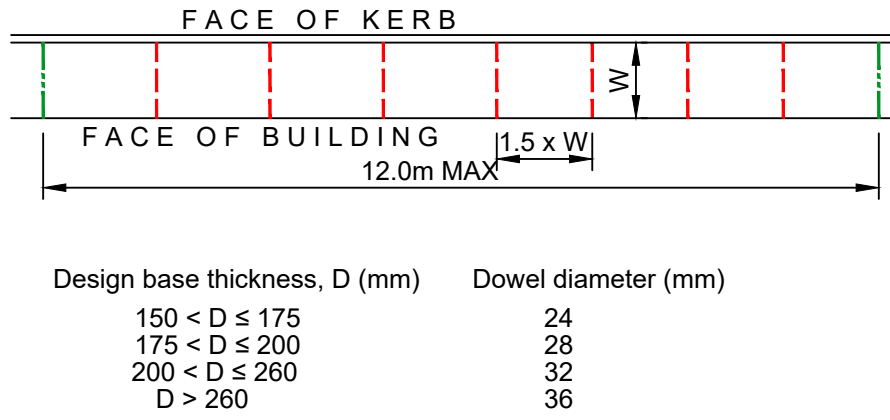
VEHICULAR PAVEMENT JOINTING

1. ALL VEHICULAR PAVEMENTS TO BE JOINTED AS SHOWN ON DRAWINGS.
2. SAW CUT JOINTS SHOULD GENERALLY BE LOCATED AT A MAXIMUM OF 6.0M CENTRES OR 1.5 X THE SPACING OF KEYED JOINTS, WHERE KEY JOINT SPACING IS LESS THAN 4.0M, WITH DOWELLED EXPANSION JOINTS AT MAXIMUM OF 24M CENTRES.
3. PROVIDE 10MM WIDE FULL DEPTH ISOLATION JOINTS BETWEEN BUILDINGS, STRUCTURES AND KERBS.
4. THE TIMING OF THE SAW CUT IS TO BE CONFIRMED BY THE CONTRACTOR ON SITE. SITE CONDITIONS WILL DETERMINE HOW MANY HOURS AFTER THE CONCRETE POUR BEFORE THE SAW CUTS ARE COMMENCED. REFER TO THE SPECIFICATION FOR WEATHER CONDITIONS AND TEMPERATURES REQUIRED.
5. INDICATIVE VEHICULAR PAVEMENT JOINTING AS FOLLOWS.



PEDESTRIAN FOOTPATH JOINTING

1. SAWCUT JOINTS ARE TO BE LOCATED WHERE POSSIBLE AT TANGENT POINTS OF CURVES AND ELSEWHERE.
2. SAW CUT JOINTS ARE TO BE LOCATED AT A MAX 1.5 X WIDTH OF THE PAVEMENT.
3. WHERE POSSIBLE JOINTS SHOULD BE LOCATED TO MATCH KERBING AND / OR ADJACENT PAVEMENT JOINTS.
4. ALL PEDESTRIAN FOOTPATH JOINTINGS AS FOLLOWS (U.N.O).
5. JOINTS SPACING ARE INDICATIVE ONLY AND THE CONTRACTOR TO REFER LANDSCAPE ARCHITECTURAL PLAN FOR FINAL LOCATION.



BULK EARTHWORKS NOTES

1. CONTRACTOR TO REFERENCE GEOTECHNICAL REPORT BY DOUGLAS PARTNERS 227191.00.R.001Rev0 DATED 15 NOVEMBER 2024 FOR SUBGRADE PREPARATION REQUIREMENTS.
2. ALL BATTERS AT A MAXIMUM SLOPE TO BE CONFIRMED AND SUBJECT TO GEOTECHNICAL ENGINEER ADVICE. REFER TO GEOTECHNICAL REPORT BY DOUGLAS PARTNERS 227191.00.R.001Rev0 DATED 15 NOVEMBER 2024.
3. EXCAVATED MATERIAL MAY BE USED AS STRUCTURAL FILL PROVIDED,
- 3.1. IT COMPLIES WITH THE SPECIFICATION REQUIREMENTS FOR FILL MATERIAL.,
- 3.2. THE PLACEMENT MOISTURE CONTENT COMPLIES WITH THE GEOTECHNICAL CONSULTANTS REQUIREMENTS, AND ALLOWS FILLING TO BE PLACED AND PROOF-ROLLED IN ACCORDANCE WITH THE SPECIFICATION. WHERE NECESSARY THE CONTRACTOR MUST MOISTURE CONDITION THE EXCAVATED MATERIAL TO MEET THESE REQUIREMENTS.

4. COMPACT FILL AREAS AND SUBGRADE TO NOT LESS THAN:		
LOCATION	STANDARD DRY DENSITY (AS 1289 5.1.1)	OPTIMUM MOISTURE CONTENT (OMC)
UNDER BUILDING SLABS ON GROUND	98%	±2%
UNDER ROADS AND CARPARKS	98%	±2%
LANDSCAPE AREAS:	95%	±2%

5. BEFORE PLACING FILL, PROOF ROLL EXPOSED SUBGRADE WITH A 10 TONNE MINIMUM ROLLER TO TEST SUBGRADE AND THEN REMOVE SOFT SPOTS (AREAS WITH MORE THAN 3MM MOVEMENT UNDER ROLLER). SOFT SPOTS TO BE REPLACED WITH GRANULAR FILL UNLESS NOTED OTHERWISE.
6. CONTRACTOR SHALL PLACE SAFETY BARRIERS AROUND EXCAVATIONS IN ACCORDANCE WITH RELEVANT SAFETY REGULATIONS.
7. BULK EARTHWORKS DRAWINGS ARE NOT TO BE USED FOR DETAILED EXCAVATION IN LANDSCAPE ZONES. CONTRACTOR TO MAKE ALLOWANCE FOR ADDITIONAL FILL OR CUT THROUGH LANDSCAPE ZONES.
8. CONTRACTOR TO REVIEW LANDSCAPE DRAWINGS TO CONFIRM SOFTSCAPE PROFILE DEPTHS.
9. STRIP ALL TOPSOIL FROM THE CONSTRUCTION AREA. ALL STRIPPED TOPSOIL SHALL BE DISPOSED OF OFFSITE UNLESS DIRECTED OTHERWISE.
10. MAKE SMOOTH CONNECTION WITH ALL EXISTING WORKS
11. COMPACT SUBGRADE UNDER BUILDINGS AND PAVEMENTS TO MINIMUM 98% STANDARD MAXIMUM DRY DENSITY IN ACCORDANCE WITH AS1289.5.1.1. COMPACTION UNDER BUILDINGS TO EXTEND 2.0M MINIMUM BEYOND BUILDING FOOTPRINT.
12. TEMPORARY STORMWATER CONTROL AND CONNECTIONS TO BE MANAGED ONSITE BY THE BUILDER/CONTRACTOR.
13. SITE TO BE FREE DRAINING AND SUBGRADE TO BE PROTECTED FROM MOISTURE INGRESS.
14. DEWATERING TO BE MANAGED BY CONTRACTOR AT ALL TIMES.
15. QUANTITIES TO UNDERLYING GEOLOGY SUCH AS ROCK OR NATURAL CLAY ARE INDICATIVE ONLY AND BASED ON THE GEOTECHNICAL INFORMATION AVAILABLE AT THE TIME OF ISSUE. UNDERLYING NATURAL CLAY AND ROCK LEVELS CAN BE HIGHLY VARIABLE BETWEEN GEOTECH SAMPLE LOCATIONS.
16. ALL EARTHWORKS ACTIVITIES SHALL BE UNDERTAKEN WITH LEVEL 1 SUPERVISION IN ACCORDANCE WITH AS3798 (2007) BY A SUITABLY QUALIFIED GEOTECHNICAL INSPECTION AND TESTING AUTHORITY (GITA) ENGAGED BY THE CONTRACTOR. AS A MINIMUM, THE FREQUENCY AND LOCATION OF TESTING SHALL BE IN ACCORDANCE WITH TABLE 3.1 OF AS3798 (2007). THE GITA IS TO MAINTAIN DAILY SITE RECORD SHEETS AS SET OUT IN AS3798 (2007).

EROSION AND SEDIMENT CONTROL

THESE DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL OTHER ENGINEERING AND ARCHITECTURAL DRAWINGS.

1. ALL WORK SHALL BE GENERALLY CARRIED OUT IN ACCORDANCE WITH:
- 1.1. LOCAL AUTHORITY REQUIREMENTS
- 1.2. EPA - POLLUTION CONTROL MANUAL FOR URBAN STORMWATER,
2. EROSION AND SEDIMENT CONTROL ARE TO BE PROVIDED FOR THE WHOLE OF THE WORKS BY THE CONTRACTOR. SHOULD THE CONTRACTOR STAGE THESE WORKS THEN THE DESIGN MAY BE REQUIRED TO BE MODIFIED. VARIATION TO THESE DETAILS MAY REQUIRE APPROVAL BY THE RELEVANT AUTHORITIES. THE EROSION AND SEDIMENT CONTROL SHALL BE IMPLEMENTED AND ADOPTED TO MEET RELEVANT EPA AND/OR AUTHORITY GUIDELINES
3. MAINTAIN ALL EROSION AND SEDIMENT CONTROL DEVICES TO THE SATISFACTION OF THE SUPERINTENDENT AND THE LOCAL AUTHORITY.
4. WHEN STORMWATER PITS ARE CONSTRUCTED PREVENT SITE RUNOFF ENTERING THE PITS UNLESS SILT FENCES ARE ERECTED AROUND PITS.
5. MINIMISE THE AREA OF SITE BEING DISTURBED AT ANY ONE TIME.
6. PROTECT ALL STOCKPILES OF MATERIALS FROM SCOUR AND EROSION. DO NOT STOCKPILE LOOSE MATERIAL IN ROADWAYS, NEAR DRAINAGE PITS OR IN WATERCOURSES.
7. ALL SOIL AND WATER CONTROL MEASURES ARE TO BE PUT BACK IN PLACE AT THE END OF EACH WORKING DAY, AND MODIFIED TO BEST SUIT SITE CONDITIONS.
8. CONTROL WATER FROM UPSTREAM OF THE SITE SUCH THAT IT DOES NOT ENTER THE DISTURBED SITE.
9. ALL CONSTRUCTION VEHICLES SHALL ENTER AND EXIT THE SITE VIA THE TEMPORARY CONSTRUCTION ENTRY/EXIT.
10. ALL VEHICLES LEAVING THE SITE SHALL BE CLEANED AND INSPECTED BEFORE LEAVING.
11. MAINTAIN ALL STORMWATER PIPES AND PITS CLEAR OF DEBRIS AND SEDIMENT. INSPECT STORMWATER SYSTEM AND CLEAN OUT AFTER EACH STORM EVENT.
12. CLEAN OUT ALL EROSION AND SEDIMENT CONTROL DEVICES AFTER EACH STORM EVENT.

SEQUENCE OF WORKS

1. PRIOR TO COMMENCEMENT OF EXCAVATION THE FOLLOWING SOIL MANAGEMENT DEVICES MUST BE INSTALLED.
- 1.1. CONSTRUCT SILT FENCES BELOW THE SITE AND ACROSS ALL POTENTIAL RUNOFF SITES.
- 1.2. CONSTRUCT TEMPORARY CONSTRUCTION ENTRY/EXIT AND DIVERT RUNOFF TO SUITABLE CONTROL SYSTEMS.
- 1.3. CONSTRUCT MEASURES TO DIVERT UPSTREAM FLOWS INTO EXISTING STORMWATER SYSTEM.
- 1.4. CONSTRUCT SEDIMENTATION TRAPS/BASIN INCLUDING OUTLET CONTROL AND OVERFLOW.
- 1.5. CONSTRUCT TURF LINED SWALES.
- 1.6. PROVIDE SANDBAG SEDIMENT TRAPS UPSTREAM OF EXISTING PITS.

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2. CONSTRUCT GEOTEXTILE FILTER PIT SURROUND AROUND ALL PROPOSED PITS AS THEY ARE CONSTRUCTED.
3. ON COMPLETION OF PAVEMENT PROVIDE SAND BAG KERB INLET SEDIMENT TRAPS AROUND PITS.
4. PROVIDE AND MAINTAIN A STRIP OF TURF ON BOTH SIDES OF ALL ROADS AFTER THE CONSTRUCTION OF KERBS.

SERVICE TRENCHES

EXCAVATION

1. BEFORE EXCAVATING TRENCHES THROUGH EXISTING PAVEMENT, SAW-CUT EXISTING CONCRETE AND BITUMINOUS SURFACES ON EACH SIDE OF THE TRENCH TO PROVIDE A STRAIGHT EVEN JOINT. LIFT AND STORE UNIT PAVING FOR LATER REINSTATEMENT.
2. EXCAVATE FOR UNDERGROUND SERVICES, TO REQUIRED LINES, LEVELS AND GRADES. GENERALLY MAKE THE TRENCHES STRAIGHT BETWEEN MANHOLES, INSPECTION POINTS AND JUNCTIONS, WITH VERTICAL SIDES AND UNIFORM GRADES. EXCAVATION OF SERVICE TRENCHES SHALL BE COMPLETED PRIOR TO LIME STABILIZATION OF THE SUBGRADE. NOTIFY THE CONTRACT ADMINISTRATOR IF ANY TRENCHES ARE BE TO EXCAVATED IN STABILISED GROUND. ANY TRENCHES IN STABILISED GROUND TO BE BACKFILLED AS SPECIFIED IN THE "BACKFILLING" NOTES.
3. KEEP TRENCH WIDTHS TO THE MINIMUM CONSISTENT WITH THE LAYING AND BEDDING OF THE RELEVANT SERVICE AND CONSTRUCTION OF PERSONNEL ACCESS WAYS AND PITS.
4. EXCAVATE TRENCHES IN SECTIONS OF SUITABLE LENGTH.
5. TRENCH DEPTHS TO BE CONSTRUCTED AS REQUIRED BY THE RELEVANT SERVICE AND ITS BEDDING METHOD.
6. IF EXCAVATION IS NECESSARY BELOW THE LEVEL OF ADJACENT FOOTINGS, GIVE NOTICE, AND PROVIDE NECESSARY SUPPORT FOR THE FOOTINGS.
7. CLEAR TRENCHES OF SHARP PROJECTIONS. CUT BACK ROOTS ENCOUNTERED IN TRENCHES TO AT LEAST 600MM CLEAR OF SERVICES. REMOVE OTHER OBSTRUCTIONS INCLUDING STUMPS AND BOULDERS WHICH MAY INTERFERE WITH SERVICES OR BEDDING.
8. KEEP TRENCHES FREE OF WATER. PLACE BEDDING MATERIAL, SERVICES AND BACKFILLING ON FIRM GROUND FREE OF SURFACE WATER.
9. IF TRENCH EXCAVATION EXCEEDS THE CORRECT DEPTH, REINSTATE TO THE CORRECT DEPTH AND BEARING VALUE USING COMPACTED BEDDING MATERIAL OR GRADE 20MPA CONCRETE.

BACKFILLING

THESE REQUIREMENTS APPLY TO BACKFILL TO STORMWATER DRAINAGE TRENCHES AND SERVICE ACCESS POINTS. BEDDING AND OVERLAY TO A MINIMUM DEPTH OF 200MM ABOVE THE SERVICE SHALL BE PIPE BEDDING AS SPECIFIED BELOW UNLESS SPECIFIED OTHERWISE IN RELEVANT SERVICE SPECIFICATION. TRENCH BACKFILL ABOVE THIS LEVEL SHALL BE BACKFILL MATERIAL AS SPECIFIED BELOW. BEDDING, OVERLAY AND TRENCH BACKFILL TO BE COMPACTED IN ACCORDANCE WITH THE COMPACTION SCHEDULE. PLACE FILLING IN LAYERS NOT EXCEEDING 200MM COMPACTED LAYER THICKNESS.

PIPE BEDDING

UNLESS NOTED OTHERWISE IN "STORMWATER DRAINAGE" NOTES, PIPE BEDDING TO BE GRANULAR MATERIAL (CLEAN SHARP WASHED RIVER SAND OR CLEAN UNWEATHERED HARD BASALTIC OR SEDIMENTARY CRUSHED ROCK, FREE OF SALT, CLAY OR ORGANIC CONTAMINANTS) OR CEMENTITIOUS MATERIAL (MORTAR OR CONCRETE) AS SPECIFIED.

CRUSHED ROCK:

SLEVE APERTURE (mm) TO AS 1152	PERCENTAGE PASSING (BY MASS)
9.50	98 TO 100
6.70	50 TO 100
4.75	15 TO 75
2.36	0 TO 40
1.16	0 TO 5

CEMENT MORTAR BEDDING: 1 PORTLAND CEMENT: 4 SAND.
CONCRETE BEDDING: NOT LESS THAN 20 MPA.

BACKFILL MATERIAL

GENERAL: GENERAL FILL EXCEPT WITH NO STONES GREATER THAN 25 MM OCCURRING WITHIN 150 MM OF THE SERVICE, OR OTHER MATERIALS AS REQUIRED FOR PARTICULAR SERVICES OR LOCATIONS. WELL GRADED, INORGANIC, NON-PERISHABLE MATERIAL, MAXIMUM SIZE 75 MM, PLASTICITY INDEX * 55% AND CLASSIFIED AS CLASS A OR CLASS S MATERIAL IN TABLE 2.1 OF AS 2870. FILL MATERIAL TO HAVE A MINIMUM 4 DAY SOAKED CBR OF 4% IN ACCORDANCE WITH AS 1239.6.1.1 UNLESS NOTED OTHERWISE ON DRAWINGS. MATERIAL TO BE NON-DISPERSIVE (A RATING OF NIL AS DEFINED BY THE DISPERSION TEST AS 1239.3.8.1).

UNDER ROADS AND PAVED AREAS: COARSE SAND, FINE CRUSHED ROCK, OR 3% CEMENT STABILISED SAND.

IN TOPSOIL AREAS: COMPLETE THE BACKFILLING WITH TOPSOIL FOR AT LEAST THE TOP 50 MM.

NOT FOR CONSTRUCTION

T4	TENDER ADDENDUM ISSUE	RP	KN	02.05.2025					Client:		Engineer:		Project:	WSU CARPARK RELOCATION PROJECT	Drawing Title:	GENERAL NOTES AND LEGENDS SHEET 1	Scale at A1	Drawn	Designed	Approved
T3	TENDER ADDENDUM ISSUE	RP	KN	19.12.2024														KN	JLE	RP
T2	TENDER ISSUE	RP	JLE	08.10.2024																
T1	TENDER ISSUE	RP	JLE	03.10.2024																
P2	PRELIMINARY ISSUE	RP	JLE	23.09.2024																
P1	PRELIMINARY ISSUE	RP	PB	13.09.2024																
Rev	Description	Eng	Draft	Date	Rev	Description	Eng	Draft	Date	Rev	Description	Eng	Draft	Date	234338-TTW-01-DR-CI-00002-T4 02.05.2025 11:42 AM					



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AREA	COMPACTION RATIO % OF MAXIMUM DRY DENSITY OR DENSITY INDEX (DI)	MOISTURE % FROM OPTIMUM*
LANDSCAPE AREA		
BEDDING AND OVERLAY	70 (DI)	±2
TRENCH BACKFILL	70 (DI) OR 95% STANDARD	±2
UNDER OR WITHIN LINE OF INFLUENCE OF PAVEMENTS, STRUCTURES OR BUILDING SLABS		
BEDDING AND OVERLAY	80 (DI)	±2
TRENCH BACKFILL	80 (DI) OR 98% STANDARD	±2
PAVEMENT ZONE	98% MODIFIED	±2

SIGNS AND LINE MARKING

1. PAVEMENT MARKING AND SIGN POSTING ON PUBLIC ROADS SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF THE RELEVANT ROAD AUTHORITY. THE CONTRACTOR SHALL OBTAIN THESE REQUIREMENTS FROM THE ROAD AUTHORITY.
2. PAVEMENT MARKING AND SIGN POSTING TO BE IN ACCORDANCE WITH R.T.A. 'INTERIM GUIDE TO SIGNS AND MARKINGS'.
3. CONTRACTOR IS TO PROVIDE GUIDE POSTS, SPACED IN ACCORDANCE WITH AS1742.2. THEY ARE TO BE LOCATED NEAR ALL HEAD WALLS AND PIPE OUTLETS.
4. RAISED PAVEMENT MARKERS TO BE IN ACCORDANCE WITH AS1742.2
5. WHERE EXISTING PAVEMENT MARKING CONFLICTS WITH PROPOSED, IT IS TO BE REMOVED.
6. LANE WIDTHS DO NOT INCLUDE WIDTH OF GUTTER.
7. LINE MARKING PLAN DOES NOT DEFINE BOUNDARIES.
8. ERECT TEMPORARY SIGN 'CHANGED TRAFFIC CONDITIONS AHEAD' 120M AHEAD OF NEW WORK IN BOTH DIRECTIONS.
9. ESTABLISH THE LOCATION OF EXISTING UTILITY SERVICES AND LOCATE NEW SIGNS CLEAR OF THESE INSTALLATIONS.
10. THE SLOPED FACE OF THE SF MEDIAN KERBS WHICH ADJOIN THROUGH LANES, ARE TO BE PAINTED WHITE IN LIEU OF AN E3 EDGE LINE. THE REFLECTIVE PAVEMENT MARKERS NORMALLY ASSOCIATED WITH AN E3 EDGE LINE ARE TO BE LOCATED ON THE PAVEMENT ADJACENT TO THE SF KERB.
11. BICYCLE PAVEMENT MARKINGS AND SIGN POSTING TO BE IN ACCORDANCE WITH AUSTROADS STANDARDS.
12. THE DESIGN OF MAJOR DIRECTIONAL SIGN POSTING TO BE PREPARED AND ASSESSED BY THE RELAVENT ROAD AUTHORITY

SAFETY IN DESIGN

EXISTING SERVICES
BEFORE EXCAVATING TRENCHES THROUGH EXISTING PAVEMENT, SAW-CUT EXISTING CONCRETE AND BITUMINOUS SURFACES ON EACH SIDE OF THE TRENCH TO PROVIDE A STRAIGHT EVEN JOINT. LIFT AND STORE UNIT PAVING FOR LATER REINSTATEMENT.

EXISTING STRUCTURES
CONTRACTOR TO BE AWARE EXISTING STRUCTURES MAY EXIST WITHIN THE SITE. TO PREVENT DAMAGE TO EXISTING STRUCTURE(S) AND/OR PERSONNEL, SITE WORKS TO BE CARRIED OUT AS FAR AS PRACTICABLY POSSIBLE FROM EXISTING STRUCTURE(S).

EXISTING TREES
CONTRACTOR TO BE AWARE EXISTING TREES EXIST WITHIN THE SITE WHICH NEED TO BE PROTECTED. TO PREVENT DAMAGE TO TREES AND/OR PERSONNEL, SITE WORKS TO BE CARRIED OUT AS FAR AS PRACTICABLY POSSIBLE FROM EXISTING TREES. ADVICE NEEDS TO BE SOUGHT FROM ARBORIST AND/OR LANDSCAPE ARCHITECT ON MEASURES REQUIRED TO PROTECT TREES.

GROUNDWATER
CONTRACTOR TO BE AWARE OF GROUNDWATER LEVELS CLOSE TO EXISTING SURFACE LEVEL. TEMPORARY DE-WATERING MAY BE REQUIRED DURING CONSTRUCTION WORKS.

EXCAVATIONS
DEEP EXCAVATIONS DUE TO STORMWATER DRAINAGE WORKS IS REQUIRED. CONTRACTOR TO ENSURE SAFE WORKING PROCEDURES ARE IN PLACE FOR WORKS. ALL EXCAVATIONS TO BE FENCED OFF AND BATTERS ADEQUATELY SUPPORTED TO APPROVAL OF GEOTECHNICAL ENGINEER.

GROUND CONDITIONS
CONTRACTOR TO BE AWARE OF THE SITE GEOTECHNICAL CONDITIONS. REFER TO THE GEOTECHNICAL REPORT BY DOUGLAS PARTNERS 227191.00.R.001.REVO DATED 15 NOVEMBER 2024 FOR FURTHER INFORMATION.

HAZARDOUS MATERIALS
EXISTING ASBESTOS PRODUCTS & CONTAMINATED MATERIAL ARE PRESENT ON SITE. CONTRACTOR TO ENSURE ALL HAZARDOUS MATERIALS ARE IDENTIFIED PRIOR TO COMMENCING WORKS. SAFE WORKING PRACTISES AS PER RELEVANT AUTHORITY TO BE ADOPTED AND APPROPRIATE PPE TO BE USED WHEN HANDLING ALL HAZARDOUS MATERIALS. REFER TO REMEDIATION ACTION PLAN BY DOUGLAS PARTNERS 227190.04.R.001.REVO DATED 14 AUGUST 2025 FOR FURTHER INFORMATION.

CONFINED SPACES
CONTRACTOR TO BE AWARE OF POTENTIAL HAZARDS DUE TO WORKING IN CONFINED SPACES SUCH AS STORMWATER PITS, TRENCHES AND/OR TANKS. CONTRACTOR TO PROVIDE SAFE WORKING METHODS AND USE APPROPRIATE PPE WHEN ENTERING CONFINED SPACES.

MANUAL HANDLING
CONTRACTOR TO BE AWARE MANUAL HANDLING MAY BE REQUIRED DURING CONSTRUCTION. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ENSURE MANUAL HANDLING PROCEDURES AND ASSESSMENTS ARE IN PLACE PRIOR TO COMMENCING WORKS.

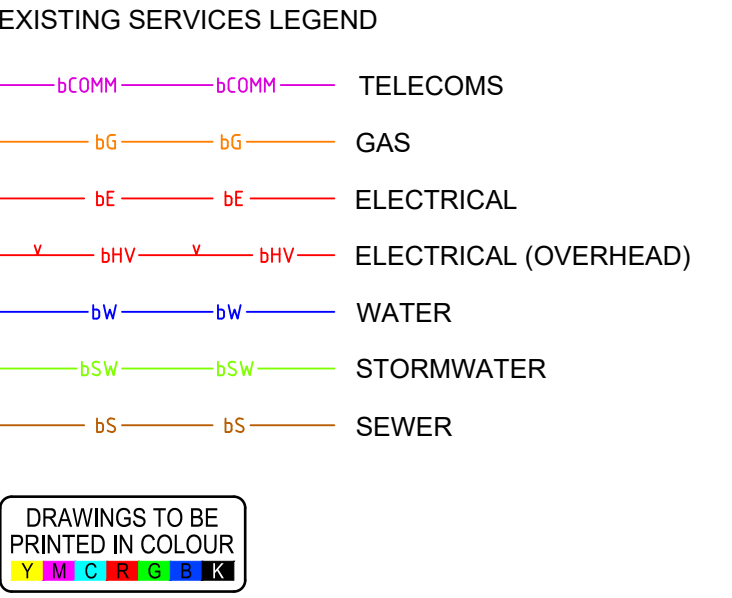
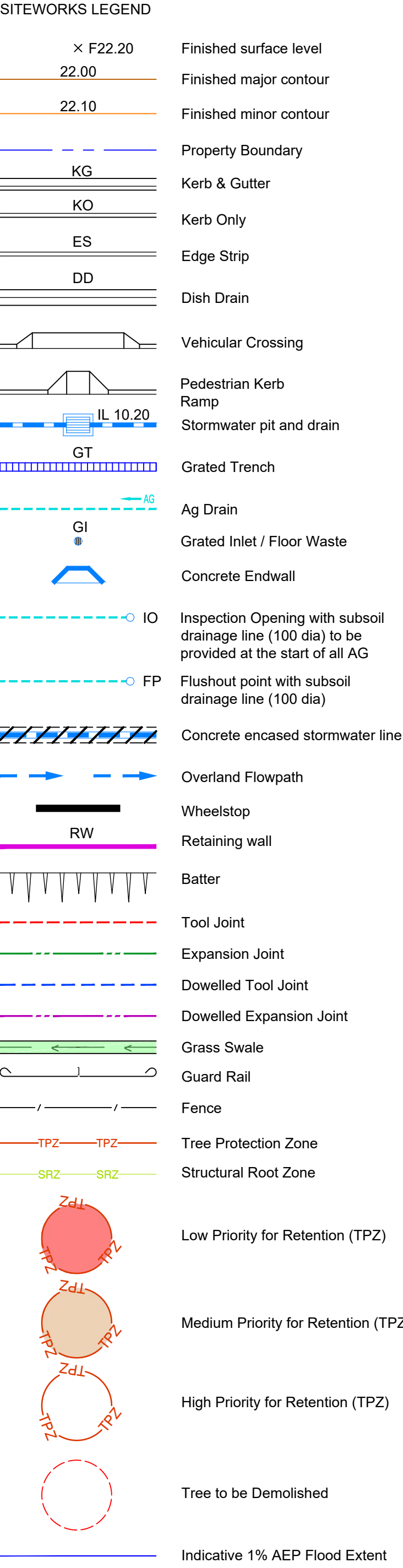
WATER POLLUTION
CONTRACTOR TO ENSURE APPROPRIATE MEASURES ARE TAKEN TO PREVENT POLLUTANTS FROM CONSTRUCTION WORKS CONTAMINATING THE SURROUNDING ENVIRONMENT, INCLUDING COUNCIL STORMWATER DRAINAGE SYSTEM.

SITE ACCESS/EGRESS
CONTRACTOR TO BE AWARE SITE WORKS OCCUR IN CLOSE PROXIMITY TO FOOTPATHS AND ROADWAYS. CONTRACTOR TO ERECT APPROPRIATE BARRIERS AND SIGNAGE TO PROTECT SITE PERSONNEL AND PUBLIC.

VEHICLE MOVEMENT
CONTRACTOR TO SUPPLY AND COMPLY WITH TRAFFIC MANAGEMENT PLAN AND PROVIDE ADEQUATE SITE TRAFFIC CONTROL INCLUDING A CERTIFIED TRAFFIC MARSHALL TO SUPERVISE VEHICLE MOVEMENTS WHERE NECESSARY.

ABBREVIATIONS

TOK	TOP OF KERB	EX	EXISTING LEVEL
IOK	INVERT OF KERB	FL	FINISHED LEVEL
BOK	BACK OF KERB	F*	FUTURE LEVEL
RCL	ROAD CENTRE LINE		
BDY	BOUNDARY	FFL	FINISHED FLOOR LEVEL
		SSL	STRUCTURAL SLAB LEVEL
TOW	TOP OF WALL		
BOW	BOTTOM OF WALL		
CL	COVER LEVEL		
IL	INVERT LEVEL		



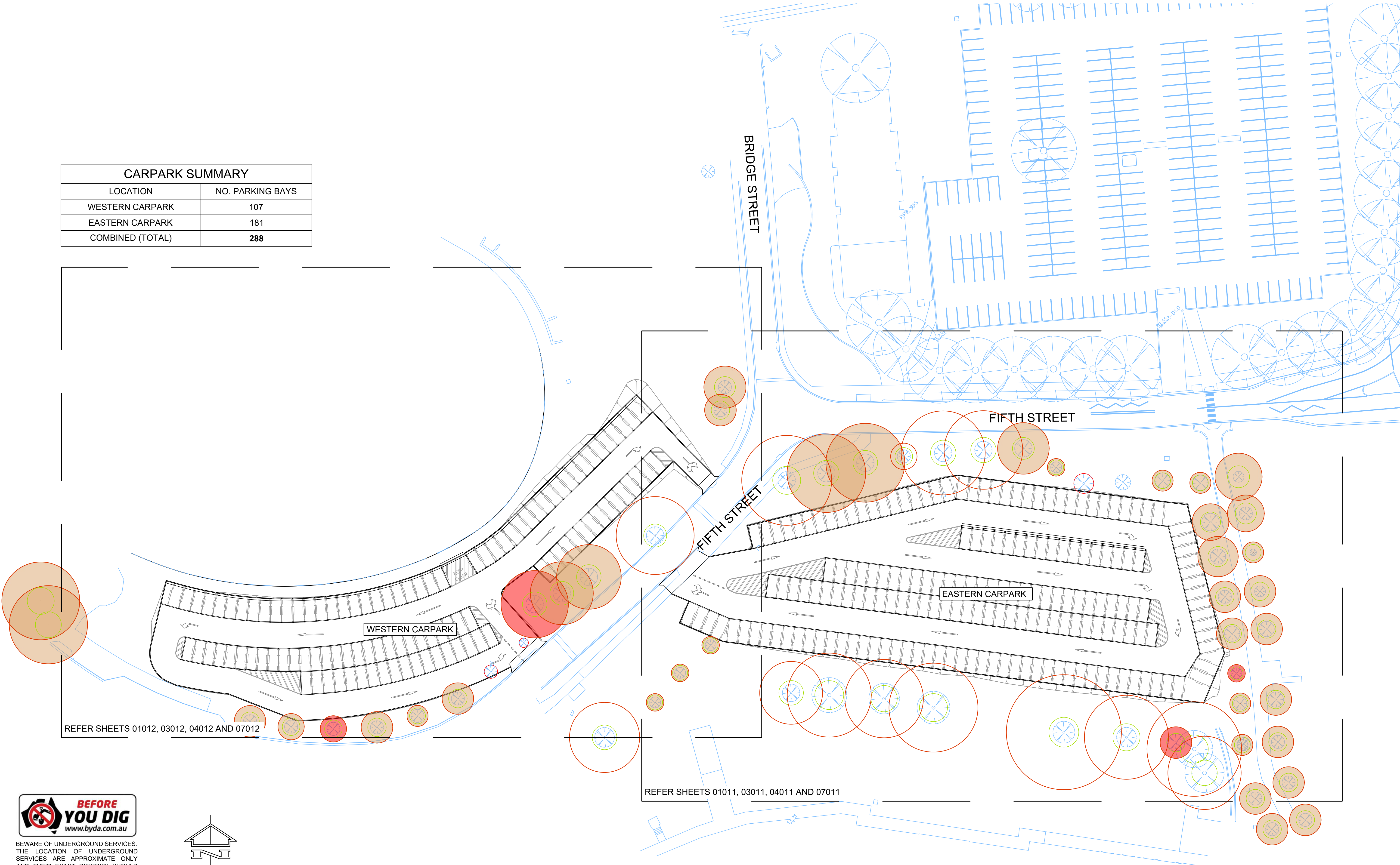
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T4	TENDER ADDENDUM ISSUE	RP	KN	02.05.2025				Client:		Engineer:		Project:	WSU CARPARK RELOCATION PROJECT	Drawing Title:	GENERAL NOTES AND LEGENDS SHEET 2	Scale at A1	Drawn	Designed	Approved
T3	TENDER ADDENDUM ISSUE	RP	KN	19.12.2024													KN	JLE	RP
T2	TENDER ISSUE	RP	JLE	08.10.2024															
T1	TENDER ISSUE	RP	JLE	03.10.2024															
P2	PRELIMINARY ISSUE	RP	JLE	23.09.2024															
P1	PRELIMINARY ISSUE	RP	PB	13.09.2024	T5	TENDER ADDENDUM ISSUE	RP	KN	14.08.2025										
Rev	Description	Eng	Draft	Date	Rev	Description	Eng	Draft	Date	Rev	Description	Eng	Draft	Date	Rev	Description	Eng	Draft	Date

234338-TTW-01-DR-CI-00003-T5
14.08.2025 10:48 AM

CARPARK SUMMARY	
LOCATION	NO. PARKING BAYS
WESTERN CARPARK	107
EASTERN CARPARK	181
COMBINED (TOTAL)	288

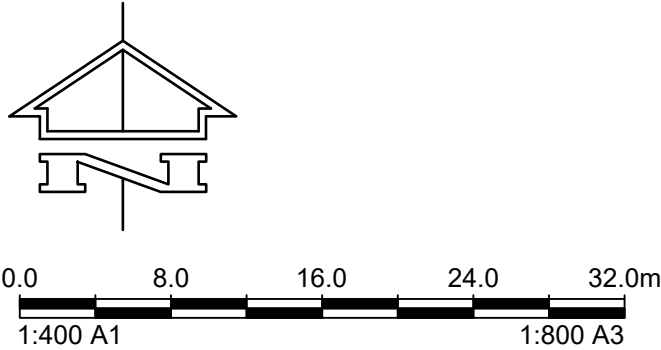


REFER SHEETS 01012, 03012, 04012 AND 07012

REFER SHEETS 01011, 03011, 04011 AND 07011



BEWARE OF UNDERGROUND SERVICES. THE LOCATION OF UNDERGROUND SERVICES ARE APPROXIMATE ONLY AND THEIR EXACT POSITION SHOULD BE PROVEN ON SITE. NO GUARANTEE IS GIVEN THAT ALL EXISTING SERVICES ARE SHOWN



T4	TENDER ADDENDUM ISSUE	RP	KN	02.05.2025					
T3	TENDER ADDENDUM ISSUE	RP	KN	19.12.2024					
T2	TENDER ISSUE	RP	JLE	08.10.2024					
T1	TENDER ISSUE	RP	JLE	03.10.2024					
P2	PRELIMINARY ISSUE	RP	JLE	23.09.2024					
P1	PRELIMINARY ISSUE	RP	PB	13.09.2024					
Rev	Description	Eng	Draft	Date	Rev	Description	Eng	Draft	Date

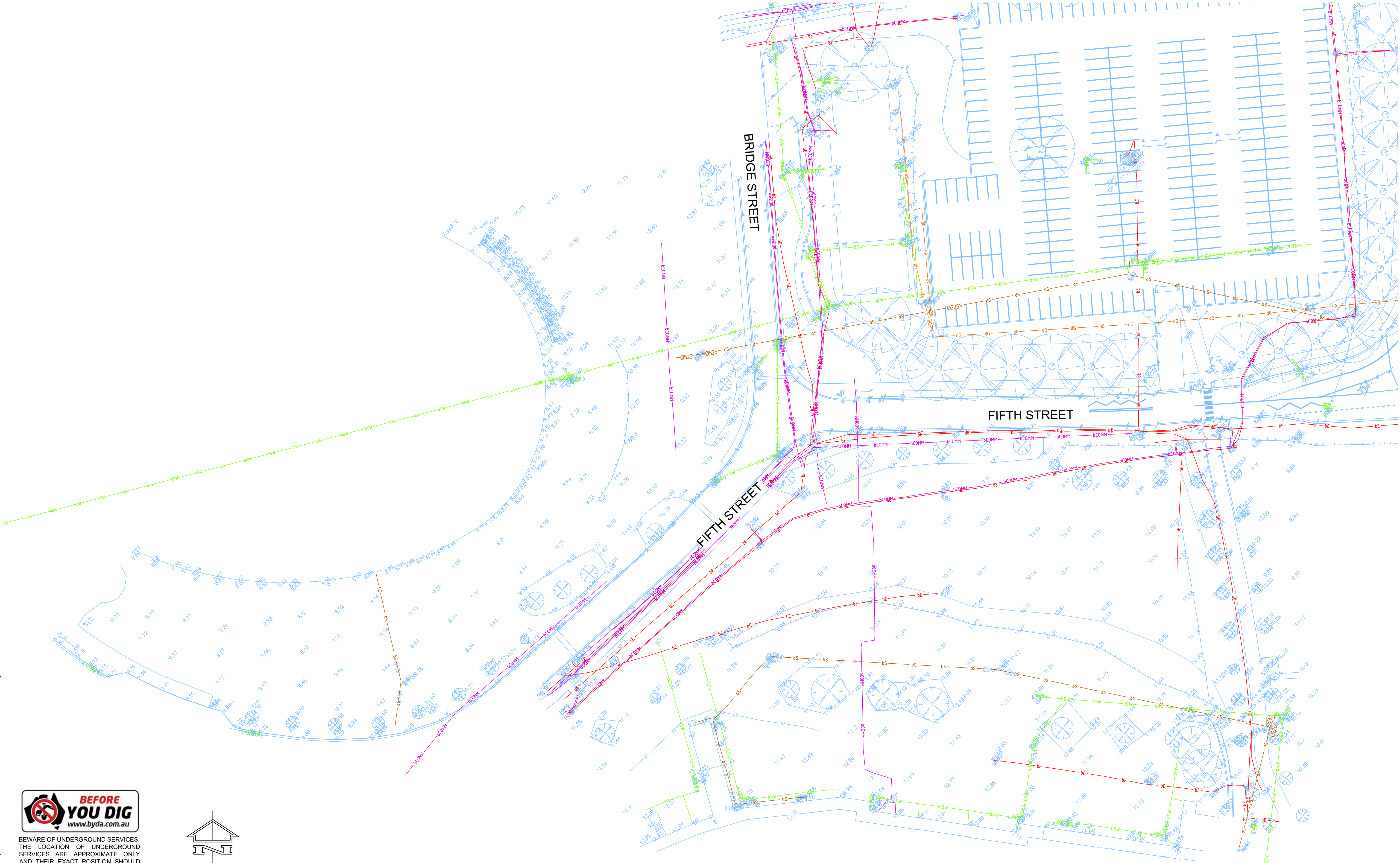
Client:
WESTERN SYDNEY UNIVERSITY

Engineer:
TTW
www.ttwengineers.com

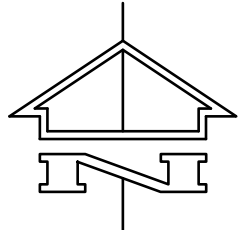
Project:
WSU CARPARK RELOCATION PROJECT

Drawing Title:
GENERAL ARRANGEMENT PLAN

Scale at A1
1:400
Drawn
KN
Designed
JLE
Approved
RP
Project No
234338-TTW-01-DR-CI-00011-T4
14.08.2025 10:53 AM



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0.0 8.0 16.0 24.0 32.0m
1:400 A1 1:800 A3

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Rev	Description	Eng	Draft	Date	Rev	Description	Eng	Draft	Date	Rev	Description	Eng	Draft	Date
T3	TENDER ADDENDUM ISSUE	RP	KN	02.05.2025										
T2	TENDER ADDENDUM ISSUE	RP	KN	19.12.2024										
T1	TENDER ISSUE	RP	JLE	08.10.2024										

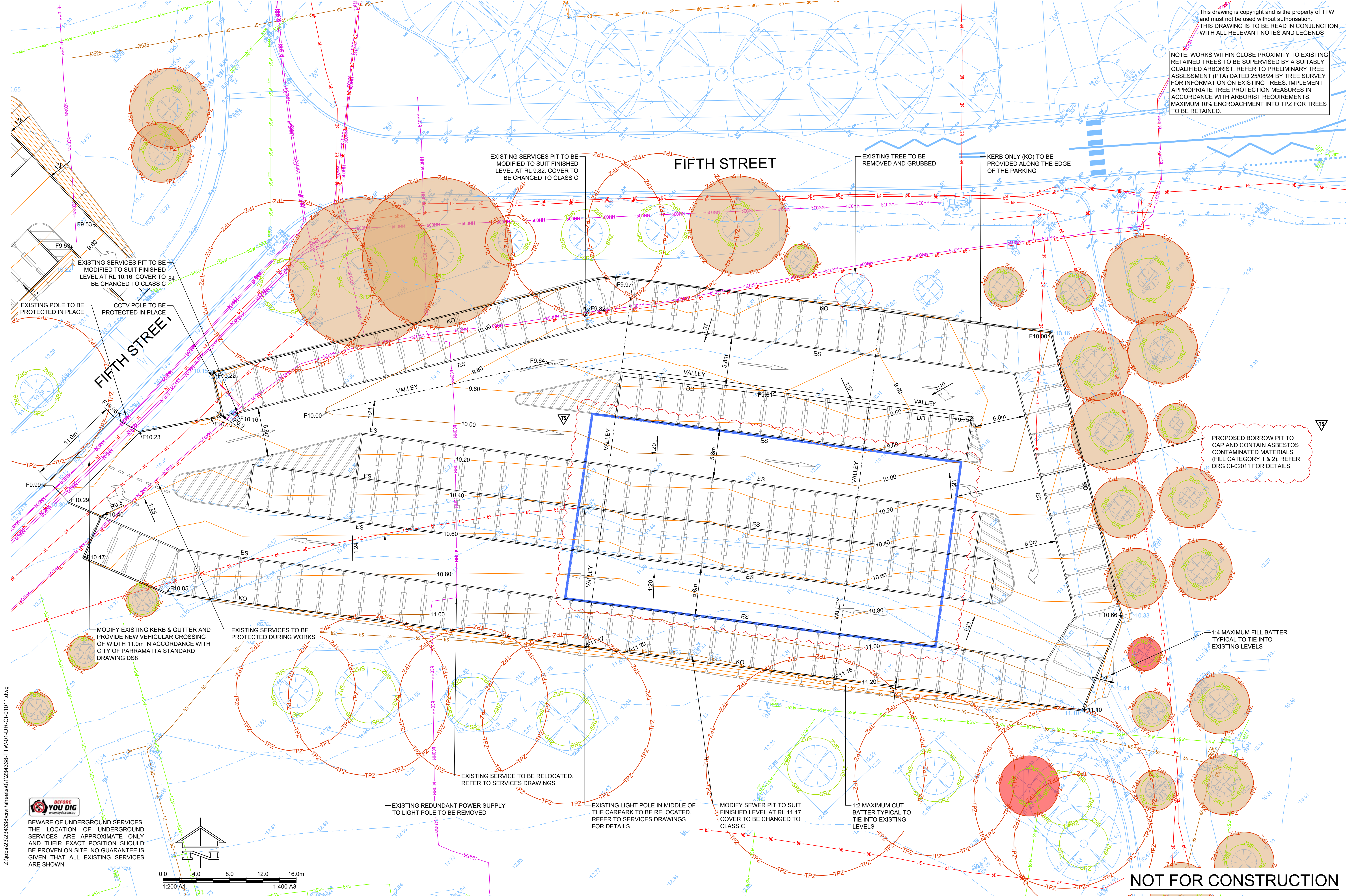
Client:
WESTERN SYDNEY UNIVERSITY

Engineer:
TTW
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Project:
WSU CARPARK RELOCATION PROJECT

Drawing Title:
GENERAL SURVEY AND SERVICES PLAN

Scale at A1: 1:400
Drawn: KN
Designed: JLE
Approved: RP
Project No: 234338-TTW-01-DR-CI-00012-T3
14.08.2025 10:54 AM



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NOTE: WORKS WITHIN CLOSE PROXIMITY TO EXISTING RETAINED TREES TO BE SUPERVISED BY A SUITABLY QUALIFIED ARBORIST. REFER TO PRELIMINARY TREE ASSESSMENT (PTA) DATED 25/08/24 BY TREE SURVEY FOR INFORMATION ON EXISTING TREES. IMPLEMENT APPROPRIATE TREE PROTECTION MEASURES IN ACCORDANCE WITH ARBORIST REQUIREMENTS. MAXIMUM 10% ENCROACHMENT INTO TPZ FOR TREES TO BE RETAINED.

PROPOSED BORROW PIT TO CAP AND CONTAIN ASBESTOS CONTAMINATED MATERIALS (FILL CATEGORY 1 & 2). REFER DRG CI-02011 FOR DETAILS

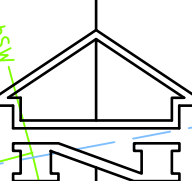
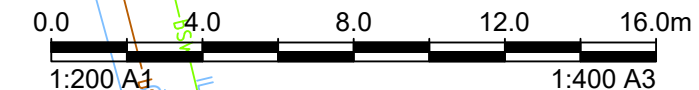
1:4 MAXIMUM FILL BATTER TYPICAL TO TIE INTO EXISTING LEVELS

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BEWARE OF UNDERGROUND SERVICES. THE LOCATION OF UNDERGROUND SERVICES ARE APPROXIMATE ONLY AND THEIR EXACT POSITION SHOULD BE PROVEN ON SITE. NO GUARANTEE IS GIVEN THAT ALL EXISTING SERVICES ARE SHOWN



T4	TENDER ADDENDUM ISSUE	RP	KN	02.05.2025			
T3	TENDER ADDENDUM ISSUE	RP	KN	19.12.2024			
T2	TENDER ISSUE	RP	JLE	08.10.2024			
T1	TENDER ISSUE	RP	JLE	03.10.2024			
P2	PRELIMINARY ISSUE	RP	JLE	23.09.2024			
P1	PRELIMINARY ISSUE	RP	PB	13.09.2024			
Rev	Description	Eng	Draft	Date	Rev	Description	Eng

Client:

WESTERN SYDNEY UNIVERSITY

Engineer:

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Project:

WSU
CARPARK RELOCATION
PROJECT

Drawing Title:

GEOMETRY
SITE PLAN
SHEET 1

Scale at A1	Drawn	Designed	Approved
1:200	KN	JLE	RP
Project No	Originator	Zone	Type
234338-TTW-01-DR-CI-01011-T5			
14.08.2025	11:07 AM		

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Scale at A1	Drawn		Designed		Approved	
1:200	KN		JLE		RP	
Project No	Originator	Zone	Type	Role	Sheet No.	Rev
234338-TTW-01-DR-CI-01012-T5						
14.08.2025 2:27 PM						

EASTERN CARPARK	
CUT	940 m ³
FILL	110 m ³

WESTERN CARPARK	
CUT	310 m ³
FILL	190 m ³

FX.XX DENOTES CUT AND FILL DEPTH FROM THE NATURAL SURFACE TO THE DESIGN FINISHED SURFACE

 DENOTES PROPOSED ACM BORROW PIT EXTENT AS PER RAP REQUIREMENTS - SEE NOTE 4 & ASBESTOS CONTAMINATED MATERIALS VOLUMES AND BORROW PIT NOTES

NOTES:

1. NO BULKING FACTOR APPLIED.
2. CUT AND FILL VOLUME ESTIMATES CALCULATED FROM THE NATURAL SURFACE TO THE DESIGNED FINISHED SURFACE.
3. NO VOLUME ALLOWANCE HAS BEEN MADE FOR EXCAVATIONS REQUIRED FOR SERVICE TRENCHING, THICKENINGS, BORROW PITS TO CAP AND CONTAIN ASBESTOS CONTAMINATED MATERIALS AS DESCRIBED IN THE REMEDIATION ACTION PLAN (RAP) BY DOUGLAS PARTNERS ETC. THE CONTRACTOR SHALL MAKE THEIR OWN ALLOWANCE AS REQUIRED TO COMPLETE BULK EARTHWORKS.
4. CONTRACTOR TO BE AWARE OF ASBESTOS CONTAMINATED MATERIALS (ACM) PRESENT ON SITE. REMEDIATION OF ACM EXPOSED ON SITE SHALL BE UNDERTAKEN IN ACCORDANCE WITH THE REQUIREMENTS NOTED IN THE REMEDIATION ACTION PLAN BY DOUGLAS PARTNERS. ACM VOLUMES ARE INDICATIVE ONLY AND ARE BASED ON REPORT BY DOUGLAS PARTNERS. ACTUAL VOLUME OF ACM MAY VARY. REFER ASBESTOS CONTAMINATED MATERIALS VOLUME AND BORROW PIT NOTES FOR ADDITIONAL REQUIREMENTS.
5. CONTRACTOR TO MAKE ALLOWANCE FOR DISPOSAL OF SITE WON MATERIAL. FOR RE-USE OF SITE WON MATERIAL, REFERENCE SHOULD BE MADE TO THE GEOTECHNICAL REPORT. THE CONTRACTOR IS TO MAKE ALLOWANCE FOR SORTING, STAGING AND HANDLING OF ANY FILL MATERIAL PROPOSED FOR RE-USE.
6. REFER TO GEOTECHNICAL REPORT PREPARED BY DOUGLAS PARTNERS 227191.00.R.001.REV.0 DATED 15 NOVEMBER 2024 FOR SUBGRADE PREPARATION.
7. WORKS WITHIN CLOSE PROXIMITY TO EXISTING RETAINED TREES TO BE SUPERVISED BY A SUITABLY QUALIFIED ARBORIST.
8. THE CONTRACTOR SHALL UNDERTAKE A DILAPIDATION SURVEY OF EXISTING PAVEMENTS AROUND THE EXTENT OF WORKS PRIOR TO COMMENCING WORKS. DAMAGE TO EXISTING PAVEMENTS OUTSIDE THE LIMIT OF WORKS SHALL BE REMEDIATED AND MADE GOOD AT THE CONTRACTOR'S EXPENSE. CONTRACTOR TO OBTAIN ALL NECESSARY AUTHORITY PERMITS & APPROVALS.

ASBESTOS CONTAMINATED MATERIALS VOLUMES AND BORROW PIT NOTES

ASBESTOS CONTAMINATED MATERIALS (ACM) VOLUMES SHOWN ARE PRELIMINARY ESTIMATES ONLY, DERIVED FROM AVAILABLE ENVIRONMENTAL INVESTIGATIONS AND GEOTECHNICAL TEST PIT DATA PROVIDED BY DOUGLAS PARTNERS.

ESTIMATES ARE BASED ON ASSUMED CONTAMINATION EXTENTS FROM THE REMEDIATION ACTION PLAN (RAP) AND MAY NOT REFLECT ACTUAL SITE CONDITIONS. ACTUAL VOLUME OF ACM MAY VARY.

TTW DRAWINGS SHOW DESIGN INTENT ONLY. BORROW PIT LOCATIONS, EXTENTS, LEVELS AND VOLUMES ARE INDICATIVE ONLY.

THE CONTRACTOR SHALL UNDERTAKE THEIR OWN SITE INVESTIGATIONS AND DETAILED DESIGN TO FINALISE THE BORROW PIT VOLUME AND ARRANGEMENT IN ACCORDANCE WITH:

- GEOTECHNICAL REPORT BY DOUGLAS PARTNERS 227191.00.R.001Rev0 DATED 15 NOVEMBER 2024
- REMEDIATION ACTION PLAN BY DOUGLAS PARTNERS 227190.04.R.001Rev0 DATED 14 AUGUST 2025
- TTW DRAWINGS (DESIGN INTENT ONLY)

THE DETAILED DESIGN SHALL BE CERTIFIED BY A SUITABLY QUALIFIED CIVIL AND/OR GEOTECHNICAL ENGINEER ENGAGED BY THE CONTRACTOR AND SUBMITTED TO THE SUPERINTENDENT PRIOR TO COMMENCEMENT OF WORKS.

CONTRACTOR TO ALLOW FOR ALL NECESSARY ELEMENTS TO CONSTRUCT BORROW PITS INCLUDING BUT NOT LIMITED TO: TEMPORARY DEWATERING, MARKER LAYERS, GEOTEXTILES, GEOGRIDS, CAPPING LAYERS ETC. AS DESCRIBED IN THE GEOTECHNICAL REPORT AND RAP.

NOTE: WORKS WITHIN CLOSE PROXIMITY TO EXISTING RETAINED TREES TO BE SUPERVISED BY A SUITABLY QUALIFIED ARBORIST. REFER TO PRELIMINARY TREE ASSESSMENT (PTA) DATED 25/08/24 BY TREE SURVEY FOR INFORMATION ON EXISTING TREES. IMPLEMENT APPROPRIATE TREE PROTECTION MEASURES IN ACCORDANCE WITH ARBORIST REQUIREMENTS. MAXIMUM 10% ENCROACHMENT INTO TPZ FOR TREES TO BE RETAINED.

LEVELS TABLE

No.	FROM LEVEL (m)	TO LEVEL (m)	COLOUR
1	-2.00	-1.50	
2	-1.50	-1.00	
3	-1.00	-0.50	
4	-0.50	0.00	
5	0.00	0.50	
6	0.50	1.00	

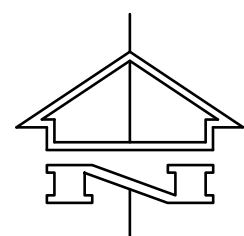
PROVIDE 3m WIDE BREAK IN
BORROW PIT ALONG SEWER
SERVICE FOR FUTURE ACCESS.
REFER TO DRG CI-01012

— CAP AND CONTAIN APPROX 1300m³ OF ACM IN BORROW PIT (EXTENT SHOWN INDICATIVELY). REFER TO DRG CI-02021 FOR SECTIONS

CAP AND CONTAIN APPROX
1000m³ OF ACM IN BORROW PIT
(EXTENT SHOWN INDICATIVELY)
REFER TO DRG CI-02021 FOR
SECTIONS



BEWARE OF UNDERGROUND SERVICES.
THE LOCATION OF UNDERGROUND
SERVICES ARE APPROXIMATE ONLY
AND THEIR EXACT POSITION SHOULD
BE PROVEN ON SITE. NO GUARANTEE IS
GIVEN THAT ALL EXISTING SERVICES
ARE SHOWN

[illegible]

Client:  **WESTERN SYDNEY**
UNIVERSITY

Engineer: **TTW**
www.ttwengeers.com

Project:
WSU
CARPARK RELOCATION
PROJECT

Drawing Title:
**EARTHWORKS
CUT AND FILL
VOLUMES PLANS**

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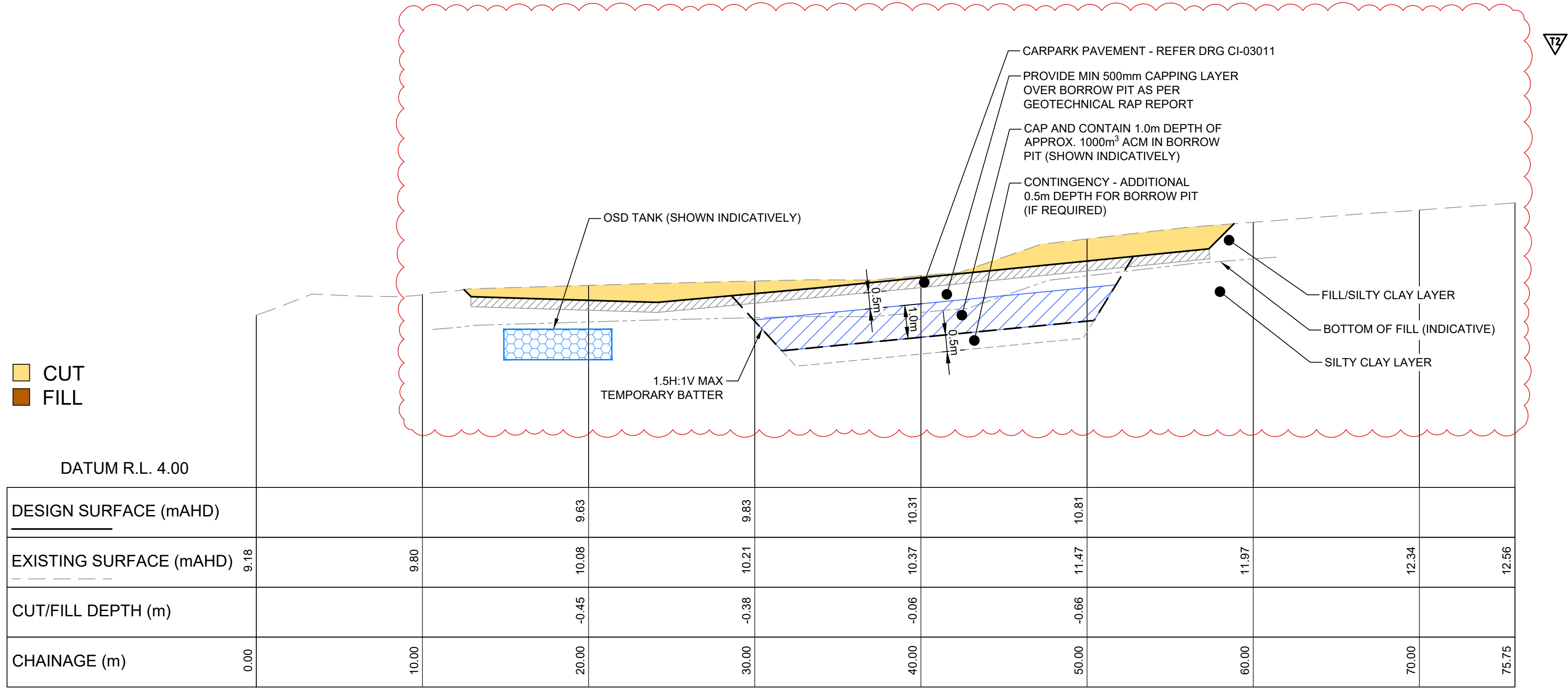
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1:400	KN	JLE	RP

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LONGITUDINAL SECTION AL - 1
SCALES: HORIZONTAL 1:200 VERTICAL 1:100

ASBESTOS CONTAMINATED MATERIALS VOLUMES AND BORROW PIT NOTES

ASBESTOS CONTAMINATED MATERIALS (ACM) VOLUMES SHOWN ARE PRELIMINARY ESTIMATES ONLY, DERIVED FROM AVAILABLE ENVIRONMENTAL INVESTIGATIONS AND GEOTECHNICAL TEST PIT DATA PROVIDED BY DOUGLAS PARTNERS.

ESTIMATES ARE BASED ON ASSUMED CONTAMINATION EXTENTS FROM THE REMEDIATION ACTION PLAN (RAP) AND MAY NOT REFLECT ACTUAL SITE CONDITIONS. ACTUAL VOLUME OF ACM MAY VARY.

TTW DRAWINGS SHOW DESIGN INTENT ONLY. BORROW PIT LOCATIONS, EXTENTS, LEVELS AND VOLUMES ARE INDICATIVE ONLY.

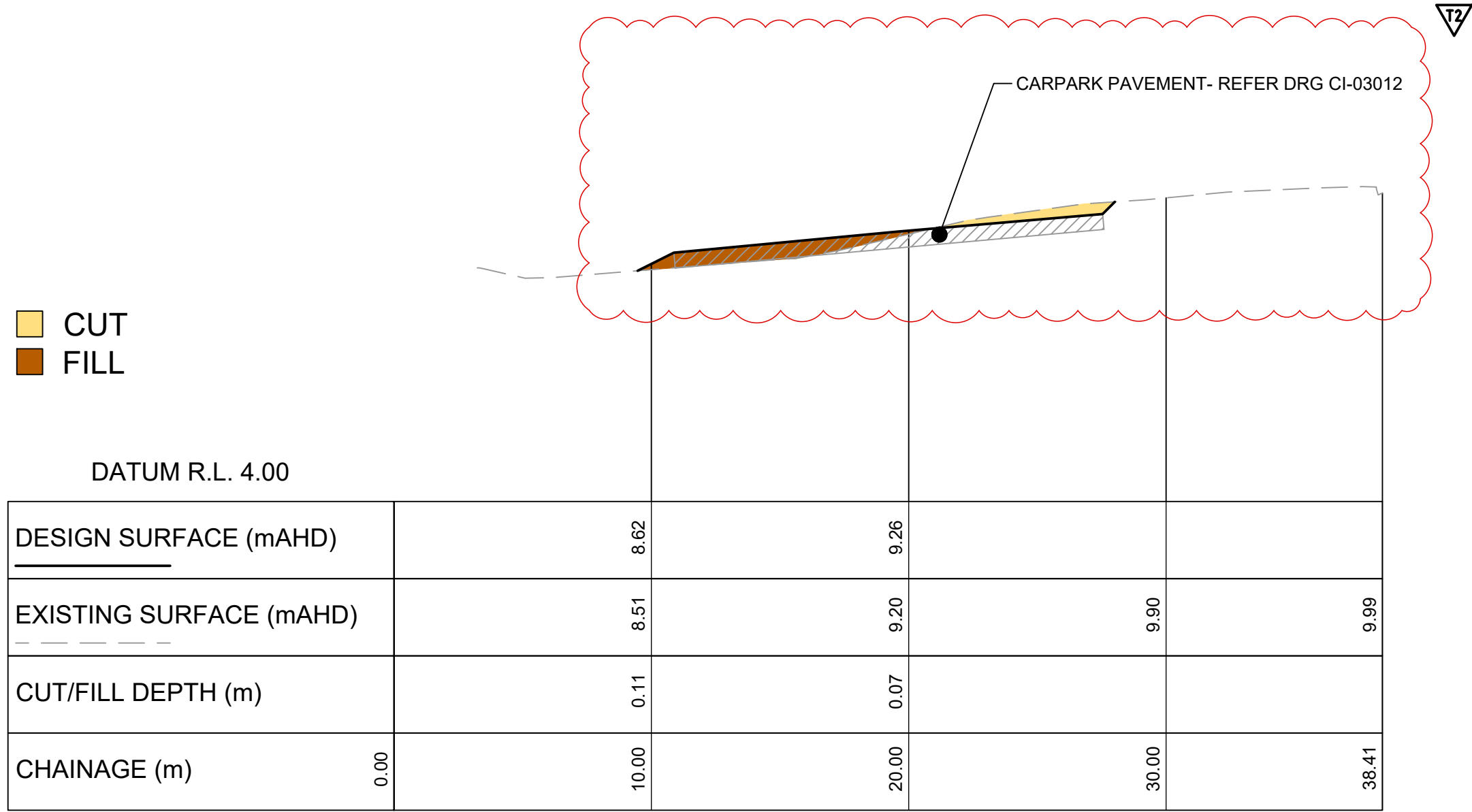
THE CONTRACTOR SHALL UNDERTAKE THEIR OWN SITE INVESTIGATIONS AND DETAILED DESIGN TO FINALISE THE BORROW PIT VOLUME AND ARRANGEMENT IN ACCORDANCE WITH:

- GEOTECHNICAL REPORT BY DOUGLAS PARTNERS 227191.00.R.001Rev0 DATED 15 NOVEMBER 2024
- REMEDIATION ACTION PLAN BY DOUGLAS PARTNERS 227190.04.R.001Rev0 DATED 14 AUGUST 2025
- TTW DRAWINGS (DESIGN INTENT ONLY)

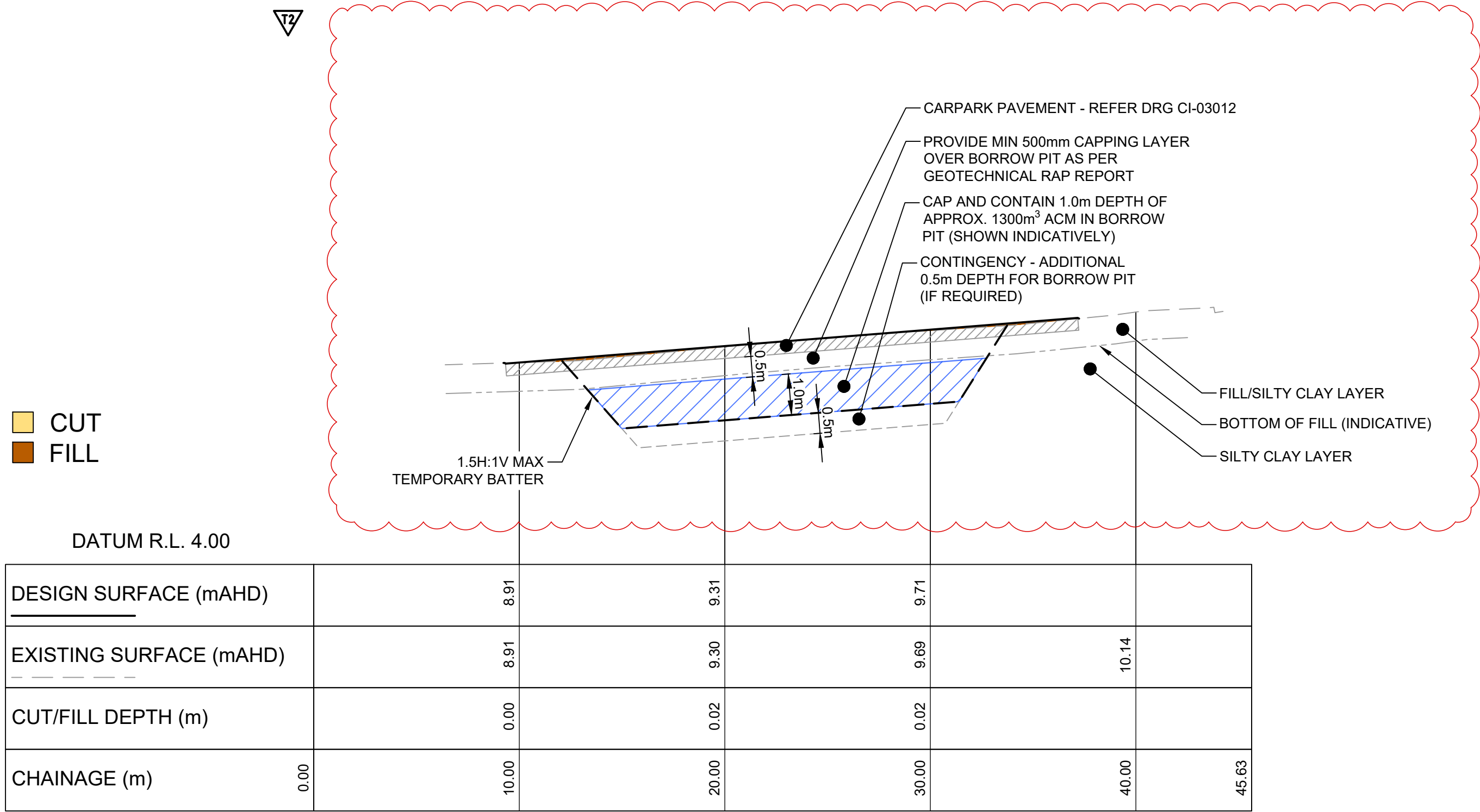
THE DETAILED DESIGN SHALL BE CERTIFIED BY A SUITABLY QUALIFIED CIVIL AND/OR GEOTECHNICAL ENGINEER ENGAGED BY THE CONTRACTOR AND SUBMITTED TO THE SUPERINTENDENT PRIOR TO COMMENCEMENT OF WORKS.

CONTRACTOR TO ALLOW FOR ALL NECESSARY ELEMENTS TO CONSTRUCT BORROW PITS INCLUDING BUT NOT LIMITED TO; TEMPORARY DEWATERING, MARKER LAYERS, GEOTEXTILES, GEOGRIDS, CAPPING LAYERS ETC. AS DESCRIBED IN THE GEOTECHNICAL REPORT AND RAP.

THE NATURAL SILTY CLAY/BOTTOM OF FILL LEVEL SHOWN IN THE LONGITUDINAL SECTIONS ARE INDICATIVE ONLY BASED ON GEOTECHNICAL BOREHOLE INFORMATION AND IS NOT GUARANTEED TO BE CORRECT OR COMPLETE. CONTRACTOR SHALL CONFIRM EXACT DEPTH TO THE NATURAL SILTY CLAY ON SITE. DEPTH MAY VARY ACROSS SITE.

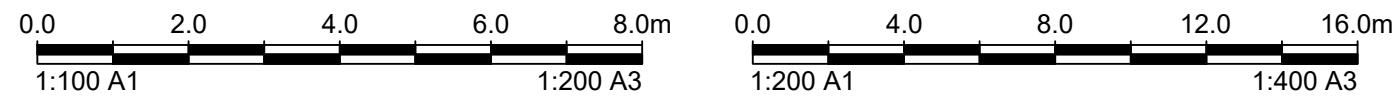


LONGITUDINAL SECTION AL - 2
SCALES: HORIZONTAL 1:200 VERTICAL 1:100



LONGITUDINAL SECTION AL - 3
SCALES: HORIZONTAL 1:200 VERTICAL 1:100

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Rev	Description	Eng Draft	Date	Rev	Description	Eng Draft	Date	Rev	Description	Eng Draft	Date
T2	TENDER ADDENDUM ISSUE	RP	KN	14.08.2025							
T1	TENDER ADDENDUM ISSUE	RP	KN	02.05.2025							



Project: WSU
CARPARK RELOCATION
PROJECT

Drawing Title: EARTHWORKS
SITE SECTIONS

Scale at A1 Drawn JLE Designed RP
AS SHOWN KN
Project No 234338-TTW-01-DR-CI-02021-T2
14.08.2025 4:19 PM

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PAVEMENT LEGEND

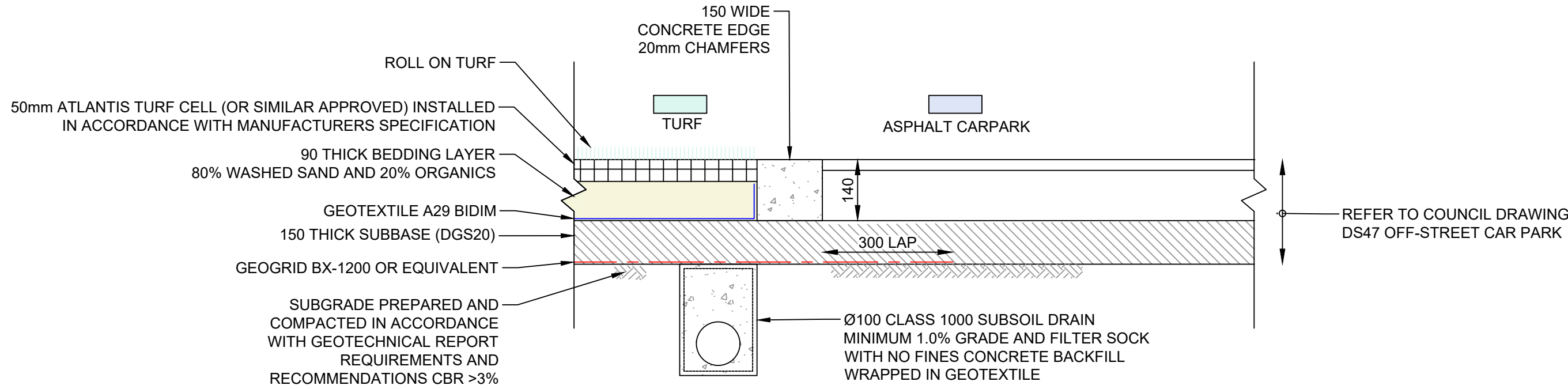
- P1

VEHICULAR ASPHALT PAVEMENT
REFER TO CITY OF PARRAMATTA COUNCIL STANDARD
DRAWING DS47 PAVEMENT FOR OFF-STREET CAR PARK.
PROVIDE BIDIM A29 GEOTEXTILE.
- P2

VEHICULAR CONCRETE PAVEMENT
REFER TO CITY OF PARRAMATTA COUNCIL STANDARD
DRAWING DS8
- P3

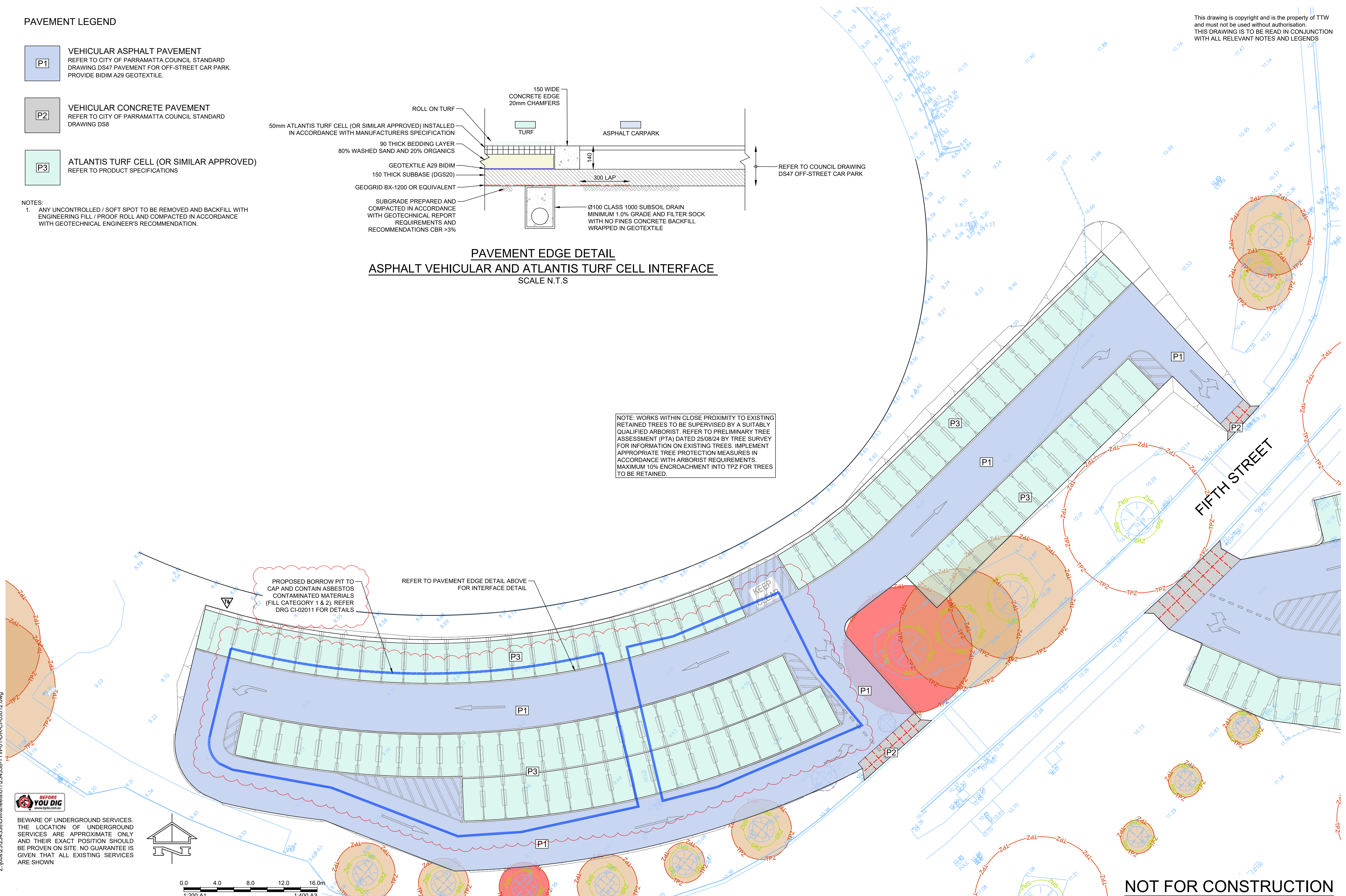
ATLANTIS TURF CELL (OR SIMILAR APPROVED)
REFER TO PRODUCT SPECIFICATIONS

NOTES:
1. ANY UNCONTROLLED / SOFT SPOT TO BE REMOVED AND BACKFILL WITH
ENGINEERING FILL / PROOF ROLL AND COMPACTED IN ACCORDANCE
WITH GEOTECHNICAL ENGINEER'S RECOMMENDATION.



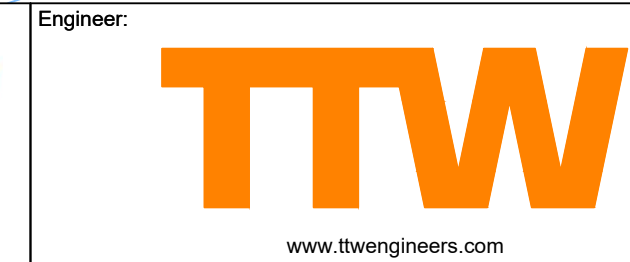
PAVEMENT EDGE DETAIL
ASPHALT VEHICULAR AND ATLANTIS TURF CELL INTERFACE
SCALE N.T.S

NOTE: WORKS WITHIN CLOSE PROXIMITY TO EXISTING
RETAINED TREES TO BE SUPERVISED BY A SUITABLY
QUALIFIED ARBORIST. REFER TO PRELIMINARY TREE
ASSESSMENT (PTA) DATED 25/08/24 BY TREE SURVEY
FOR INFORMATION ON EXISTING TREES. IMPLEMENT
APPROPRIATE TREE PROTECTION MEASURES IN
ACCORDANCE WITH ARBORIST REQUIREMENTS.
MAXIMUM 10% ENCROACHMENT INTO TPZ FOR TREES
TO BE RETAINED.



BEWARE OF UNDERGROUND SERVICES.
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T4	TENDER ADDENDUM ISSUE	RP	KN	02.05.2025					
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T2	TENDER ISSUE	RP	JLE	08.10.2024					
T1	TENDER ISSUE	RP	JLE	03.10.2024					
P2	PRELIMINARY ISSUE	RP	JLE	23.09.2024	T6	TENDER ADDENDUM ISSUE	RP	KN	14.08.2025
P1	PRELIMINARY ISSUE	RP	PB	13.09.2024	T5	TENDER ADDENDUM ISSUE	RP	SFU	06.05.2025
Rev	Description	Eng	Draft	Date	Rev	Description	Eng	Draft	Date

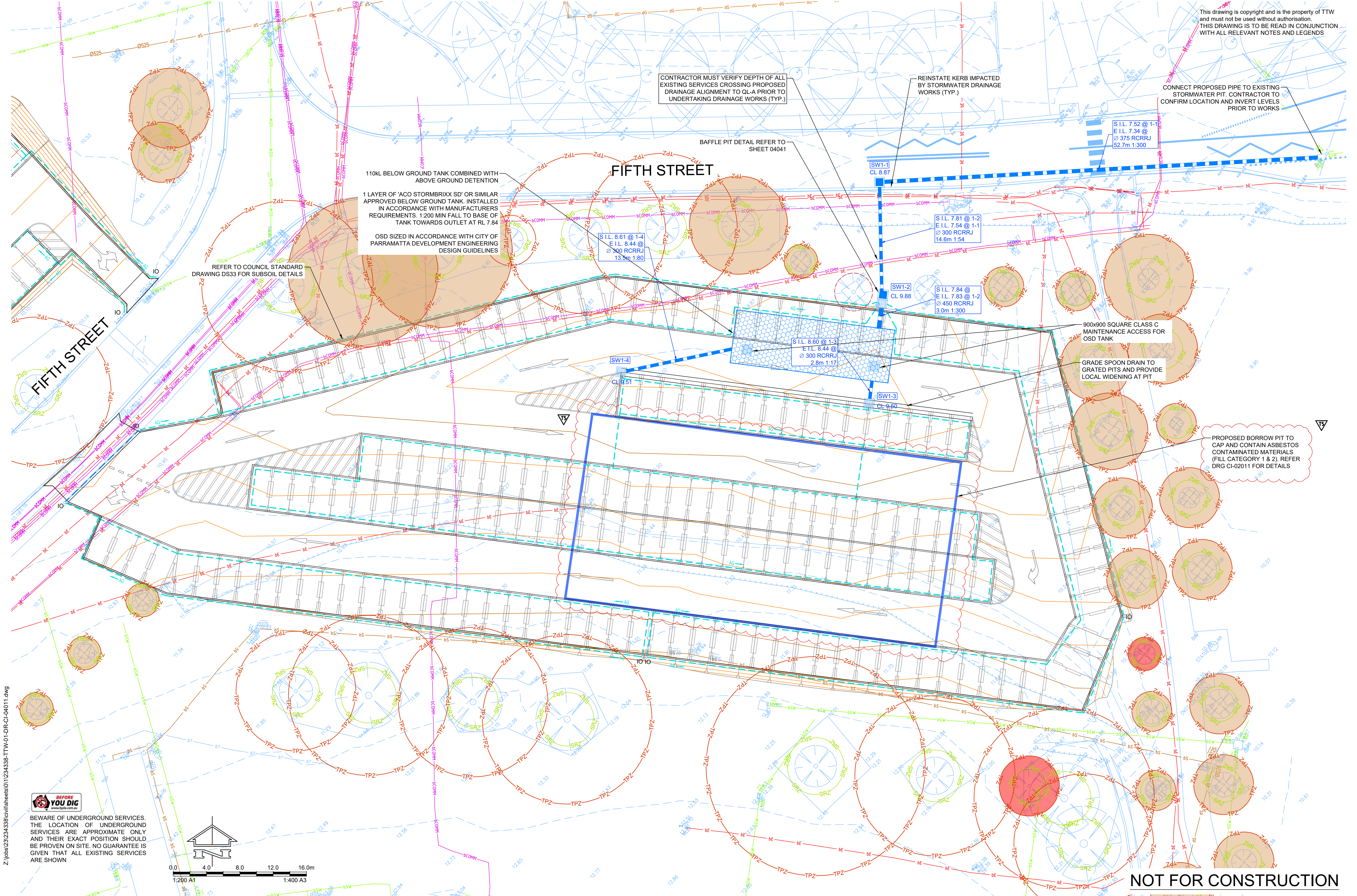


Project:
WSU
CARPARK RELOCATION
PROJECT

Drawing Title:
PAVEMENT
AND JOINTING PLAN
SHEET 2

NOT FOR CONSTRUCTION

Scale at A1	Drawn	Designed	Approved
1:200	KN	JLE	RP
Project No	Originator	Zone	Type
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T4 TENDER ADDENDUM ISSUE RP KN 02.05.2025			Client: WESTERN SYDNEY UNIVERSITY			Project: WSU CARPARK RELOCATION PROJECT			Drawing Title: STORMWATER DRAINAGE PLAN SHEET 1			Scale at A1: 1:200			Drawn: KN			Designed: JLE			Approved: RP		
T3 TENDER ADDENDUM ISSUE RP KN 19.12.2024			Engineer: TTW			Project: WSU CARPARK RELOCATION PROJECT			Drawing Title: STORMWATER DRAINAGE PLAN SHEET 1			Scale at A1: 1:200			Drawn: KN			Designed: JLE			Approved: RP		
T2 TENDER ISSUE RP JLE 08.10.2024			Project: WSU CARPARK RELOCATION PROJECT			Drawing Title: STORMWATER DRAINAGE PLAN SHEET 1			Scale at A1: 1:200			Drawn: KN			Designed: JLE			Approved: RP			Scale at A1: 1:200		
T1 TENDER ISSUE RP JLE 03.10.2024			Project: WSU CARPARK RELOCATION PROJECT			Drawing Title: STORMWATER DRAINAGE PLAN SHEET 1			Scale at A1: 1:200			Drawn: KN			Designed: JLE			Approved: RP			Scale at A1: 1:200		
P1 PRELIMINARY ISSUE RP JLE 23.09.2024			Project: WSU CARPARK RELOCATION PROJECT			Drawing Title: STORMWATER DRAINAGE PLAN SHEET 1			Scale at A1: 1:200			Drawn: KN			Designed: JLE			Approved: RP			Scale at A1: 1:200		
P2 PRELIMINARY ISSUE RP PB 13.09.2024			Project: WSU CARPARK RELOCATION PROJECT			Drawing Title: STORMWATER DRAINAGE PLAN SHEET 1			Scale at A1: 1:200			Drawn: KN			Designed: JLE			Approved: RP			Scale at A1: 1:200		
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T5 TENDER ADDENDUM ISSUE RP KN 14.08.2025			Project: WSU CARPARK RELOCATION PROJECT			Drawing Title: STORMWATER DRAINAGE PLAN SHEET 1			Scale at A1: 1:200			Drawn: KN			Designed: JLE			Approved: RP			Scale at A1: 1:200		
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CONNECT PROPOSED PIPE TO EXISTING PIT. CONTRACTOR TO CONFIRM LOCATION AND INVERT LEVELS PRIOR TO WORKS

EXISTING COUNCIL STORMWATER DRAIN

MODIFY EXISTING GRATED PIT TO SUIT PROPOSED VEHICLE CROSSOVER IN ACCORDANCE WITH COUNCIL STANDARD DRAWING DS29

INDICATIVE 1% AEP FLOOD EXTENT

REFER TO COUNCIL STANDARD DRAWING DS33 FOR SUBSOIL DETAILS

PROPOSED BORROW PIT TO CAP AND CONTAIN ASBESTOS CONTAMINATED MATERIALS (FILL CATEGORY 1 & 2). REFER DRG CI-02011 FOR DETAILS

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1:200	KN	JLE	RP			
Project No	Originator	Zone	Type	Role	Sheet No.	Rev
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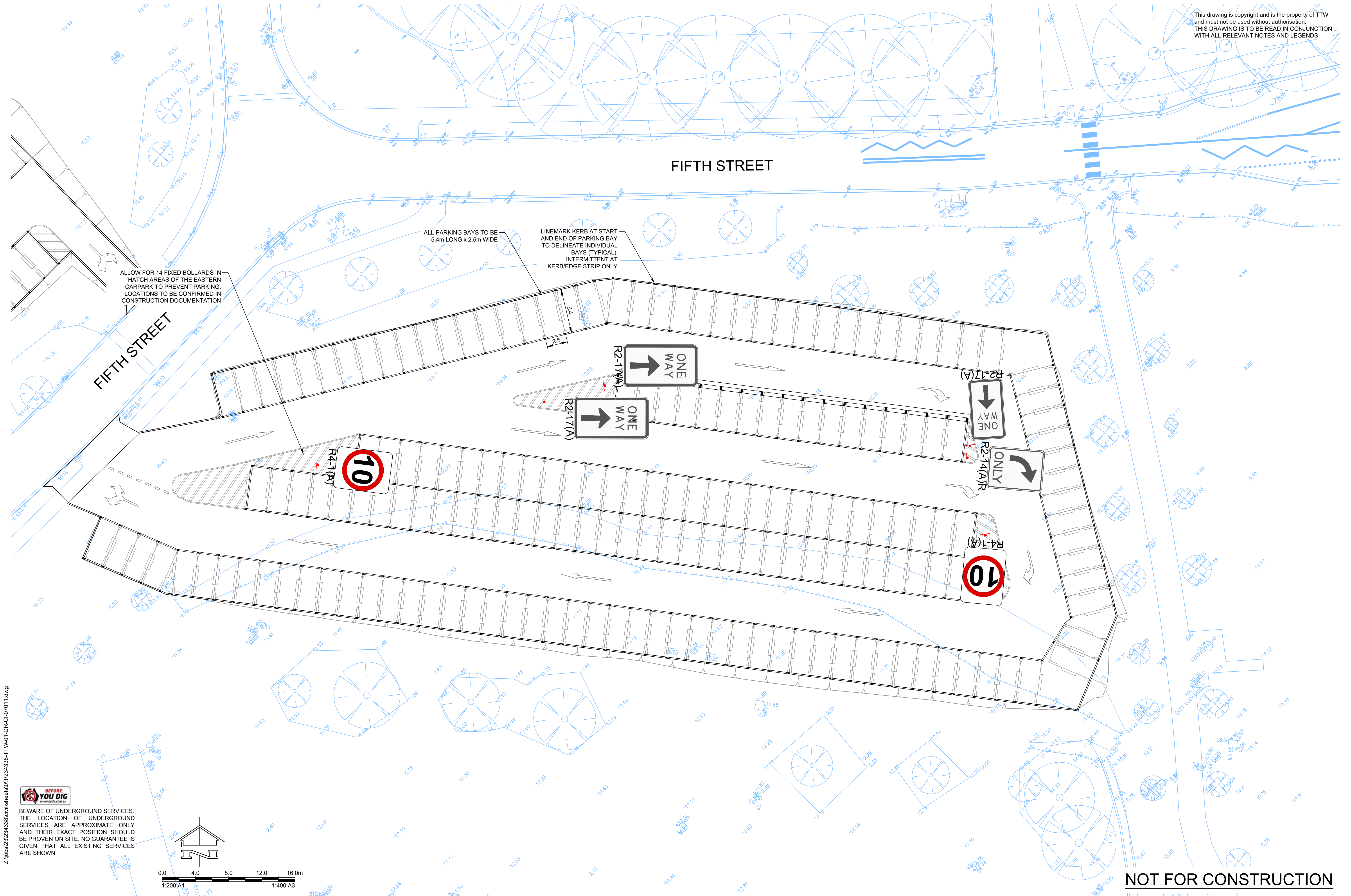
STORMWATER STRUCTURE SCHEDULE												
STRUCTURE ID	PIT TYPE	COVER	SETOUT COORDS	WIDTH	LENGTH	INLET DIA	INLET I.L.	OUTLET DIA	OUTLET I.L.	COVER RL	PIT DEPTH [m]	REMARKS
SW TEMP CARPARK-1-1	JUNCTION PIT	D	E: 79.085 N:-125.818	900	900	300	7.54	375	7.52	8.87	1.36	IN ACCORDANCE WITH COUNCIL STANDARD DRAWING DS26
SW TEMP CARPARK-1-2	BAFFLE PIT	C	E: 79.390 N:-140.370	1300	900	450	7.83	300	7.81	9.88	2.07	REFER TO SHEET 04041 FOR DETAILS
SW TEMP CARPARK-1-3	GRATED PIT	C	E: 77.840 N:-152.420	900	900			300	8.60	9.50	0.97	IN ACCORDANCE WITH COUNCIL STANDARD DRAWING DS25
SW TEMP CARPARK-1-4	GRATED PIT	C	E: 48.082 N:-148.627	900	900			300	8.61	9.51	0.97	IN ACCORDANCE WITH COUNCIL STANDARD DRAWING DS25
SW TEMP CARPARK-2-1	JUNCTION PIT	B	E: -35.706 N:-125.974	900	900	375 225	7.25 7.97	375	7.23	8.83	1.63	IN ACCORDANCE WITH COUNCIL STANDARD DRAWING DS26
SW TEMP CARPARK-2-2	KERB INLET PIT	C	E: -40.673 N:-133.461	850	675	375	7.30	375	7.28	8.86	1.60	IN ACCORDANCE WITH COUNCIL STANDARD DRAWING DS21
SW TEMP CARPARK-2-3	KERB INLET PIT	C	E: -58.748 N:-150.748	850	675	300	7.40	375	7.38	8.88	1.50	IN ACCORDANCE WITH COUNCIL STANDARD DRAWING DS21
SW TEMP CARPARK-2-4	KERB INLET PIT	C	E: -82.178 N:-162.205	850	675	225	7.52	300	7.50	8.95	1.45	IN ACCORDANCE WITH COUNCIL STANDARD DRAWING DS21
SW TEMP CARPARK-2-5	KERB INLET PIT	C	E: -109.421 N:-165.677	850	675	225	7.68	225	7.66	8.76	1.10	IN ACCORDANCE WITH COUNCIL STANDARD DRAWING DS21
SW TEMP CARPARK-2-6	KERB INLET PIT	C	E: -133.326 N:-161.745	850	675			225	7.80	8.63	0.83	IN ACCORDANCE WITH COUNCIL STANDARD DRAWING DS21
SW TEMP CARPARK-2-7	KERB INLET PIT	C	E: -27.314 N:-120.095	850	675			225	8.02	8.85	0.83	IN ACCORDANCE WITH COUNCIL STANDARD DRAWING DS21

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T4	TENDER ADDENDUM ISSUE	RP	KN	02.05.2025										
T3	TENDER ADDENDUM ISSUE	RP	KN	19.12.2024										
T2	TENDER ISSUE	RP	JLE	08.10.2024										
T1	TENDER ISSUE	RP	AE	03.10.2024										

Client:

WESTERN SYDNEY UNIVERSITY

Engineer:

TTW

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Project:

WSU CARPARK RELOCATION PROJECT

Drawing Title:

TRAFFIC CONTROL SIGNAGE AND LINEMARKING SHEET 1

Scale at A1: 1:200

Drawn: KN

Designed: JLE

Approved: RP

Project No: 234338-TTW-01-DR-CI-07011-T4

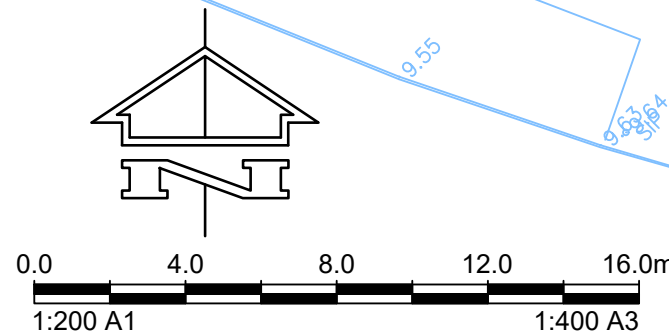
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Rev	Description	Eng	Draft	Date	Rev	Description	Eng	Draft	Date	Rev	Description	Eng	Draft	Date
T4	TENDER ADDENDUM ISSUE	RP	KN	02.05.2025										
T3	TENDER ADDENDUM ISSUE	RP	KN	19.12.2024										
T2	TENDER ISSUE	RP	JLE	08.10.2024										
T1	TENDER ISSUE	RP	AE	03.10.2024										

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Project:

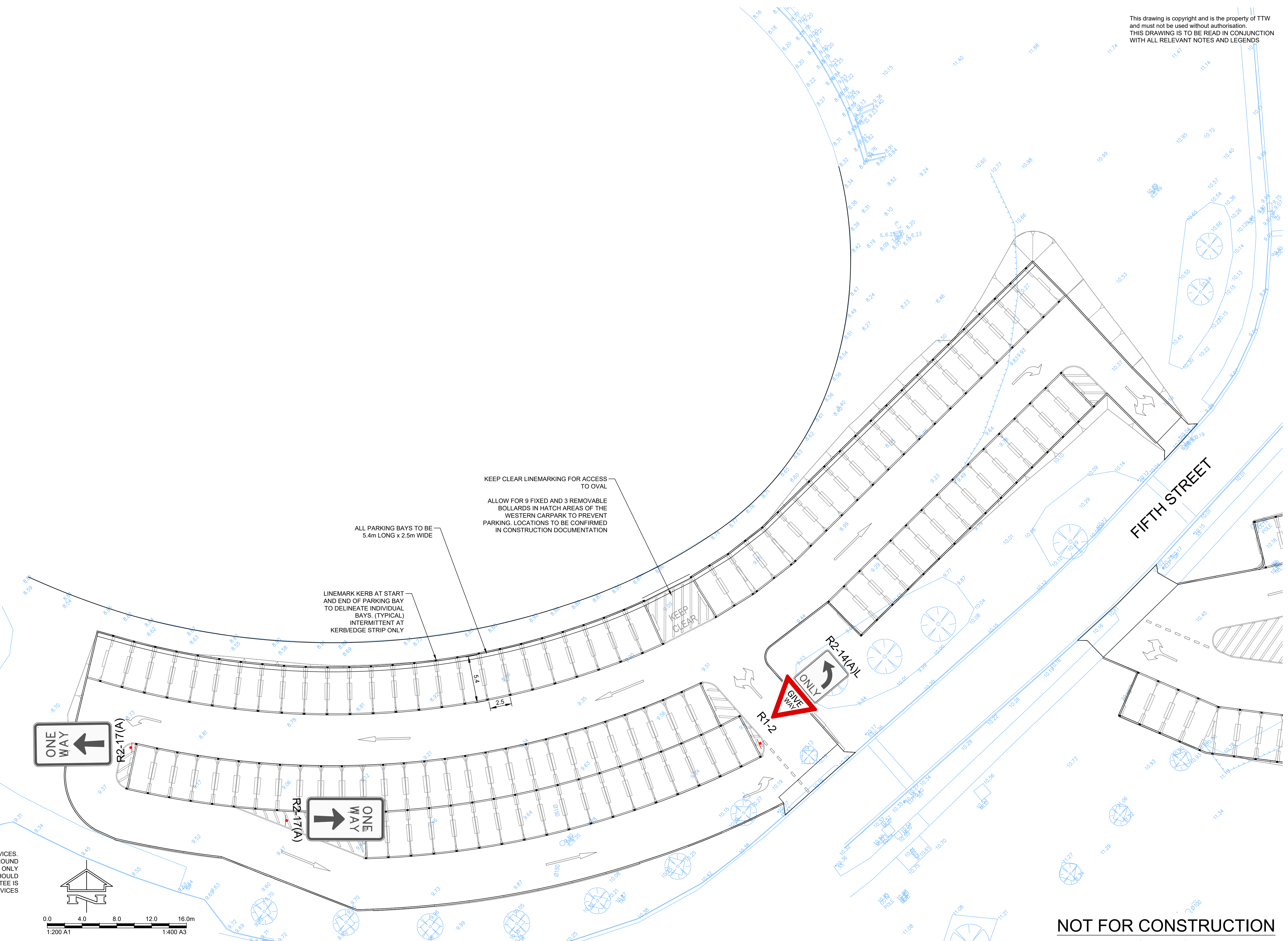
WSU
CARPARK RELOCATION
PROJECT

Drawing Title:

TRAFFIC CONTROL
SIGNAGE AND LINEMARKING
SHEET 2

Scale at A1: 1:200

Drawn	KN	Designed	JLE	Approved	RP	
Project No	Originator	Zone	Type	Role	Sheet No.	Rev
234338-TTW-01-DR-CI-07012-T4						
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Civil Specification

WSU Temporary Carpark Relocation Project

Prepared for Western Sydney University / 14 August 2025

234338

PREPARED BY	APPROVED BY	STATUS	ISSUE	DATE
Richard Penwell	Jake Barnes	FOR TENDER	Issue T1	03 October 2024
Richard Penwell	Jake Barnes	FOR TENDER	Issue T2	14 August 2025

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1.0 GENERAL REQUIREMENTS

1.1 GENERAL

1.1.1 GENERAL

Precedence

Requirements of individual technical sections of the specification override conflicting requirements in this section.

Current editions

General: Use referenced documents which are editions, with amendments, current 3 months before the closing date for tenders, except where other editions or amendments are required by statutory authorities. Refer to individual specification sections for referenced documents.

Site copies: 1

Contractual relationships

Responsibilities and duties of the principal, contractor and contract administrator are not altered by requirements in referenced documents.

1.1.2 SAFETY IN DESIGN

So far as is reasonably practicable, TTW has identified potential risks to the health and safety of persons who may be affected by the civil design.

Identified hazards & risks have been included in the Civil Risks and Solutions Register which has been forwarded to TTW's Client.

The principal contractor must familiarise itself with the hazards and risks identified in the report and the measures proposed to eliminate or mitigate those hazards and risks.

The principal contractor must notify TTW in a timely manner should they require any further information regarding any identified hazards or risks related to the civil design. If no request for further information is received the project principal contractor acknowledges that the information provided is adequate for its purpose.

The provision of such advice by TTW does not release the principal contractor from its own health and safety obligations under any legislation, contract or otherwise.

1.1.3 INTERPRETATION

General

Unless the context otherwise requires, the following definitions apply:

- Supply: "Supply", "furnish" and similar expressions mean "supply only".
- Provide: "Provide" and similar expressions mean "supply and install".
- Contract Administrator: "Contract Administrator", "Project Manager", Superintendent" means persons approved by the Principal to give direction to the Contractor.

- Approved: "Approved", "reviewed", "directed", "rejected", "endorsed" and similar expressions mean "approved (reviewed, directed, rejected, endorsed) in writing by the contract administrator".
- Give notice: "Give notice", "submit", "advise", "inform" and similar expressions mean "give notice (submit, advise, inform) in writing to the contract administrator".
- Obtain: "Obtain", "seek" and similar expressions mean "obtain (seek) in writing from the contract administrator".
- Proprietary: "Proprietary" mean identifiable by naming manufacturer, supplier, installer, trade name, brand name, catalogue or reference number.
- Samples: Includes samples, prototypes and sample panels.

Technical

Zinc-coated steel: Includes zinc-coated steel, zinc/iron alloy-coated steel, and aluminium/zinc-coated steel.

Pipe: Includes pipe and tube.

Maintenance period

Co-extensive with the defects liability period.

Abbreviations

ABS: Acrylonitrile-butadiene-styrene.

EPDM: Ethylene-propylene diene monomer.

GRP: Glass-fibre reinforced polyester.

NATA: National Association of Testing Authorities.

PTFE: Polytetrafluoroethylene.

RMS: Roads and Maritime Services (Formally Roads & Traffic Authority)

SSL: Scientific Services Laboratory.

uPVC: Unplasticised Poly Vinyl Chloride

1.1.4 CONTRACT DOCUMENTS

General

Diagrammatic layouts: Layouts of service lines, plant and equipment shown on the drawings are diagrammatic only, except where figured dimensions are provided or calculable. Before commencing work, obtain measurements and other necessary information.

Levels: Spot levels take precedence over contour lines and ground profile lines. Inform the Contract Administrator of any apparent discrepancies before proceeding.

1.1.5 AUTHORITIES APPROVALS

General: Contractor is to arrange inspections and approvals as required by the relevant regulatory authority. Contractor is to provide documentary evidence of approvals prior to covering work.

Works by Statutory Authorities: If the responsible authority is required to or, pursuant to the statutory powers vested in it, elects to perform or supply part of the works or to inspect or test the works during construction, make the necessary arrangements with the authority and pay and bear the fees payable in connection therewith.

1.1.6 WORK OUTSIDE SITE

Requirement: Make necessary arrangements with adjoining property owners and the relevant authorities.

1.1.7 AUTHORITIES REQUIREMENTS

Where works are on public property, or property which is to come under the control of a Statutory Authority, or where the works are to come under the control of a Statutory Authority (i.e. stormwater drainage in a future easement), the works shall comply with the requirements of the relevant Statutory Authority, and where the requirements of the Statutory Authority are different to the requirements of this Specification, the requirements of the Statutory Authority will be applicable.

The Contractor shall be responsible for determining the requirements of any relevant Statutory Authorities.

1.2 QUALITY

1.2.1 INSPECTION

General: Refer to Appendix A for schedule of inspection and testing requirements. It is the contractor's responsibility to construct the works in accordance with the specifications and drawings and any inspections by the contract administrator or their representatives shall not be construed as relieving or relaxing this requirement. The contract administrator and their representatives are not fulltime or part time inspectors for the contractor, and any inspections made are for the contract administrator's purpose only.

Notice

Witness points: If notice of inspection is to be given in respect of parts of the works, advise if and when those parts are to be concealed.

Hold points: If notice of inspection is to be given in respect of parts of the works, do not conceal those parts without approval.

Concealed Work: Give notice before covering work so that inspection may be made.

Minimum Notice: Where inspection by the Engineer is required or notification to the contract administrator to allow opportunity to inspect is required, give 48 hours minimum notice. If the area of work is not completed at the scheduled time of inspection or is defective and requires re-inspection, re-inspection shall be at Contractors expense. Scheduled inspections should be cancelled a minimum of 4 hrs prior to the scheduled time if work will not be ready for inspection. Completed Contractors checklists and Materials Certificates and Test results as required shall be available at time of inspection.

1.2.2 TESTS

Notice

General: Give sufficient notice so that designated tests may be witnessed.

Hold points: Do not carry out designated tests without approval.

Minimum notice for tests to be witnessed:

- 5 working days for site tests; and
- 10 working days for local pre-delivery tests.

Testing authorities

General: Have tests carried out by authorities accredited by NATA to test in the relevant field, or an organisation outside Australia recognised by NATA through a mutual recognition agreement. Cooperate as required with testing authorities.

Process Control Tests: The specified process control tests are the minimum requirement. Perform tests of the type and frequency necessary to adequately control the materials and processes used in the construction of the Works.

Compliance Assessment Tests: Materials and work specified to be subject to testing may not be accepted as complying with the Contract until the results of all tests (including both compliance assessment and process control tests) relating to that material or work are satisfactory.

Compliance Assessment: If compliance assessment tests are specified to be carried out by an independent testing authority, arrange for the independent testing authority to submit three copies of each test result direct to the Superintendent.

Methods: Unless otherwise specified use applicable standard test methods specified in Australian standards.

Testing: Take and prepare the samples required for the specified tests. A plan showing the detail of proposed test lots shall be approved by the Contract Administrator prior to commencing any operation where testing is specified. Test lots shall be uniform, usually consisting of an area placed and/or compacted in one day, and the Contract Administrator shall select testing sites within each test lot on a random basis. If the test results show that part of a lot does not conform with the specification requirements, the Contract Administrator may direct that additional testing be performed to determine the extent of the non-conforming work. The cost of additional tests shall be borne by the Contractor.

For concrete work test lots shall consist of each separate concrete pour.

Timing: Unless otherwise specified materials samples shall be obtained at the time of delivery to the site.

Reports: Submit written test results including a plan showing the location and reduced level of tests. The location and reduced level of test locations shall be surveyed and co-ordinated and a level shall be recorded in accordance with the site grid and datum. Test reports shall state the purpose of the test i.e. stormwater trench backfill.

Costs of tests

The contractor is to bear the costs of tests and repeat tests in the case of failure.

Covering Work:

If tests are to be carried out on parts of the works, do not conceal those parts and do not commence further work on those parts until the tests have been satisfactorily completed and compliance verified.

1.2.3 SAMPLES

Timing

Delays: Coordinate submissions of related samples. Do not cause delays by making late submissions or submitting inadequate samples.

Quantity

General: Submit a sample of each designated item and 2 copies of supporting documentation. Include ancillary items such as fasteners, flashings and seals.

Identification

Identify the project, contractor, subcontractor or supplier, manufacturer, applicable product, model number and options, as appropriate and include pertinent contract document references. Include service connection requirements and product certification. Identify non-compliances with project requirements, and characteristics which may be detrimental to successful performance of the completed work.

Approval

General: Do not commence work affected by samples until the samples have been approved. Submit further samples as necessary.

Retention

Keep approved samples in good condition on site, until practical completion.

Incorporation

Incorporate in the works samples which have been approved for incorporation. Do not incorporate other samples.

Criteria

Match approved samples throughout the works.

1.2.4 CONTRACTOR'S SUBMISSIONS

Timing

General: Submit documents in a timely manner, to suit the construction program. Advise if any of the documents are to be returned.

Delays: Coordinate submissions of related items. Do not cause delays by making late or inadequate submissions.

Quantity

Bound documents:	3 copies.
Loose documents up to and including A3:	One copy.
Loose documents larger than A3:	One transparency on heavyweight plastic film the same size as the standard contract drawings.
Standard contract drawing size:	>
Electronic Format: Provide copies of documents in agreed electronic format.	

Identification

Identify the project, contractor, subcontractor or supplier, manufacturer, applicable product, model number and options, as appropriate and include pertinent contract document references. Include service connection requirements and product certification. Identify non-compliances with project requirements, and characteristics which may be detrimental to successful performance of the completed work.

Quality Assurance

Requirement: Where there is a recognized quality assurance program applicable to a specified product, provide assurance of product quality under the authority of that program. The program shall be one in which the Manufacturer has in place a quality control management system which is subject to continual monitoring through quality audits by a recognized independent organization.

Program: Submit a copy of the contractor's quality assurance programme with the Tender.

During the construction phase the contractor shall provide a written verification to the contract administrator that he has completed quality assurance procedures on the construction work detailed in the specifications and drawings.

Description: Provide a written description of each quality management system, with specific reference to the following:

- the relevant Australian standard
- where the standard provides for classification levels, the level adopted
- the scope and field of application
- the personnel involved and their responsibilities
- construction method statements
- Inspection Test Plans (ITP's)
- the various procedures required by the standard including those for management review, contract review, design and document control, process control, inspection and testing, etc.
- the quality audit system
- where external quality audits are required by a recognised independent organization, the name of that organisation
- other relevant information.

Quality control: The Contractor shall submit their Construction Method and Inspection Test Plan (I.T.P) for each work procedure to the contract administrator for approval a minimum of 14 days prior to commencing the relevant work. I.T.Ps shall include checklists showing that the Contractor has checked that the work has been completed in accordance with the specifications and drawings and showing testing and client inspection requirements.

Endorsement

Witness points: Give notice before commencing work affected by contractor's submissions, unless the submissions have been endorsed as satisfactory.

Hold points: Do not commence work affected by contractor's submissions until, if appropriate, the submissions have been endorsed as satisfactory.

Errors: If a document contains errors, submit a new or amended document as appropriate, indicating changes since the previous submission.

Design

General: If part or all of an installation is to be designed by the contractor, submit documents showing the layout and details of the installation.

Variation documents: If it is proposed to change the installation from that shown on the contract documents, or if changes are required by statutory authorities, submit variation documents showing the proposed changes. Where the contract administrator deems that the proposed variation work is to be reviewed and inspected by the relevant consultant(s), this review and inspection shall be at the contractor's expense.

Shop drawings

General: Submit dimensional drawings showing details of fabrication and installation of services and equipment, including relationship to building structure and other services.

Diagrammatic layouts: Coordinate work shown diagrammatically in the contract documents, and submit dimensioned set-out drawings.

Authorities

Correspondence: Submit copies of correspondence and notes of meetings with authorities.

Authorities' approvals: Submit documents showing approval of the authorities whose requirements apply to the work.

Tests

Tests program: Submit a testing and commissioning program which is consistent with the construction program. Include particulars of test stages and procedures.

Test records: For designated tests, including pre-delivery tests, record results and submit reports or certificates in a form suitable for inclusion in operation and maintenance manuals.

Samples

If it is intended to incorporate samples into the works, submit proposals.

Materials and components

Product data: Submit the manufacturer's product data including

- technical specifications and drawings
- type test reports
- performance and rating tables
- recommendations for installation and maintenance.

Proposed products schedules: For major products not specified as proprietary items, within 3 weeks of site possession submit a schedule of those proposed for use.

Product certification: If products must comply with product certification schemes, submit evidence of compliance.

Execution

Acceptance of substrate: Submit installers' statements verifying that the substrate is satisfactory for receiving the installation.

1.2.5 NON-CONFORMING WORK

Where a section of work does not comply with the requirements of the specification and drawings (including requirements for inspection and testing) the Contractor shall submit a non-conformance report detailing the proposed rectification method to the contract administrator for approval. Where the contract administrator deems that the proposed rectification method and work is to be reviewed and/ or inspected by the relevant consultant(s), this review and inspection shall be at the contractor's expense.

1.3 MATERIALS AND COMPONENTS

1.3.1 GENERAL

Proprietary items

Implication: Identification of a proprietary item does not necessarily imply exclusive preference for the item so identified but indicates the necessary properties of the item.

Alternatives: Unless otherwise agreed, alternatives shall not be ground for any claim for variation to cost or time. If alternatives are proposed, submit proposed alternatives and include samples, available technical information and reasons for proposed substitutions. If necessary, provide an English translation. If so requested, obtain and submit reports on relevant tests by an independent testing authority. State if use of proposed alternatives will necessitate alteration to other parts of the works. If the alternative product is accepted, carry out any such alteration without extra charge.

Manufacturers' or suppliers' recommendations

General: Select, if no selection is given, and transport, deliver, store, handle, protect, finish, adjust, prepare for use, and use manufactured items in accordance with the current written recommendations and instructions of the manufacturer or supplier.

Instructions: Submit the recommendations and instructions and advise of conflicts with other requirements.

Project modifications: Advise of activities that supplement, or are contrary to, manufacturer's or suppliers' written recommendations and instructions. Provide written certification and warranty from the product manufacturer specifically for its intended purpose and performance in this project.

Product certification: If products must comply with product certification schemes, use them in accordance with the certification requirements.

Installation: The manufacturer shall visit the site during construction and at completion of construction to certify in writing that the work has been carried out in accordance with their requirements. The manufacturer must also certify that individual components of the proprietary products have not been substituted with alternative products.

Sealed containers

If materials or products are supplied by the manufacturer in closed or sealed containers or packages, bring the materials or products to point of use in the original containers or packages.

Consistency

For the whole quantity of each material or product use the same manufacturer or source and provide consistent type, size, quality and appearance.

1.4 COMPLETION

1.4.1 GENERAL

Samples

Remove unincorporated samples on completion.

Contractor's submissions

Within 2 weeks after practical completion, submit 3 copies of designated documents.

Warranties

General: Name the principal as warrantee. Register with manufacturers as necessary. Retain copies delivered with components and equipment.

Commencement: Commence warranty periods at practical completion or at acceptance of installation, if acceptance is not concurrent with practical completion.

Approval of installer: If installation is not by manufacturer, and product warranty is conditional on the manufacturer's approval of the installer, submit the manufacturer's written approval of the installing firm.

Table 1.4.1-1: Warranty Schedule

Item	Period
Pipework	20 years
Pits	20 years
Access covers, grates and frames	20 years

1.4.2 RECORD DRAWINGS (WORK AS EXECUTED DRAWINGS AND CCTV)

General

It is the Contractor's responsibility to provide adequate survey information to confirm what they have "installed" or constructed is in accordance with the design and documentation. Should the Contractor administrator deem the survey information provided inadequate, the contractor shall submit a new survey information to the contract administrator's approval.

Submit record drawings. Show the "as installed" locations of all works constructed under this contract. Show off-the-grid dimensions where applicable. Record drawings are to be submitted in electronic data both in two and three-dimensional formats, accompanied by a "hard copy". Electronic formats to be agreed with Contract Administrator. Record drawings are to be made by a registered surveyor.

It is the Contractor's responsibility to provide Closed Circuit Television (CCTV) information of all the in-ground stormwater to confirm what they have "installed" or constructed is of good structural condition and no blockage present.

Services

Show dimensions, types and location of equipment, cables, piping and ductwork in relation to permanent site features and other underground services. Include relationship to building structure and other services, and changes made during commissioning and the maintenance period. Include diagrammatic drawings of each system showing piping and wiring, and principal items of equipment.

Format

Use the same borders and title block as the contract drawings.

1.4.3 OPERATION AND MAINTENANCE MANUALS

General

General: Submit operation and maintenance manuals for installations.

Authors and compilers: Use personnel experienced in the maintenance and operation of equipment and systems installed, and with editorial ability.

Subdivision: By installation or system, depending on project size.

Referenced documents: If referenced documents or technical sections require that manuals be submitted, include corresponding material in the operation and maintenance manuals.

Format

A4 size loose leaf, in commercial quality, 4 ring binders with hard covers, each indexed, divided and titled and an electronic copy of the manual on CD disk in a format approved by the Contract Administrator. Include the following features:

- **Pagination:** Number pages consecutively.
- **Cover:** Identify each binder with typed or printed title "OPERATION AND MAINTENANCE MANUAL", to spine. Identify title of project, volume number, volume subject matter, and date of issue.
- **Ring size:** 50 mm maximum, with compressor bars.
- **Text:** Manufacturers' printed data, including associated diagrams, or typewritten, single-sided on bond paper, in clear concise English.
- **Dividers:** Durable divider for each separate element, with typed description of system and major equipment components. Clearly print short titles under laminated plastic tabs.
- **Drawings:** Fold drawings to A4 size and accommodate them in the binders so that they may be unfolded without being detached from the rings. Provide with reinforced punched binder tabs.

Contents – General

Include the following:

- **Drawings and technical data:** As necessary for the efficient operation and maintenance of the installation.
- **Table of contents:** For each volume. Title to match cover.
- **Directory:** Names, addresses, and telephone and facsimile numbers of principal consultant, subconsultants, contractor, subcontractors and names of responsible parties.

Equipment descriptions:

- **Name, address and telephone and facsimile numbers** of the manufacturer and supplier of items of equipment installed, together with catalogue list numbers.
- **Schedules (system by system)** of equipment, stating locations, duties, performance figures and dates of manufacture. Provide a unique code number cross-referenced to the record and diagrammatic drawings and schedules, including spare parts schedule, for each item of equipment installed.

Operation procedures:

- **Manufacturer's technical literature** as appropriate.

Maintenance procedures:

- Manufacturer's technical literature as appropriate. Register with manufacturer as necessary. Retain copies delivered with equipment
- Detailed recommendations for preventative maintenance frequency and procedures
- Safe troubleshooting, disassembly, repair and reassembly, cleaning, alignment and adjustment procedures. Provide logical step-by-step sequence of instructions for each procedure
- Schedule of spares recommended to be held on site, being those items subject to wear or deterioration and which may involve the principal in extended deliveries when replacements are required. Include complete nomenclature and model numbers, and local sources of supply

Certificates:

- Copies of manufacturers' warranties.
- Certificates from authorities.
- Product certification.

Drawings:

- Record drawings, full size and electronic versions in approved format.

Timing and quantity

Draft manuals: Submit 2 draft manuals 8 weeks before the date for practical completion to enable the principal's staff to familiarise themselves with the installation. Include provisional record drawings and preliminary performance data.

- Format: As for the final manuals, with temporary insertions for items which cannot be finalised until the installation is commissioned and tested.

Revised draft manuals: Submit revised draft manuals 2 weeks before commissioning.

Progressive: For equipment put into service during construction and operated by principal, submit manuals within 2 weeks after acceptance.

Final drafts: Submit for review after completion of commissioning and no later than 2 weeks before the date for practical completion. If available, include certificates from authorities, and warranties.

Final copies: Submit 3 sets of final volumes and CD disk within 2 weeks after practical completion. Incorporate feedback from review and from training of principal's staff, including preparation and insertion of additional data.

Revisions: Submit 3 sets of loose-leaf amendments for insertion in the manuals, incorporating feedback from the maintenance period, within 2 weeks after completion.

1.4.4 SPARES

General

Schedule: At least 8 weeks before the date for practical completion, submit a schedule of spare parts necessary for maintenance of the installation. State against each item the recommended quantity, and the manufacturer's current price, including for

- packaging and delivery to site

- checking receipt, marking and numbering in accordance with the spare parts schedule
- referencing equipment schedules in the operation and maintenance manuals
- painting, greasing and packing to prevent deterioration during storage

2.0 SITE PREPARATION

2.1 GENERAL

Site preparation includes:

- service identification
- erosion and sediment control establishment
- dust control
- marking all items to be protected during the construction period
- dewatering
- site clearing and topsoil stripping
- traffic control establishment
- identification of underpinning extents if required

2.1.1 CROSS REFERENCES

General

Refer to the General requirements section.

Related sections

Refer to the following sections:

- General Requirements
- Earthwork
- Demolition
- Appendix A - Schedule of Inspection and Testing Requirements

2.1.2 INTERPRETATION

Services: Pipes, cables, ducts, associated structures or similar objects, including electrical, communication and control cables, drains, sewers, water pipes, gas pipes, and the like.

2.2 QUALITY

2.2.1 INSPECTION

General

Refer also to General Requirements section and Appendix A.

Witness points

Give sufficient notice so that inspection may be made of the following:

- Enclosures to trees to be retained.
- Erosion control measures installed
- Stripping of Topsoil complete
- Site clearing complete
- Traffic control devices installed.

Hold points

2.2.2 CONTRACTOR'S SUBMISSIONS

Materials

Submit details of materials proposed, including the following:

- Use of cleared vegetation for mulching.

Execution

Submit the methods and equipment proposed for the groundworks, including the following:

- Dewatering and groundwater control and disposal of surface water.
- Control of erosion, contamination and sedimentation of the site, surrounding areas and drainage systems.
- Dust control.
- Proposals for underpinning of existing structures.

2.3 SITE MANAGEMENT

2.3.1 REMOVAL OF TOPSOIL

General

Extent: Remove the topsoil layer of the natural ground containing substantial organic matter, over the areas to be excavated or regraded, and areas to be occupied by structures, pavements, embankments and the like, and other areas designated to have topsoil removed.

Depth to be removed: Approx. 150mm typically.

Topsoil stockpiles

Dispose of topsoil off site unless directed otherwise by the Contract Administrator or contract documents. Where directed to stockpile topsoil on site, establish stockpiles to sizes and in locations as directed, to heights not exceeding 2.5 m. Provide adequate drainage and erosion protection. Do not burn off or remove plant growth which may occur during storage. Do not allow traffic on stockpiles. If a stockpile is to remain for more than four weeks, sow with temporary grass. Protect the topsoil stockpiles from contamination by other excavated material, weeds and building debris.

2.3.2 TREE PROTECTION

Warning sign

General: Display a sign in a prominent position at each entrance to the site, warning that trees and plantings are to be protected during the contract. Remove on completion.

Lettering: Road sign type sans serif letters, 100 mm high, in red on a white background, to AS 1744.

2.3.3 TREES TO BE RETAINED

Marking

General: Mark trees and shrubs to be retained using suitable non-injurious, easily visible and removable means of identification.

Tags: 100 x 50 mm zincanneal tags, painted yellow and lettered to conform with the tree number on the drawings. Secure tags to trees using loose galvanised steel wire bands.

Trees to be retained: Refer to Landscape Drawings and Arboricultural Report

Protection and repair

Protection: Protect from damage the trees and shrubs to be retained, including those beyond the site area, both above and below ground.

Repair: Repair trees damaged during the work.

Tree enclosures

General: Provide temporary protective enclosures or guards.

Wire enclosures: Four strands of fencing wire, or plastic mesh barrier, supported on star pickets spaced at not more than 4 m.

Mesh enclosures: SL62 reinforcing mesh 1800 mm high wired to 2400 mm long star pickets, driven 600 mm into the ground, spaced 1800 mm apart at a minimum distance of 1 m from the tree trunk.

Sheeting to excavations: Where excavations are to be made near trees, add continuous 900 mm high corrugated galvanised steel sheeting, bedded 150 mm into the ground, wired to the enclosure.

Trees to be enclosed: Refer to Landscape Drawings and Arboricultural Report

Type of enclosure: Refer to Landscape Drawings and Arboricultural Report

Work on trees

If it is proposed to perform work on trees, give notice and obtain instructions.

Removal

If a tree is damaged and repair work is considered impractical, or is attempted and fails, give notice and obtain instructions. If directed remove the tree and root system, make good and either replace the tree with a replacement tree of the same species and a similar size, or pay damages.

2.3.4 WORK NEAR TREES

Protection

Protect trees specified or shown to be retained from damage by groundworks. Take necessary precautions including the following:

Harmful materials

Keep the area within the dripline free of construction material and debris. Do not place bulk materials and harmful materials under or near trees. Do not place spoil from excavations against tree trunks. Prevent wind-blown materials such as cement from harming trees and plants.

Damage

Prevent damage to tree bark. Do not attach stays, guys and the like to trees.

Work under trees

General: Do not remove topsoil from, or add topsoil to, the area within the dripline of the trees.

Excavation: If excavation is required near trees to be retained, give notice and obtain instructions. Open up excavations under tree canopies for as short a period as possible.

Hand methods: Use hand methods to locate, expose and cleanly remove the roots on the line of excavation. If it is necessary to excavate within the drip line, use hand methods such that root systems are preserved intact and undamaged.

Roots

Do not cut tree roots exceeding 50 mm diameter. Where it is necessary to cut tree roots, use means such that the cutting does not unduly disturb the remaining root system.

Immediately after cutting, apply a bituminous fungicidal sealant to the cut surface to prevent the incursion of rot or disease.

Backfilling

Backfill to excavations around tree roots with a mixture consisting of three parts by volume of topsoil and one part of well-rotted compost with a neutral pH value, free from weed growth and harmful materials. Place the backfill layers, each of 300 mm maximum depth, compacted to a dry density similar to that of the original or surrounding soil. Do not backfill around tree trunks to a height greater than 300 mm above the original ground surface. Immediately after backfilling, thoroughly water the root zone surrounding the tree.

Compacted ground

Do not compact the ground under trees. If compaction occurs, give notice and obtain instructions.

2.3.5 EXISTING SERVICES

Approval: Do not excavate by machine within 1 m of existing underground services without prior approval.

Location: Position and number of existing services shown on drawings is only indicative and may not include all existing services. It is the Contractor's responsibility to confirm the position of all existing services prior to commencing work.

Alterations: Alter existing services as necessary. All work to comply with authorities requirements. Notify the superintendent prior to contacting authorities.

Interruptions: Obtain necessary approval before interrupting an existing service and perform the work so that the duration and number of interruptions are reduced to a minimum. Provide a program before starting this work.

Supporting existing work: If an existing service or structure, which is to be retained, crosses the line of a required trench/excavation, provide permanent support for the existing service or structure.

Costs: the contractor shall allow for all costs involved including obtaining approvals, fees and inspections as required by relevant authorities.

Existing Services to be removed

Remove exiting services which are not required for the completed works. Stage removal to suit the works program and to maintain supply as required. Where the service to be removed connects to a service which is

to be retained, disconnect the section to be removed and carry out works as necessary such that the remaining section is protected and remains operational.

Following removal of existing services, backfill service trenches in accordance with the Services Trenches specification.

2.3.6 ENVIRONMENTAL PROTECTION

Erosion control

General: Plan and carry out the work so as to avoid erosion, contamination, and sedimentation of the site, surrounding areas, and drainage systems. Comply with the requirements of the erosion and sediment control drawings and relevant authorities. Maintain landscaped areas in good condition.

Temporary erosion control measures

Staging: Stage operations (e.g. clearing, stripping).

Restoration: Progressively restore disturbed areas.

Drains: Provide temporary drains, catch drains and sedimentation basins.

Dispersal: Divert and disperse concentrated flows to points where the water can pass through the site without damage.

Spreader banks or other structures: Disperse concentrated run-off.

Silt traps: Construct and maintain silt traps to prevent discharge of scoured material to downstream areas.

Temporary grassing to disturbed areas.

Temporary fencing: Required.

Maintenance: After each rain inspect, clean, and repair if required, temporary erosion and sediment control works.

Completion: Erosion and sediment control measures are to be repaired and left in a good condition at the completion of the works where they are still required. If erosion and sediment control measures are no longer required, remove temporary erosion and sediment control works and make good.

Dewatering

General: Keep groundworks free of surface and ground water. Provide and maintain slopes, crowns and drains on excavations and embankments to ensure free drainage. Install and maintain temporary sumps and dewatering equipment where necessary. All stormwater to be disposed of according to relevant authorities requirements. Place construction, including fill, masonry, concrete and services, on ground from which free water has been removed. Prevent water flow over freshly laid work.

2.3.7 SITE RESTORATION

Requirement

Where existing ground surfaces are not required to be varied as part of the works, restore them to the condition existing at the commencement of the contract.

2.3.8 RECORDS, EXISTING STRUCTURES

Provide dilapidation reports prepared by an independent consultant for existing structures and works to be retained including adjacent properties, public roads and areas which may be affected by the works.

2.3.9 UNDERPINNING, EXISTING STRUCTURES

The new works may involve underpinning of existing structures. The proposals, which shall be submitted for approval, shall ensure the operation of these buildings, paths and accesses is not adversely affected at any stage.

2.3.10 ARTEFACTS

The Superintendent is to be notified should any artefacts or old footings and structures be encountered during any excavation process.

2.3.11 NOISE, VIBRATION, DUST CONTROL

The contractor will demonstrate to the Superintendent that the proposed equipment is within acceptable limits for noise and vibration as determined by a registered acoustic consultant. A proposal detailing control measures shall be submitted before commencement of the works. Noise, vibration and dust levels shall comply with the requirements of relevant authorities and any specific contract requirements.

2.3.12 TRAFFIC MANAGEMENT

The Contractor shall construct the Works in a safe manner with the least possible obstruction to traffic, both vehicular and pedestrian.

The Contractor shall prepare a Traffic Guidance Scheme and submit it to the Contract Administrator and the relevant authorities where required. Carry out all activities for controlling traffic, both vehicular and pedestrian, in accordance with AS 1742.3, and the requirements of the relevant Authorities.

Vehicular and pedestrian access to properties shall be maintained wherever possible. Minimum notice of 48 hours shall be provided to property owners whose access will be restricted (give longer notice where required by relevant authorities).

The Contractor is required to consult with the affected property owners to minimise the impact of the works on the property owners' operations including impacts of works and Traffic Guidance Scheme on businesses and around commercial areas.

On State Roads, Regional Roads, in proximity to certain traffic control devices and where required by the relevant authorities, the Contractor shall obtain formal approval of the Traffic Guidance Scheme from the Statutory Road Authority, Council and Police.

In case of full road closures on local roads, the Contractor shall obtain prior approval from Council.

2.4 SITE CLEARING

2.4.1 SITE CLEARING

Extent

General: Clear only the following site areas:

- Areas to be occupied by works such as buildings, paving, excavation, regrading and landscaping.
- Other areas designated to be cleared.

Contractor's site areas: If not included within the areas specified above, clear generally only to the extent necessary for the performance of the works.

Clearing operations

Removal: Remove everything on or above the site surface, including rubbish, scrap, grass, vegetable matter and organic debris, scrub, trees, timber, stumps, boulders and rubble.

Grubbing: Grub out stumps and roots over 75 mm diameter to a minimum depth of 500 mm below subgrade under buildings, embankments or paving, or 300 mm below finished surface in unpaved areas.

Old works: Remove old works, including slabs, foundations, paving, drains and manholes.

Existing grass: Remove grass to a depth just sufficient to include the root zone.

2.4.2 SPOIL

Offsite disposal

General: Remove surplus excavated material and surplus site clearance material from the site unless directed otherwise by the Contract Administrator or the contract documents.

Surplus material: Dispose of surplus material according to relevant authority's requirements and pay for all associated costs.

Mulch

If directed by the Contract Administrator or contract documents put cleared vegetation through a chipper. Reduce to pieces not larger than 75 x 50 x 15 mm and stockpile for re-use as mulch. Otherwise remove from site and dispose in accordance with "Surplus material".

On site burial

Do not bury boulders, concrete fragments and the like on site.

2.5 COMPLETION

2.5.1 COMPLETION

Temporary works

Where directed by the Contract Administrator or contract documents, leave temporary works in good condition. Otherwise remove temporary works including:

- Tree enclosures: Remove temporary tree enclosures at completion and make good.
- Tree marking: Remove temporary marks and tags at completion.
- Erosion and Sediment Control devices: Remove devices which are no longer required at completion and make good. Devices which are to remain are to be cleaned and left in good condition.
- Traffic control measures: Remove temporary traffic control measures which are no longer required and make good.

3.0 EARTHWORKS

3.1 GENERAL

Earthworks includes;

- Review of the geotechnical report
- Identification of unsuitable material
- Providing complying fill material confirmed by testing
- Excavation to tolerances and testing
- Filling to tolerances, proof rolling and testing

3.1.1 CROSS REFERENCES

General

Refer to the General requirements section.

Related sections

Refer to the following sections:

- General Requirements
- Site Preparation
- Service Trenches
- Demolition
- Appendix A - Schedule of Inspection and Testing Requirements

3.1.2 INTERPRETATION

Definitions

General: To AS 1348.1.

Description and classification of soils: To AS 1726.

Bad ground: Ground unsuitable for the purposes of the works, including fill liable to subsidence, ground containing cavities, faults or fissures, ground contaminated by harmful substances and ground which is or becomes soft, wet or unstable.

Unsuitable Material: Material containing rubbish, organic matter, contaminants and other deleterious material and material which does not comply with the type of fill specified.

Discrepancy: A difference between contract information about the site and conditions encountered on the site, including but not limited to discrepancies concerning:

- the nature or quantity of the material to be excavated or placed;
- existing site levels; and
- services or other obstructions beneath the site surface.

Line of influence: A line extending downward and outward from the bottom edge of a footing, slab or pavement and defining the extent of foundation material having influence on the stability or support of the footings, slab or pavement. Generally extended at 26° below horizontal unless noted otherwise.

Rock: Monolithic material with volume greater than 0.5 m³ which cannot be removed until broken up either by explosives or by rippers or percussion tools.

Subgrade: The trimmed or prepared portion of the formation on which the pavement or slab is constructed.

SITE INVESTIGATION

Geotechnical Report and Environmental Investigation

These reports are provided for information only. The geotechnical and environmental information given is information on the nature of the ground at each tested part. It is not a complete description of conditions existing at or below ground level.

Refer to Geotechnical Investigation Report (Ref: 227191.00.R.001.Rev0 dated 15 November 2024) and Remediation Action Plan (RAP) (Ref 227190.04.R.001.Rev0 dated 14 August 2025) by Douglas Partners.

Notice

If conditions are encountered which are outside of the scope of the contract, give notice immediately and obtain instructions before carrying out any further work in the affected area.

Survey

Survey marks will be confirmed by the contractor using one or more existing features on site.

3.1.3 RECORDS OF MEASUREMENT

Excavation and Backfilling

Agreed quantities: If a schedule of rates applies, provisional quantities are specified, or there are variations to the contract levels or dimensions of excavations, do not commence backfilling or place permanent works in the excavation until the following have been agreed and recorded:

- Depths of excavations related to the datum.
- Final plan dimensions of excavations.
- Quantities of excavations in rock (where rock is to be paid for at a different rate).
- Quantities of fill and topsoil, imports being recorded separately.
- **Certified Records:** Provide a copy of the agreed records of measurement certified by the contractor and the contract administrator.

Rock

Level and class: If rock is to be measured for payment purposes, whether as extra over excavation of material other than rock or for adjustment of provisional measurements, do not remove the rock until the commencing levels and the classes of rock have been determined.

3.2 QUALITY

3.2.1 INSPECTION

General

Refer also to General Requirements section and Appendix A.

Witness Points

Give sufficient notice so that inspection may be made of the following:

- Areas to be cleared and/or stripped of topsoil.
- Areas stripped of topsoil.
- Excavation completed to contract levels or founding material.
- Base completed to contract levels.
- Stockpiled topsoil before spreading.

Hold Points

Subgrade before placing sub-base, base, working base, filter fabric or membrane, as applicable.

Filter fabric in place before backfilling.

Items to be measured as listed in Records of measurement.

Provision: Provide a smooth drum 10 tonne static weight roller with operator for proof roll inspections. Contractor is to allow for provision of safe access for inspections as required.

3.2.2 TESTS

General

Refer also to General Requirements section and Appendix A.

Testing Authority

Use an independent testing laboratory.

Testing

Compaction (density): Test for compliance.

Retesting: Rework and retest areas which do not achieve the required density until that density is achieved.

Test methods

Field dry density: To AS 1289.5.3.1, AS 1289.5.3.5 or AS 1289.5.8.1. If using AS 1289.5.8.1 calibrate the surface moisture-density gauge in accordance with AS 1289.5.8.4 before use.

Density index: To AS 1289.5.6.1.

Standard maximum dry density: To AS 1289.5.1.1.

Modified maximum dry density: To AS 1289.5.2.1.

Fill: Test to AS 1141 or AS 1289 as appropriate.

California bearing ratio: Sample and test to AS 1289.6.1.1, AS 1289.6.1.2 or AS 1289.6.1.3, as appropriate.

Table 3.2.2-2: Test Schedule

Type of test:	Test Method: AS1289 Method No	Frequency/No. of Tests:
Material Properties of imported fill and excavated material	3.1.1, 3.3.1, 3.6.1 and 6.1.1 Contamination Testing	1 test per 500 m ³ min of 2 per source As required by the Relevant Authorities.
Field Density of compacted fill For confined areas	5.3.1, 5.8.1 or 5.6.1	1 test per 200 mm layer per 1000 m ² 1 test per layer per lot
Field Density of compacted fill under pavements	5.3.1, 5.8.1 or 5.6.1	1 test per layer per 500 m ³
Backfilling to structures	5.3.1, 5.6.1 or 5.8.1	1 test per two layers per 40 m. Min of 1 test per two layers per lot

Contractor to submit testing plan for Superintendents approval.

3.2.3 SAMPLES

General

Submit samples of the following:

- Each type of filter fabric.
- Each type of imported fill.

3.2.4 CONTRACTOR'S SUBMISSIONS

Design

Calculations: Submit calculations to show that proposed excavations and temporary supports, including where applicable supports for adjacent structures, will be stable and safe.

Tests

Imported fill: Submit certification or test results which establish the compliance of imported fill with the contract.

Materials

Submit details of materials proposed, including the following:

- Sources of imported fill.

Execution

Submit the methods and equipment proposed for the groundwork's, including the following:

- Excavation methods, stages, clearances, batters and temporary supports.
- Stockpiles and borrow pits.
- Placing and compaction methods and stages.

The checking and certification of the stability of proposed excavations and the design and certification of temporary supports including, where applicable, supports for adjacent structures, shall be the responsibility of the contractor.

3.3 EXCAVATING

3.3.1 TOLERANCES

Surfaces

Finish groundworks to reasonably smooth and uniform surfaces conforming to the required tolerances.

Subgrades

General: The tolerances in the **Subgrade tolerances table** apply to finished subgrade levels unless overridden by the specific requirements (including tolerances) for finished surface levels and thicknesses of covering materials.

Absolute level tolerance: Maximum deviation from design level.

Relative level tolerance: Maximum deviation from a 3 m straight edge laid anywhere on each plane surface.

Table 3.3.1-3: Subgrade tolerances table

Item	Level tolerance (maximum)	
	Absolute	Relative
Cut subgrade in earth and fill subgrade	+ 0 - 20	Unspecified
Cut subgrade in rock	+ 0 - 20	Unspecified

Other Groundworks

Batters: Not steeper than the slope specified or shown on the Drawings or recommended in the Geotechnical report whichever is less steep.

Vertical: The tolerances on vertical faces of excavation in relation to the line of excavation shown on the drawing is:

Bulk Excavation

inside line of excavation: 0 mm

outside line of excavation: 150 mm

Detailed Excavation

inside line of excavation: 0 mm

outside line of excavation: 100 mm

3.3.2 EXCAVATION

Extent

Site surface: Excavate over the site to give correct levels and profiles as the basis for construction, paving, filling and landscaping. Make allowance for compaction or settlement.

Footings: Excavate for footings, pits, wells and shafts, to the required sizes and depths. Confirm that bearing capacity is adequate.

Crawl space: Provide clear space under timber floor bearers.

Minimum clearance: 400 mm.

Grading

External Areas: Grade external areas to give falls away from the building, minimum 1:100, unless shown otherwise on drawings.

Subfloor Areas: Grade the ground surface under suspended floors to drain ground or surface water away from the building without ponding, unless shown otherwise on drawings.

Electrical Substation: Where external electrical substations/kiosks are to be installed, prepare and grade the ground surface in accordance with the Relevant Authorities requirements.

Existing Footings

If excavation is required below the line of influence of an existing footing, use methods which maintain the support of the footing and ensure that the structure and finishes supported by the footing are not damaged.

Proof Rolling

Extent: Proof roll excavations for pavements, filling and non-spanning slabs on ground to determine the extent of any bad ground.

Proof rolling method:

- Roller type and size: Smooth drum 10 Tonne static weight
- Number of passes: 1
- Settlement limit (mm): 3

3.3.3 PROVISIONAL DEPTHS

Contract Depths

The footing or pier depths shown on the drawings are provisional.

3.3.4 EXPLOSIVES

General

Do not use explosives.

3.3.5 BAD GROUND

Requirement: Where the existing subgrade or excavated material is deemed unsuitable for the purposes of the works (refer 1.2 INTERPRETATION, Bad Ground/unsuitable material), the material shall be either reworked to comply with the specification or removed from site and replaced with material complying with the specification. Where necessary the Contractor should seek advice from a suitably qualified geotechnical engineer regarding alternative treatment of the bad ground.

The Contractor shall familiarise themselves with the site conditions and the geotechnical site investigation report and shall be deemed to have allowed for any work required to rectify bad ground.

Contaminated Ground

The contractor shall familiarise themselves with the site conditions and the Environmental Investigation Report and shall be deemed to have allowed for all costs associated with the excavation, offsite disposal or treatment and the replacement of contaminated materials as required. The contractor shall allow for the cost of verifying that all remedial works comply with the requirements of the Relevant Statutory Authorities.

3.3.6 BEARING SURFACES

General

Provide even plane bearing surfaces for loadbearing elements including footings. Step to accommodate level changes. Make the steps to the appropriate courses if supporting masonry.

Deterioration

If the bearing surface deteriorates after approval because of water or other cause, excavate further to a sound surface before placing the loadbearing element. The Contractor will be deemed to have caused the conditions and will conduct necessary additional work at no extra charge and without extension of time for completion.

3.3.7 REINSTATEMENT OF EXCAVATION

General

Where excavation exceeds the required depth, or deteriorates, reinstate to the correct depth, level and bearing value.

Particular

Below or within the "line of influence" of footings, beams, or other structural elements: Concrete of strength equal to the structural element, minimum 15 MPa.

Below slabs or pavements: Use selected filling compacted to the specified density. In cut subgrades if the over excavation is less than 100 mm, do not backfill, but make good by increasing the thickness of the layer above.

Line of influence

Angle from horizontal: 45°

3.3.8 SUPPORTING EXCAVATIONS

Removal of supports

Remove temporary supports progressively as backfilling proceeds.

Voids

Guard against the formation of voids outside sheeting or sheet piling if used. Fill and compact voids to a dry density similar to that of the surrounding material.

3.3.9 ADJACENT STRUCTURES

Temporary supports

General: Provide supports to adjacent structures where necessary, sufficient to prevent damage arising from the works.

Lateral supports: Provide lateral support using shoring.

Vertical supports: Provide vertical support where necessary using piling or underpinning or both.

Permanent supports

If permanent supports for adjacent structures are necessary and are not described, give notice and obtain instructions.

Encroachments

If encroachments from adjacent structures are encountered and are not shown on the drawings, give notice and obtain instructions.

3.4 PLACING AND COMPACTION

3.4.1 FILL

Fill Material

General: Inorganic, non-perishable material. All fill to be select fill unless noted otherwise.

Sulphur content: Do not use filling with sulphur content exceeding 0.5% within 500 mm of cement bound elements (for example concrete structures or masonry) unless such elements are protected by impermeable membranes or equivalent means.

Sources:

Provide fill imported on to the site from suitable sources unless the fill type can be provided from

- spoil recovered from the excavations; or
- borrow material from designated borrow pits.

Imported fill must be uncontaminated material of a type approved by the Relevant Authorities for use as filling on this site. Contractor to undertake all necessary investigations and testing on proposed material.

Fill Types

General fill: Well graded material, maximum particle size 75 mm, low to medium plasticity and classified as Class A or Class S material in table 2.1 of AS 2870. Fill material to have a minimum 4 day soaked CBR of 4% in accordance with AS 1289.6.1.1 unless noted otherwise on drawings. Material to be a low dispersion risk, minimum Emerson class 3.

Select fill: Material complying with the following:

Table 3.4.1-4: Select fill grading table

Sieve aperture (mm) to AS 1152	Percentage passing (by mass)
75.0	100
9.5	100 to 50
2.36	100 to 30
0.60	50 to 15
0.075	<25%

- Plasticity index: $\geq 2\%$, $\leq 15\%$.
- Non dispersive (a rating of nil as defined by the “dispersion” test AS 1289.3.8.1).
- Minimum 4 day soaked CBR of 6% in accordance with AS 1289.6.1.1 unless noted otherwise on drawings.
- Granular fill: Granular backfill adjacent to retaining walls shall be free draining crushed hard rock or crushed natural gravel as specified below

Table 3.4.1-5: Granular fill grading table

Sieve aperture (mm) to AS 1152	Percentage passing (by mass)
9.5	100
6.70	95-98
4.75	58-78
2.36	37-50
1.38	22-30
0.425	10-17
0.075	2-10

- Plasticity Index: Not greater than 3%.
- Liquid Limit: Not greater than 25%.
- Coefficient of permeability: Not less than 0.1 mm/sec.
- Non-dispersive (a rating of nil as defined by the ‘dispersion test’ AS 1289.3.8.1).

Building Basecourse:

Crushed hard rock or crushed natural gravel capable of being compacted to an even stable surface and complying with the grading and properties listed below:

Table 3.4.1-6: Building basecourse grading table

Sieve aperture (mm) to AS 1152	Percentage passing (by mass)
9.5	100
6.70	95-98
4.75	58-78
2.36	37-50
1.38	22-30
0.425	10-17
0.075	2-10

- Plasticity Index: Not greater than 3%.
- Liquid Limit: Not greater than 25%.
- Coefficient of permeability: Not less than 0.1 mm/sec.
- Non-dispersive (a rating of nil as defined by the 'dispersion test' AS 1289.3.8.1).

Subsoil filter: Crushed stone graded to the subsoil grading table.

Table 3.4.1-7: Subsoil grading table

Sieve aperture (mm) to AS 1152	Percentage passing (by mass) Course filter
26.5	100
19.0	90-100
9.5	10-15
4.75	3-10
2.36	
1.18	0-5
0.60	
0.30	
0.15	
0.075	0-3

Fill Subgrades

Use material in the top 150 mm which has a maximum particle size of 40 mm.

Site Borrow Pits

General

Only where approved by the Contract Administrator or shown on the Contract Documents.

Location: Locate site borrow pits so that no pit edge is closer than 3 m from any fence line, site boundary, or edge of excavation or embankment. Clear the pit area, and strip and store the topsoil.

Erosion protection: Provide erosion protection during the winning operations, including drainage such that the pit is free draining.

Completion: On completion of winning operations, grade the pit to remove abrupt changes of slope or level, respread the topsoil, and grass the pit by hydroseeding.

3.4.2 PREPARATION FOR FILLING

General

Prepare the ground surface before placing fill (including topsoil fill), ground slabs or load bearing elements. Remove loose material, debris and organic matter and compact the ground to achieve the required density. Refer to the Geotechnical report for any special requirements such as re-compaction of existing poorly compacted material or removal of unsuitable material.

Benching

If fill is to be placed on a surface which slopes more than 1:4, bench the surface to form a key for the fill. As each of layer of fill is placed, cut the existing ground surface progressively to form a series of horizontal steps at least 1 m in width. Recompact the excavated material as part of the filling.

Under Earth Mounds

Cultivate the ground to a depth of 200 mm before mound formation.

Under Slabs, Paving and Embankments

Compact the ground to achieve the densities specified for these locations. If necessary loosen the ground to a depth of 200 mm and adjust the moisture content before compaction.

Rock Ledges

Remove overhanging rock ledges.

Tolerances

Finish the surface to the required level, grade and shape within the following tolerances:

- Under slabs pavements and loadbearing elements: +0, -20 mm.
- Other ground surfaces: ± 20 mm, provided the area remains free draining and matches adjacent construction where required.

3.4.3 FILTER FABRIC

Material

Type: Polymeric fabric formed from a plastic yarn composed of at least 85% by weight of propylene, ethylene, amide or vinylidene chloride and containing stabilisers or inhibitors to make the filaments resistant to deterioration due to ultraviolet light.

Identification and marking: To AS 3705.

Protection

Provide heavy duty protective covering. Store clear of the ground and out of direct sunlight. During installation do not expose the filter fabric to sunlight for more than 14 days.

Preparation

Before placing the filter fabric trim the ground to a smooth surface free from cavities and projecting rocks.

Placing

Lay the fabric flat, but not stretched tight, and secure it with anchor pins. Overlap joints 300 mm minimum.

3.4.4 PLACING FILL

General

Layers: Place fill in layers not exceeding 150 mm compacted thickness.

Extent: Place and compact fill to the designated dimensions, levels, grades, and cross sections so that the surface is always self draining.

Placing at Structures

General: Place and compact fill in layers simultaneously on both sides of structures, culverts and pipelines to avoid differential loading.

Concrete: Do not place fill against concrete until the concrete has been in place for fourteen days.

Placing for Structural Platforms

Unless noted otherwise, compaction of fill for building floor slabs and pavements shall extend at least 2 m beyond the building or pavement extent at the bulk earthworks level.

Moisture Content

Adjustment: Where necessary to achieve the required density or moisture content, adjust the moisture content of the fill before compaction.

Proof rolling: Proof roll existing subgrade before placing filling and finished subgrade.

Location: At existing subgrade level and at finished subgrade.

Extent: All Fill Areas

Roller type and size: Smooth drum 10 (ten) tonne static weight

Acceptance criteria: Less than 3 mm movement

3.4.5 COMPACTION

Density

Compact each layer of fill to the required depth and density.

Table 3.4.5-8: Compaction schedule

AREA	COMPACTION RATIO % OF MAXIMUM DRY DENSITY OR DENSITY INDEX (DI)	MOISTURE % FROM OPTIMUM	TYPE OF FILL
Landscape Areas	95% Standard or 70 DI	-2, +2	General
Fill and subgrade under or within line of influence of structures	98% Standard or 80 DI	-2, +2	General
Fill and subgrade under or within line of influence of pavements or building slabs	98% Standard or 80 DI	-2, +2	General
Backfill behind retaining wall	98% standard or 80 DI	-2, +2	Granular fill
Building Basecourse	98% modified or 85 DI	-2, +2	Building Basecourse

Moisture variations shown are the maximum allowable variations from the optimum moisture content. The Contractor must ensure that the fill material is placed at a moisture content which allows it to be compacted and proof rolled in accordance with the specification (i.e. stricter moisture control may be required on site).

Protection

Protect the works from damage due to compaction operations. Where necessary, limit the size of compaction equipment or compact by hand. Commence compacting each layer at the structure and proceed away from it.

3.4.6 GRADING

External Areas

Grade to give falls away from buildings, minimum 1:100.

Subfloor Areas

General: Grade the ground surface under suspended floors to drain ground or surface water away from buildings without ponding.

3.5 BARRIERS AND MEMBRANES

3.5.1 PROTECTION TO MEMBRANES

Protective Covering

Do not disturb or damage the protective covering of membranes during backfilling.

3.6 RETAINING WALLS

3.6.1 REINFORCED CONCRETE BLOCK AND CAST INSITU CONCRETE WALLS

Reinforced concrete block walls and cast insitu concrete walls shall be constructed in accordance with the details and notes on the drawings.

3.6.2 CRIB WALLS

General

Type: Proprietary system of interlocking precast concrete or preservative treated timber cribs with selected backfill placed and compacted progressively with the crib to form a retaining wall. Crib walls to be installed in accordance with the Manufacturer's requirements.

3.6.3 GABIONS

General

Type: Proprietary system of steel mesh or fabric baskets wired together and filled with rock to form permeable scour protection linings and retaining walls. All work to be in accordance with manufacturers requirements. Place filter fabric under and behind the gabions.

Rock Fill

General: Clean, hard, durable crushed rock, rock spalls or river gravel, with minimum size larger than the maximum opening size of the mesh or fabric forming the basket.

Los Angeles value (to AS 1141.23): Maximum 45.

Assembly

Assemble the baskets and join them together by wiring along edges both horizontally and vertically in accordance with the manufacturers requirements before placing the rock fill. Fix the top of the basket by wiring to both the sides and the diaphragms.

3.6.4 EARTH REINFORCEMENT

General

Type: Proprietary system of galvanised steel strips or steel mesh strips placed in layers with compacted fill and connected to precast concrete facing panels to form vertical retaining walls. Provide the necessary accessories including levelling pad, bearing pads, and joint fillers or covers to keep the fill material out of the panel joints. Fill materials, compaction and other construction details to be in accordance with the manufacturer's requirements.

3.6.5 INTERLOCKING BLOCK WALL

Description

Proprietary system of dowelled precast concrete block with or without membrane reinforcement as specified by the Manufacturer and backfill material as specified by the Manufacturer placed and compacted progressively with the blockwork to form a retaining wall.

General Requirements

The Contractor shall design and construct the interlocking block wall to sustain vehicle loads during construction and service loads in accordance with all statutory requirements. Minimum serviceable life of 100 years is required.

Drawings and Calculation

The Contractor shall provide sets of design calculations and drawings showing clearly the design parameters, member sizes and details, backfill material and compaction for review by the superintendent 28 days prior to commencing work.

This review will not relieve the Contractor of fulfilling his responsibilities under the contract.

Certification

The Contractor will provide certificates certifying the design and construction for compliance with the relative standards and Local Authority requirements.

3.7 COMPLETION

3.7.1 COMPLETION

Records

Certified records of measurement: Submit a certified copy of the agreed records of measurement.

Temporary Works

Temporary supports: Remove temporary supports to adjacent structures at completion.

4.0 SERVICE TRENCHING

4.1 GENERAL

4.1.1 GENERAL

Service Trenching includes;

- Trench excavation
- Testing the trench base
- Bedding installation
- Backfill installation and testing
- Reinstating the surface

4.1.2 CROSS REFERENCES

General

Refer to the General requirements section.

Related sections

Refer to the following sections:

- General Requirements
- Site Preparation
- Earthwork
- Stormwater
- Appendix A - Schedule of Inspection and Testing Requirements

4.1.3 APPLICATION OF THIS SPECIFICATION

This specification applies to work on privately owned property. Where works are on public property, or property which is to come under the control of a Statutory Authority (Council, State Road Authority etc), or where the works are to come under the control of a Statutory Authority (i.e. stormwater drainage in a future easement), works shall be carried out in accordance with the requirements of the relevant Statutory Authority.

4.2 QUALITY

4.2.1 INSPECTION

General

Refer also to General Requirements section and Appendix A.

Witness points

Give sufficient notice so that inspection may be made at the following stages:

- Service trenches excavated before laying the service.
- Services laid in trenches and ready for backfilling.

4.2.2 TESTS

General

Refer also to General Requirements section and Appendix A.

Testing

Compaction (density): Test for compliance.

Retesting: Rework and retest areas which do not achieve the required density until that density is achieved.

Test methods

Field dry density: To AS 1289.5.3.1, AS 1289.5.3.5 or AS 1289.5.8.1 calibrate the surface moisture-density gauge in accordance with AS 1289.5.8.4 before use.

Density index: To AS 1289.5.6.1.

Standard maximum dry density: To AS 1289.5.1.1.

Modified maximum dry density: To AS 1289.5.2.1.

Test frequency: At least 2 tests per section of work. A number of the specified tests should be conducted on the backfill to personnel access points and pits as directed by the contract administrator.

4.3 SERVICE TRENCHES

4.3.1 EXCAVATING

Existing Surfaces

Before excavating trenches, saw-cut existing concrete and bituminous surfaces on each side of the trench to provide a straight even joint. Lift and store unit paving for later reinstatement.

Excavation

Excavate for underground services, to required lines, levels and grades. Generally make the trenches straight between manholes, inspection points and junctions, with vertical sides and uniform grades.

Excavation of service trenches shall be completed prior to lime stabilisation of the subgrade. Notify the contract administrator if any trenches are to be excavated in stabilised ground. Any trenches in stabilised ground to be backfilled as specified in the Reinstatement of Surfaces Subsection.

Trench Widths

Keep trench widths to the minimum consistent with the laying and bedding of the relevant service and construction of personnel access ways and pits.

Trench Lengths

Excavate trenches in sections of suitable length.

Trench Depths

General: As required by the relevant service and its bedding method.

Notice: If excavation is necessary below the level of adjacent footings, give notice, and provide necessary support for the footings.

Obstructions

Clear trenches of sharp projections. Cut back roots encountered in trenches to at least 600 mm clear of services. Remove other obstructions including stumps and boulders which may interfere with services or bedding.

Dewatering

Keep trenches free of water. Place bedding material, services and backfilling on firm ground free of surface water.

Excess Excavation

If trench excavation exceeds the correct depth, reinstate to the correct depth and bearing value using compacted bedding material or grade N20 concrete.

4.3.2 BORING

Subcontractor

If under road boring is required in lieu of trenches, engage a suitably qualified subcontractor to do the work.

Process

Ensure a tight fit to the service pipes. If voids are encountered, fill by pressure grouting.

4.3.3 BACKFILLING

These requirements apply to backfill to service trenches and service access points. Bedding and overlay to a minimum depth of 200 mm above the service shall be Pipe Bedding as specified below unless specified otherwise in relevant service specification. Trench backfill above this level shall be backfill material as specified below. Bedding, overlay and trench backfill to be compacted in accordance with the compaction schedule. Place filling in layers not exceeding 200 mm compacted layer thickness.

Marking services

Underground marking tape: To AS/NZS 2648.1.

Pipe Bedding

TYPE: Granular material (clean unweathered hard basaltic or sedimentary crushed rock, free of salt, clay or organic contaminants) or cementitious material (mortar or concrete) as specified.

Table 4.3.3-9: Crushed Rock criteria

Sieve Aperture (mm) to AS1152	Percentage Passing (by mass)
9.5	98 to 100
6.7	50 to 100
4.75	15 to 75
2.36	0 to 40
1.18	0 to 5

Cement Mortar Bedding: 1 Portland cement: 4 sand.

Concrete Bedding: Not less than 20 MPa.

Backfill Material

General: General fill except with no stones greater than 25 mm occurring within 150 mm of the service, or other materials as required for particular services or locations. Well graded, inorganic, non-perishable material, maximum size 75 mm, plasticity index * 55% and classified as Class A or Class S material in Table 2.1 of AS 2870. Fill material to have a minimum 4 day soaked CBR of 6% in accordance with AS 1239.6.1.1 unless noted otherwise on drawings. Material to be non-dispersive (a rating of nil as defined by the dispersion test AS 1239.3.8.1).

Under roads and paved areas: Fine crushed rock, or 3% cement stabilised sand.

In topsoil areas: Complete the backfilling with topsoil for at least the top 50 mm.

In reactive clay: In sites classified M, H or E to AS2870, use an impervious material where trenches fall towards footings. In other trenches use selected fill, (See earthwork section), not sand.

Table 4.3.3-10: Compaction schedule - service trenches

AREA	COMPACTION RATIO % OF MAXIMUM DRY DENSITY OR DENSITY INDEX (DI)	MOISTURE % FROM OPTIMUM *
Landscape Areas		
- bedding and overlay	70 (DI)	-2, +2
- trench backfill	70 (DI) or 95% standard	-2, +2
Under or within line of influence of pavements, structures or building slabs		
- bedding and overlay	80 (DI)	-2, +2
- trench backfill	80 (DI) or 98% standard	-2, +2
- pavement zone	modified	-2, +2

NOTE: Moisture variations shown are maximum allowable variations from the optimum moisture content. The Contractor must ensure that the backfill material is placed at a moisture content which allows it to be compacted and proof rolled in accordance with the specification (i.e. stricter moisture control may be required).

4.3.4 REINSTATEMENT OF SURFACES

General

Reinstate existing surfaces removed or disturbed by trench excavations to match existing and adjacent work.

Lawn Areas

Provide 150 mm of loam and resow the lawn over the trench and other disturbed areas.

Paving and Roads

Reinstate to match adjacent work, paved surfaces and assets disturbed or removed during excavation of trenching. Where lime stabilised subgrade is disturbed, replace this layer with crushed rock material as specified for the sub-base.

Concrete Surfaces

Reinstate concrete surfaces to the original level. If necessary, provide steel reinforcement tied to the adjacent concrete and laid to prevent the reinstalled concrete from subsiding and cracking. Engineer to approve proposed reinforcing details. Provide crushed rock base and sub-base to match existing pavement.

Bituminous Surfaces

General: Provide crushed rock base and subbase to match the existing pavement. Prime coat the edges of the existing surfacing with bitumen. Lay and compact hot-mix asphalt so that the edges are flush and the centre is cambered 10 mm above the existing pavement.

Minimum asphalt thickness: 50 mm or the adjacent pavement thickness, whichever is thicker.

Unit Paving

Provide crushed rock base and subbase to match the existing pavement. Provide sand bedding. Reinstate the paving units. Replace any damaged units with matching items. Provide jointing sand and lay and compact the paving units in accordance with the manufacturer's requirement. Replace damaged edge restraints to match existing.

5.0 STORMWATER

5.1 GENERAL

Stormwater includes:

- Pipe work installation
- Pit installation
- Subsoil installation
- Hydrostatic testing
- Maintenance of pipe covers and protection of pipe work during construction

5.1.1 CROSS REFERENCES

General

Refer to the General requirements section.

Related Sections

Refer to the following sections:

- General Requirements
- Site Preparation
- Earthwork
- Service Trenching
- Appendix A - Schedule of Inspection and Testing Requirements

5.1.2 APPLICATION OF THIS SPECIFICATION

This specification applies to work on privately owned property. Where works are on public property, or property which is to come under the control of a Statutory Authority (Council, State Road Authority etc), or where the works are to come under the control of a Statutory Authority (i.e. stormwater drainage in a future easement), works shall be carried out in accordance with the requirements of the relevant Statutory Authority.

5.1.3 STANDARD

Stormwater Drainage

General: To AS 3500.3.2.

5.1.4 INTERPRETATION

Definition

Pipe surround: Includes pipe overlay, pipe side support, side zone and haunch zone.

5.1.5 EXISTING SERVICES

Refer to Site Preparation section.

5.2 QUALITY

5.2.1 INSPECTION

General

Refer also to General Requirements section and Appendix A.

5.2.2 SAMPLES

General

Submit samples of the following:

- Each type of imported pipe bedding material.
- Each type of filter material.

Certificates: With the samples also provide certificates from the supplier indicating that the sample conforms with the specified particle size distribution and material properties.

5.2.3 TESTS

General

Refer also to General Requirements section and Appendix A.

Table 5.2.3-11: Test Schedule

Type of test	Test Frequency	Test Method
Density tests: Bedding Pipe surround Backfill	Refer service trenching section	
Pipework tests	All pipework	AS 3500.3.2 and pipework testing schedule
Concrete Testing	Each concrete pour (refer concrete tests)	To AS 1012
Material Tests Subsoil filter, pipe bedding, pipe surround, trench backfill	1 test per 250 m ³ , min of 2 tests per source of supply / material type	AS 1289

Pipework Testing

Requirement: Carry out required tests to AS 3500.3.2 and as required by relevant authorities. Supply the apparatus and materials necessary. Submit the test results in writing.

Hydrostatic Tests

Table 5.2.3-12: Tests (additional to AS 3500.3.2) schedule

Product	Test method	Criteria	Report
All downpipes	AS 3500.3.2 Section 10	Full compliance	Test certificate

All stormwater pipes	Hydrostatic test table	Full compliance	Test certificate
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Table 5.2.3-13: Hydrostatic Test Table

Type of joint	Pressure Head (Height)	Test Period	Max Water Loss (Per 30 Metre Length of Drain)
Rubber ring	1750 mm min 1850 mm max	15 minutes	250 millilitres per 25 mm pipe diameter
Cement Mortar	1750 mm min 1850 mm max	15 minutes	250 millilitres per 25 mm pipe diameter
Solvent Welded	1750 mm min 1850 mm max	15 minutes	No loss permitted

Preparation for testing: Securely anchor pipes and fittings in position to prevent movement during the tests.

Concealed work: Do not cover or conceal work until it has been tested. Leave pipe joints exposed to enable observation during the tests.

Density Tests

Requirement: Obtain density tests for pipe bedding and trench backfill from an independent testing authority. Do not proceed with work subject to testing until tests are satisfactorily completed. Refer to the Service Trenching section for testing requirements.

Concrete Tests

Requirement: Carry out all necessary tests for concrete used in pits, pipe surround, pipe supports and the like.

Test Methods: To AS 1012.

Frequency of sampling: Where project assessment of strength grade is specified, spread the site sampling evenly throughout the pour. The following minimum requirements shall apply in addition to those in AS 1379 Clauses B 7.2 (b) and B 7.3 9 (b) but not less than project control testing, in accordance with the following table:

Table 5.2.3-14: Compressive Tests Schedule

NUMBERS OF BATCHES PER DAY	NUMBER OF SAMPLES
1	1
2 to 5	2
6 to 10	3
11 to 20	4
For each additional 10 batches, one additional sample shall be taken	

Acceptance criteria: The average strength of the samples representing an element shall be not less than the specified strength.

5.3 EXECUTION

5.3.1 EXECUTION

Requirement: Install the stormwater drains as necessary to connect downpipes, surface drains, subsoil drains and drainage pits to the outlet point or point of connection.

Excavation and Backfilling: Excavation, bedding and backfill requirements are specified in Earthwork and Service Trenching sections. All stormwater services beneath pavements should be installed prior to commencing stabilisation or final trimming of the subgrade.

Unstable Foundations (Unsuitable Trench Subgrade Material)

Requirement: Where the existing trench subgrade material is deemed unsuitable for the purposes of the works, the unsuitable material shall be either reworked to comply with the specification or removed from site and replaced with material complying with the specification. Where necessary the Contractor should seek advice from a suitably qualified geotechnical engineer regarding alternative treatment of the unsuitable trench subgrade material.

The Contractor shall familiarise themselves with the site conditions and the geotechnical site investigation report and shall be deemed to have allowed for any work required to rectify unsuitable trench subgrade material.

Gradients: Lay drains to gradients complying with the relevant authority's requirements, to the levels shown on the Drawings, and in any case, not less than the following:

Table 5.3.1-15: Minimum Pipe Gradients

Pipe Diameter (mm)	Stormwater Drains
100	1 in 100
150	1 in 150
225 and up	1 in 200

Downpipe connections: Turn up the drain branch pipeline with a suitable bend to meet the downpipe, to finish 50 mm above finished ground or pavement level unless detailed otherwise on drawings. Downpipe

connections to be made using manufactured adaptors and to be pressure tested in accordance with the Tests subsection.

Tolerances: Place pipelines in accordance with the Pipeline maximum tolerances table.

Table 5.3.1-16: Pipeline maximum tolerances table

	Angular deviation from required alignment	Displacement from required alignment
Horizontal	1 in 300	15 mm
Vertical	1 in 500	5 mm

Conditions: Tolerances stated above are conditional on falls to outlets being maintained and no part of a pipeline being at less than the designated gradient.

Pipe underlay: Bed the pipework on a continuous underlay of bedding material, not less than 75 mm thick after compaction. Grade the underlay evenly to the required gradient of the pipeline.

Chases: Form chases where necessary to prevent sockets, flanges or the like from bearing on the trench bottom or the underlay.

Anchor blocks: Install anchorages in the form of lateral or longitudinal anchor blocks, of not less than 15 MPa concrete, to restrain lateral movement in pipelines at ends and changes of gradient or direction or longitudinal movement in pipelines laid to gradients exceeding 7%. Bear anchorages against the body of the pipe only, clear of joints, and against firm undisturbed ground or compacted filling.

Lateral Anchor Blocks: Bear against the full diameter of the pipe for a length equal to not less than the pipe diameter, with a thrust bearing against the excavation of not less than 0.25 m² or the (pipe diameter) 2, whichever is the greater.

Longitudinal Anchor Blocks: At 10 m maximum intervals. Extend 150 mm into the sides and bottom of the trench, and 75 mm above the crown of the pipe. Width (measured parallel to the pipe axis) 300 mm.

Encasement: Unless otherwise permitted by the relevant authority, concrete encase the following:

- Pipelines which cannot be provided with the required minimum cover;
- Pipelines shown on the drawings or otherwise specified to be encased.

Encase the pipeline in concrete not less than 150 mm above and below the pipe and 150 mm each side or the width of the trench, whichever is the greater.

Concrete: Grade N20 to AS 1379.

Pipe surround: The pipe surround shall include the haunch zone, side zone and overlay to a depth of 200 mm above the top of the pipe. Place the material in the pipe surround in layers not more than 100 mm loose thickness and compact in accordance with the compaction schedule without damaging or displacing the pipework. Material in the pipe surround shall conform with requirements for bedding material.

Minimum Cover Over Pipe: Unless overridden by regulatory authority requirements or otherwise specified, the following table shall apply:

Table 5.3.1-17: Minimum cover over pipe table

PIPE LOCATION	MINIMUM COVER
Pipes not subject to vehicular loading:	400 mm
Pipes subject to vehicular loading - not in roadways - under sealed roadways - under unsealed roadways	600 mm 600 mm 750 mm
Pipes in embankments or subject to Construction equipment loading.	750 mm

Stormwater Pipeline Schedule

Unless noted otherwise the following schedule is to be complied with:

Table 5.3.1-18: Stormwater pipeline schedule

Location	Pipe material and size	Class	Jointing
All	Concrete	2	Rubber ring joint
All	uPVC	SH	Solvent welded
All	VCP	3	Rubber ring joint

Charged Lines

Stormwaters pipes are not to be changed unless noted on the drawings.

Connections To Existing

Connect new pipelines to existing drains as follows:

New Pits: Where a new pit is to be installed in an existing pipeline, cut the existing pipes back flush with the interior walls of the new pit and construct the new pit in accordance with the drawings and specification. If the existing pipe is damaged during construction or if construction requires the removal of existing pipes, replace the pipes with new pipes equivalent to the existing pipes. All connections between new pipes and existing pipes to use joints equivalent to the joints in the original pipeline. Where relevant provide new flexible connections either side of the pit as specified above.

To Authority's Main: As required by the regulatory authority. If the authority elects to perform the work, comply with Works by Statutory Authorities in Authorities Approvals (General Requirements Section).

To Pits, Culverts, Channels etc: All connections to existing pits, culverts etc to comply with the requirements of the Relevant Authorities where applicable. Make an opening in the existing structure to the minimum size required to accept the new pipe. New pipe to finish flush with the interior wall of the existing structure. Make good the opening in the structure and adjust the benching as required. Where relevant use flexible connections as specified above.

To Existing Pipelines Less than 375 mm : If the new pipeline is 300 mm or less, remove an appropriate length of the existing pipeline and insert a new slope junction and new pipework consistent with the existing pipeline.

To Existing Pipelines 375mm or Larger: Connection as specified in AS 3500.3.2 Clause 8.8.1(b). Centreline of branch to intersect centreline of main, and change of direction of flow at cut-in must be between 45° and 90°.

Junction Pits: Provide a junction pit for new branch drains greater than 100 mm, unless otherwise specified on drawings.

To Street Gutter: (Stormwater lines where shown): Enter the pipe into an opening made in the kerb, to finish flush with the kerb face, and seal by pointing in 1 cement: 3 sand. Restore the kerb and pavement as necessary, to match existing.

5.3.2 LINED SURFACE DRAINS

Half round pipe drains: Surface drains lined with half round pipe including the necessary bedding and jointing.

Grated trench: Cast in situ concrete trench. Grating as specified in pits subsection.

Lined surface drains schedule - as shown on the civil drawings

5.3.3 PRECAST BOX CULVERTS

Standards

Culverts < 1200 mm span x 900 mm high: To New South Wales Roads and Maritime Services Authority QA Specification No. R16.

Culverts 1500 - 4200 mm span x 4200 mm (maximum) high: To AS 1597.2 or New South Wales Roads and Maritime Services Authority QA Specification No. R16 as relevant.

General: Design loading shall include the depth of fill over the culvert as shown on the drawings and T44 truck loading in accordance with Austroads Standards. Certification of the concrete box culvert and manufacturers certificates shall be provided by the Contractor prior to culvert installation. The culvert manufacturer shall have an approved quality assurance program in place.

Precast box culverts schedule - as shown on the civil drawings.

Lifting gear: Provide suitable attachments for lifting gear to culverts of 600 x 450 mm or larger.

Base slab: Preparation of ground under base slabs shall be in accordance with the requirements of the Earthwork section for subgrade preparation under structures including requirements for compaction, testing and inspection. Unless specified otherwise, ground under base slabs shall be compacted to 98% Standard Maximum Dry Density (AS 1239.5.1.1). All workmanship, materials and testing for concrete base slabs to be in accordance with the requirements of AS 3600 and AS 1012 and the contract documents.

Installation: Screed and compact the bedding for precast bases to provide uniform support. Install culvert sections to provide a continuous waterway without abrupt changes in alignment or grade. Seal joints between box culvert units using 150 mm wide Densopol 60 HT tape or approved equivalent. Fill joint between culvert leg and base slab with grout and seal with Densopol 60 HT tape.

Backfilling: The backfill to the sides and above precast box culverts shall be selected filling (refer to the Earthwork section) compacted in accordance with the requirements of the compaction schedule for stormwater

trench backfill (refer service trenching section). Place and compact filling in layers simultaneously on both sides of the culvert to avoid differential loading.

Where completed pavements (including lime or cement stabilised subgrade) are disturbed by excavation for culverts, the pavement shall be restored as specified in the Service Trenching section.

5.3.4 CORRUGATED STEEL PIPE DRAINS AND DETENTION TANKS

Standards

Products, design and installation: To AS 1761 and AS 1762 or AS 2041 as relevant.

Corrugated steel pipe drains schedule: As shown on the drawings.

5.3.5 SUBSOIL DRAINS

General

Provide PVC subsoil drains to intercept groundwater seepage and prevent water build-up behind walls and under floors and pavements. Connect subsoil drains to surface drains or to the stormwater drainage system as applicable.

Pipe depth

Provide the following minimum clear depths, measured to the crown of the pipe, where the pipe passes below the following elements:

- 100 mm below formation level of the pavement, kerb or channel.
- 100 mm below the average gradient of the bottom of footings.
- 450 mm below the finished surface of unpaved ground.

Jointing

At junctions of subsoil pipes provide tees, couplings or adaptors to AS 2439.1.

Trench width

Minimum 300 mm unless shown otherwise on the drawings.

Pipe Underlay

General: Grade the trench floor evenly to the gradient of the pipeline. If the trench floor is rock, correct any irregularities with compacted bedding material. Bed piping on a continuous layer of coarse filter material at least 100 mm thick after compaction. Lay the pipe with one line of perforations at the bottom.

Chases: If necessary, form chases to prevent projections such as sockets and flanges from bearing on the trench bottom.

Pipe Surrounds

General: Place the filter material in the pipe surround in layers of 200 mm loose thickness, and compact without damaging or displacing the piping.

Depth of overlay:

- To the underside of the bases of overlying structures such as pavements, slabs and channels.
- To within 150 mm of the finished surface of unpaved or landscaped areas.
- As shown on the drawings.

Filter Material

Surround to subsoil drains shall be crushed hard rock or natural gravel, complying with the following grading:

Table 5.3.5-19: Filter material criteria

Sieve Aperture (mm) to AS 1152	Percentage Passing (by mass) Coarse Filter (Nom. 20 mm)
26.5	100
19.0	90-100
9.5	10-15
4.75	3-10
2.36	
1.18	0-5
0.600	
0.300	
0.150	
0.075	0-3

Filter Fabric

General: Provide polymeric fabric formed from plastic yarn composed of at least 85% by weight propylene, ethylene, amide or vinylidene chloride, and containing stabilisers or inhibitors which provide resistance to deterioration due to ultraviolet light.

Marking: To AS 3705.

Protection: Provide heavy duty protective covering. Store clear of the ground and out of direct sunlight. During installation do not expose the filter fabric to sunlight for more than 14 days.

Filter Socks

Provide polyester permeable socks capable of retaining particles of 0.25 mm size. Securely overlay the sock at each joint.

Subsoil pipeline schedule - as shown on the civil drawings.

Backfilling: Backfill material above pipe overlay to be in accordance with the requirements of the drawings and the Service Trenching section.

Flushing Points: Shall be turned up and capped at the surface with a cast iron box with hinged lid set in a concrete surround 300 mm square by 150 mm deep.

Where a drain is under a pavement, risers shall be diverted from the line of the drain so that the cover will be at the outside edge of the nearer shoulder or behind the nearer kerb. Surround risers with compacted filter medium.

Flushing: Flush drains clean on completion by adding water at the flushing points at a rate between 1 and 2 L/s. Flush each point in turn, commencing at the high end. Observe outlets and continue flushing until clean water is discharged. Pump silt and water from silt traps while flushing upstream points to maintain free flow into traps during flushing. Install rodent proofing to outlets immediately on completion of flushing.

Tolerances: Pipelines shall be within 50 mm of design line and shall fall towards the outlet at all points. Subsoil drains to be installed at a minimum grade of 1% unless otherwise specified.

5.3.6 PITS AND OTHER STRUCTURES

Requirement: Construct pits, sumps, manholes, tanks, wells, headwalls, cast insitu culverts and the like as shown on the drawings and as follows, unless otherwise specified:

General: All materials, workmanship and testing to be in accordance with AS 3600 and AS 1012.

Floors and Walls:

In situ concrete: N25 MPa, reinforced with SL82 fabric (40 cover to inside face) unless shown otherwise. Thickness not less than 150 mm, unless otherwise shown or specified.

Prefabricated concrete: Walls of spun precast sections not less than 60 mm thick. Floor cast in situ or prefabricated. Provide cored holes as required. Details of the proposed pits are to be submitted to the Contract Administrator for approval.

Finish to exposed surfaces: Smooth, seamless, equal to steel trowelled render or concrete cast in steel forms. Cove or splay internal corners. Bench floors and fall to drain.

Render: 1 cement : 3 sand, minimum thickness 20 mm.

Pit Access Steps: To AS 1657, 24 mm diameter galvanised deformed mild steel. Provide steps to pits greater than 0.9 m deep, cast or built into the pit walls clear of drain outlet openings or discharges. Pit access step spacing and size to be in accordance with drawings and AS 1657.

Ladders: Where required, provide steel ladders, ladder cages and landings in accordance with AS 1657 and the requirements of the relevant authorities. Steelwork is to be hot dip galvanised as specified in AS 1650.

Pipe connections: Build inlet and outlet pipes into the pit walls during construction. In existing or prefabricated pits, make openings of the correct size and pack the joint around the pipe to the full thickness of the wall with 1:3 mortar. Pipes to finish flush with the inside wall of the pit.

Pipe Channels: When pipe channels are required in pit floors, form the channel to the full depth of the pipe.

Metal access covers and grates

Standard: To AS 3996.

Cover schedule: As shown on the civil drawings.

Cover levels: Top of cover or grate, including frame:

- In paved areas: Flush with the paving surface.
- In landscaped areas: 25 mm above finished surface (gratings to be flush).
- Gratings taking surface water runoff: Locate to receive runoff without ponding.

6.0 ROADBASE AND SUBBASE

6.1 GENERAL

Roadbase and subbase includes:

- Supply, installation and testing of roadbase and subbase

6.1.1 CROSS REFERENCES

General

Refer to the General Requirements section.

Related Sections

Refer to the following sections:

- General Requirements
- Site Preparation
- Earthwork
- Appendix A - Schedule of Inspection and Testing Requirements

6.1.2 INTERPRETATION

Definitions

Standard: To AS 1348.1.

Absolute level tolerance: Maximum deviation from design levels.

Relative level tolerance: Maximum deviation from a 3 m straightedge laid on the surface.

RMS: Road and Maritime Services.

Rigid Pavement

Pavement construction in which the base consists of Portland cement concrete and the subbase consists of unbound materials, or cement treated materials, or lean mix Portland cement concrete.

6.1.3 APPLICATION OF THIS SPECIFICATION

This specification applies to work on privately owned property. Where works are on public property, or property which is to come under the control of a Statutory Authority (Council, State Road Authority etc), or where the works are to come under the control of a Statutory Authority, works shall be carried out in accordance with the requirements of the relevant Statutory Authority.

6.2 QUALITY

6.2.1 INSPECTION

General

Refer also to General Requirements section and Appendix A.

Witness Points

Give sufficient notice so that inspection may be made at the following stages:

- Materials or areas of work ready for tests.
- Testing including proof rolling.
- Each pavement layer placed and compacted.
- Automatic level control devices in place.
- Subgrade material opened up so that its nature can be assessed.
- Surfaces prepared for priming, sealing or surfacing.
- Placing subbase and base.
- Subbase and base completed.

Hold points - proof roll inspection and test certificates for underlying work (filling, subgrade etc).

6.2.2 TESTS

General

Refer also to General Requirements section and Appendix A.

Process Control Tests

Perform tests of the type and frequency necessary to adequately control the materials and processes used in the construction of the works. Tests described in the Process control schedule are the minimum requirement.

Table 6.2.2-20: Compliance assessment schedule

Type of Test	Test Frequency	Test Method
Material properties of subbase/ basecourse	In accordance with RMS Specification No.3051	In accordance with RMS specification No 3051
Material properties of Lime	1 per source	In accordance with RMS Teste Method T430.
Lime stabilised subgrade, lime content and cement stabilised subbase cement content	1 per 250 m ²	RMS Test Method T134 or RMS Test Method T143 as applicable

Sampling

Process control tests: Determine timing and location.

Compliance Assessment Tests:

Timing: Obtain materials samples from stockpiles prior to delivery to site. Ensure that material tested represents material delivered to site.

Location: Sample from selected sample sites within designated uniform test lots, consisting of an area placed, or compacted or both in one day. Test lots must be uniform in terms of material properties and density.

Subgrade, Subbase and Base

General: Test for compliance with the specified density, and for criteria given in the Subbase tests table and the Base tests table.

Density Test Methods:

- Field dry density: To AS 1289.5.3.1, AS 1289.5.3.5 or AS 1289.5.8.1. If using AS 1289.5.8.1 calibrate the surface moisture-density gauge in accordance with AS 1289.5.8.4 before use on the site.
- Standard maximum dry density: To AS 1289.5.1.1.
- Modified maximum dry density: To AS 1289.5.2.1.
- Compaction: To AS 1289.5.4.1.

Table 6.2.2-21: Density tests schedule

Location	Test frequency
Subgrade	1 per 250 m ² or 3 No. per lot
Subbase	1 per 250 m ² or 3 No. per lot
Base	1 per 250 m ² or 3 No. per lot

6.2.3 SAMPLES

General

Submit samples of the following at least one month before use in the works:

Granular materials: One 20 kg sample of each proposed type and size of material including base, subbase and cement treated subbase.

Identification

Attach a tag to each sample showing relevant information including description, source and nominal size of material.

6.2.4 CONTRACTOR'S SUBMISSIONS

General

Refer also to General Requirements section for Quality Assurance and testing requirements.

Tests

Compliance assessment: If compliance assessment tests are to be carried out by an independent testing authority, have the authority submit 3 copies of each test result.

Certificate of compliance: If a certificate of compliance is acceptable as an alternative to testing a manufactured material, submit the manufacturer's certificate together with the results of recent tests undertaken by the manufacturer, showing compliance with test criteria.

Materials

Delivery dockets: Submit a delivery docket at the time and place of delivery for each truckload of subbase and base material, showing

- empty and loaded mass of vehicle;
- date and time of batching;
- supplier and location of mixing plant;
- registration number of the vehicle; and
- nature of material.

Execution

General: Submit proposals for the methods and equipment to be used for the roadworks, including the following:

- Staging of the work, access and traffic control methods.
- Disposal of surface water, control of erosion, contamination and sedimentation of the site, surrounding areas and drainage systems.
- Methods and equipment for each operation.
- Sources of materials.
- Material stockpiles.

Cement treated materials: Submit proposed method of mixing.

Compaction: If it is proposed that a layer is to exceed 150 mm in thickness, submit evidence demonstrating that the proposed compaction equipment can achieve the required density throughout the layer.

Records of measurement

Submit certified records of work performed as follows: >

6.3 MATERIALS

6.3.1 BASE MATERIALS

Source Material

Type: Crushed rock or natural gravel consisting of hard, dense, durable particles of uniform quality, free from deleterious materials or coatings including clay and organic matter.

River stones: If the material is produced by crushing rounded river stones, 75% of the particles larger than 9.5 mm must have at least 2 fractured faces.

If it is proposed to use recycled building material, details of the proposed material must be submitted for approval. Recycled building material must be crushed cement concrete only complying with the requirements of RMS QA Specification 3051 including Table 3051.3 Limits of Foreign Material for Recycled Building Materials.

Base material - Base material to conform with the particle size distribution and other required properties specified in RMS QA specification 3051 for Category 2(b) materials. Base material to be DGB20 unless otherwise specified on the drawings.

6.3.2 SUBBASE MATERIALS

Source Material

As specified for base material.

Subbase Material

Subbase material to conform with the particle size distribution and other properties specified in RMS QA specification 3051 for Category 2(b) materials. Subbase material to be DGS40 unless specified otherwise on the drawings.

6.3.3 CEMENT TREATED MATERIALS

Source Material

Type: Crushed rock or natural gravel consisting of hard, dense, durable particles of uniform quality, free from deleterious materials or coatings including clay and organic matter.

River stones: If the material is produced by crushing rounded river stones, 75% of the particles larger than 9.5 mm must have at least 2 fractured faces.

If it is proposed to use recycled building material, details of the proposed material must be submitted for approval. Recycled building material must be crushed cement concrete only complying with the requirements of RMS QA Specification 3052 including Table 3052.3 Limits of Foreign Material for Recycled Building Materials.

Subbase/Base Material

Material to conform with the particle size distribution and other required properties specified in RMS QA specification 3052 for Category 2(b) materials.

Cement Treated Base and Subbase

Cement type to AS 3972: GP.

Cement content (% by dry mass of aggregate): As specified on the drawings.

- Tolerance: $\pm 0.3\%$.

Mixing

Mix cement and water with the subbase/base material in mixing plant before placing the material. Provide mixes which are consistently uniform and of the required proportions and moisture content.

6.3.4 LIME STABILISED SUBGRADE

General: Hydrated lime shall be used for stabilisation.

Standard: RMS Test Method T430.

Hydrated lime: The hydrated lime shall have the following properties:

- The available lime calculated as calcium hydroxide, shall not be less than 85%.
- The material shall be dry.
- The material shall be in powder form and the residue on a 300 micrometre sieve shall not exceed 2%

6.3.5 LEAN MIX CONCRETE SUBBASE

Refer to the concrete road surfacing section.

6.4 SUBGRADE, SUBBASE AND BASE

6.4.1 TOLERANCES

Surface Level

General: Provide a finished surface which is free draining and evenly graded between level points.

Edges abutting gutters: Within ± 5 mm of the level of the actual gutter edge.

Tolerances: The tolerances in the Surface level tolerances table apply to the finished level of each layer, unless overridden by the requirements (including tolerances) for the finished level and thickness of the surface course.

Table 6.4.1-22: Surface level tolerances table

Item	Level tolerance:	
	Absolute	Relative
Cut subgrade in earth and fill subgrade	+ 0 mm - unspecified	20 mm
Cut subgrade in rock	+ 0 mm - unspecified	unspecified
Subbase surface	+ 0 mm	10 mm - 10 mm
Lean mix concrete subbase surface	+ 0 - 10 mm	5 mm
Base surface	+ 0 mm -20 mm	10 mm -20 mm
Base surface under segmental unit paving	+10 mm -0 mm	10 mm

Compacted Layer Thickness

Subbase and base (individual layers and total thickness): + unspecified, - 10 mm.

6.4.2 SUBGRADE PREPARATION

General

Trim the subgrade to an even surface free from loose material.

Subgrades Affected by Moisture

Where the existing subgrade or filling is unable to support construction equipment or it is not possible to compact the overlying pavement because of deterioration due to water or any other cause occurring after the exposure of the existing subgrade or filling the Contractor shall be deemed to have caused the conditions. Perform one or more of the following at no extra charge and without extension of time for completion.

- Allow the subgrade to dry until it will support equipment and allow compaction.

- Scarify the subgrade, work as necessary to accelerate drying, and recompact when the moisture content approximates the optimum.
- Excavate the wet material and remove to spoil.

Draining depressions

General: Grade depressions to drain to the edge of the formation.

Rock subgrades: In rock subgrades, drain depressions with subgrade drains at least 150 mm wide, backfilled with coarse filter, and connected to the stormwater system or to longitudinal subsoil drains.

- Depth of subgrade drain: 100 mm

Unsuitable Material

Remove roots, boulders, silt, organic matter and other unsuitable materials. Refer also to Earthworks Section regarding unsuitable material and bad ground.

Backfilling

Select filling: Replace over-excavation, including excavation for grub holes and removal of wet or unsuitable material, with granular material complying with the following:

- Maximum particle size: 75 mm.
- Proportion passing 0.075 mm sieve: 25% maximum.
- Plasticity index: > 2%, * 15%.

Subbase material: In cut subgrades, if over-excavation, other than excavation to remove unsuitable material, requires a replacement layer less than 100 mm thick, do not backfill, but make good by increasing the thickness of the lowest pavement layer.

Coarse filter: Backfill rock depressions and subgrade drains with coarse subsoil filter.

6.4.3 COMPACTION

Fill Subgrades

Maximum particle size of material in the top 150 mm: 75 mm.

Table 6.4.3-23: Compaction Schedule

Required Subgrade Densities: Location:	Minimum density required: (% of maximum dry density):	Moisture Content % variation from optimum *
Backfilling of grub holes:	98% Standard	± 2
Replacement of over excavation:	98% Standard	± 2
Replacement of unsuitable material:	98% Standard	± 2
Top 150 mm of fill subgrades:	98% Standard	± 2
Cut subgrade in earth to a minimum depth of 150mm	98% Standard	± 2
Lime stabilised subgrade	98% Standard	± 2
Required Base and Subbase Densities		
Item description:	Minimum density required:	
Base:	98% Modified	± 2
Subbase:	98% Modified	± 2
Cement-treated subbase:	98% Modified	± 2

* Moisture variations shown are the maximum allowable variations from the optimum moisture content. The Contractor must ensure that the fill material is placed at a moisture content which allows it to be compacted and proof rolled in accordance with the specification (i.e. stricter moisture control may be required on site).

Proof Rolling

Proof roll the subgrade using a smooth steel-wheeled roller of at least 10 t mass. Fill or replace depressions or soft spots developed on the subgrade during proof-rolling and continue rolling until uniform compaction is obtained.

Cement treated material: Begin compacting immediately after spreading and complete it in a continuous operation not more than 2 hours after the cement and water have been mixed into the material.

Compaction Requirements

Apply uniform and sufficient compactive effort over the whole area to be compacted. Use rollers appropriate to the materials and compaction requirements.

Layer Thickness

General: Compact the material in layers of 100 - 150 mm compacted thickness. Within these limits, provide layers of the same material in multi-layer courses which are of equal thickness.

Moisture Content

General: During spreading and compaction, maintain materials at the optimum moisture content appropriate to each material.

Moisture Control

General: Moisten prepared subgrades and preceding layers of subbase immediately before spreading subbase or base material. Keep the leading edges of subbase or base material moist until new material is added next to it. Do not wash fines from the subbase or base material.

Spraying: Maintain moisture content. Use water spraying equipment capable of distributing water uniformly in controlled quantities over uniform lane widths.

Cement treated material: Keep the compacted surface of each layer moist by watering until covered by further material or a bituminous curing seal. Apply bitumen emulsion or cut back bitumen to the final surface as soon as possible after the completion of compaction and in any case after not more than 8 hours.

Rectification

If a section of subgrade or pavement material fails to meet the required density or moisture content after compaction, rectify as follows:

- Fill subgrades: Remove the non-complying material, replace with fill material as specified in Subgrade preparation, and recompact.
- Cut subgrades: Rework the material and recompact.
- Pavement material: Remove the non-complying material, replace with new pavement material, and recompact.

Level Corrections

Rectify incorrect levels as follows:

- High areas, unbound layers: Grade off.
- High areas, bound layers: Remove to the full depth of the layer, replace with new cement-treated material, and recompact.
- Low areas: Remove bound layers to the full depth and unbound layers to a minimum depth of 75 mm, replace with new material and recompact.

6.4.4 PLACING BASE AND SUBBASE

General

Weak surfaces: Do not place material on a surface which has been so weakened by moisture that it will not support, without damage, the constructional plant required to perform the work.

Spreading: Spread material in uniform layers without segregation, by direct tipping from suitable vehicles or using a mechanical spreader.

Segregation: Do not tip materials in heaps and then spread by grader. If material becomes segregated, remix using a rotary hoe or other suitable equipment.

Moisture content: Maintain wet mixed materials at the required moisture content before and during spreading. Add water to dry mixed materials through fine sprays to the entire surface of the layer after spreading, to bring the material to the required moisture content.

Layer thickness: 100 - 150 mm (after compaction). Use equal layers in multilayer courses.

Joints

Plan spreading and delivery to minimise the number of joints. Offset joints in successive layers by at least 300 mm.

Cement Treated Subbase

Joints: Make longitudinal and transverse joints, as specified in Junctions with existing pavements:

- at the end of each day's work;
- where spreading has been halted for more than 2 hours; and
- where required.

6.4.5 JUNCTIONS WITH EXISTING PAVEMENTS

General

Trimming: Where the pavement is to be joined to an existing pavement remove a strip of the existing pavement at least 300 mm wide for its full depth and trim the edge to an angle of approximately 45° in steps of maximum height 150 mm before placing new pavement material.

6.4.6 FINISHING BASE SURFACES

Surfaces to be Primed

Produce a tight even surface without loose stones or a slurry of fines. Construct the fine crushed rock surface slightly higher than the required levels and cut it to profile using a power grader towards the end of the compaction process.

Disposal of Cuttings

Cuttings from the surface may be used in fills or elsewhere in the works.

Subbase to concrete pavements (debonding): The subbase under concrete pavements should be trimmed and compacted as described above for surfaces to be primed and covered with two coats of wax emulsion curing compound. The wax emulsion curing compound shall have a water retention efficiency of not less than 90% when tested to AS 3799, have a weight solid content of not less than 30% and comply with AS 3799 and RMS specification 3202. Each coat of wax emulsion is to be applied at a rate of 0.2L/m². The first coat should be applied immediately upon completion of trimming the subbase material. Any damage or wear to the wax emulsion coating which occurs prior to placing the concrete base course shall be repaired at the Contractor's expense.

6.4.7 SERVICE TRENCHES AND PITS

General: Any reference to trenches also includes pits. All services beneath pavements should be installed prior to commencing stabilisation or final trim of subgrade. Where it is necessary to excavate a service trench in a partially completed or completed pavement area, the trench is to be restored as described below.

Requirement: Backfill the trench to the underside of the pavement zone in accordance with the requirements of the Service Trenching Section. The pavement zone includes subbase, base and pavement surfacing.

Any pavement material adjacent to the trench which has been disturbed or contaminated by the trench excavation shall be removed, and pavement material shall be removed for a minimum width of 300 mm either side of the trench excavation. The joint with existing pavement shall be trimmed as described in Junctions with Existing Pavements.

The pavement material shall be reinstated using material, layer thicknesses and compaction as specified for the original pavement. The pavement surface layer (concrete, asphaltic concrete etc.) is to be restored in accordance with the requirements of the relevant subsection of this specification.

Testing: Materials certificates are to be supplied for each type of pavement material used in the restoration in accordance with the relevant subsection of this specification.

Density tests are to be conducted on each layer of pavement material. Frequency of testing shall be:

1 test per 20 m, min of 1 test per layer per lot.

6.4.8 LIME STABILISATION OF SUBGRADE

Generally: Prior to in place mixing, the layer to be stabilised shall be compacted to a minimum of 95% standard and shall be trimmed parallel to the designed grade level. Lime stabilising shall be done after all services are backfilled. If it is necessary to excavate service trenches or pits following stabilisation, the trench or pit is to

be backfilled using DGB 20 fine crushed rock compacted to 98% modified maximum dry density over the depth of the lime stabilised layer.

Should ripping or tining of the in-situ material be subsequently required to facilitate in place mixing, it shall be carried out prior to spreading of the lime in such a manner as not to disturb the layer beneath the layer to be stabilised.

The Contractor shall nominate the spread rate that will be used to achieve the specified proportion of lime.

Spreading shall be carried out using a mechanical spreader capable of spreading the lime uniformly, to an accuracy of 10% of the nominated rate.

The actual spread rate shall be verified on a daily basis and shall be within -10% and +20% of the nominated rate.

No traffic nor any equipment not actually used in the spreading or mixing of the lime agent shall be allowed to pass over the spread lime until it has been mixed in to the layer to be stabilised.

Mixing shall be done so that uniform mixing is achieved over the whole area and to the full nominated depth. Lime content throughout the full depth shall be in excess of the nominated percentage.

The uniformity of mixing in the vertical direction shall be checked by determining separately the percentage by weight of lime content in the top and bottom halves of a test hole, dug to the specified depth of mixing.

Water shall be added to the materials during the mixing process, as required, so as to achieve the specified moisture content.

No water shall be added to the mixed material after mixing and before compaction is completed, other than light surface wetting to reduce moisture loss and lay dust.

Spillage: Stabilising agent spilt shall be removed within four hours of occurrence at no cost to the Principal.

Placement: Spreading, trimming and compaction of the stabilised material shall be carried out in accordance with Earthworks and Roadworks Specifications except that the minimum dry density to be achieved shall be the comparative dry density performed on material taken by the Contractor, as soon as practicable after placement in the layer. Field dry density shall be carried out in approximately the same location from which the comparative dry density sample is obtained.

Stabilisation shall not be carried out during wet weather or if rain is likely to fall during the process. Stabilisation shall not be carried out during periods of wind which could cause loss of stabilising agent or cause nuisance or danger to people or property.

Trimming and compaction shall be done within 24 hours after the commencement of mixing. Reworking of materials will be allowed up to 24 hours after mixing, subject to the agreement of the Superintendent.

Material shall not be cut and spread onto the mixed layer but all trimmed material shall be either cut to waste, picked up and used as fill or spread as directed.

The depth of the stabilised layer as specified shall be maintained after such trimming protection.

Stabilisation shall be carried out so that the full width of carriageway specified is completed in the one day operation.

Stabilisation shall commence from any end or ends of the limits of the work and shall continue from that end or ends without gap to completion.

Special attention to compaction shall be given at the joints so that the material complies in all respects with the Specification and the existing edge is not damaged.

Longitudinal Joints: Stabilising operations shall be planned so that compaction is carried out without the need for longitudinal joints.

Longitudinal joints may only occur where the contractor can demonstrate that the joints are unavoidable. If compaction of adjoining runs cannot be affected within two hours of incorporating the lime, a longitudinal joint shall be formed between the runs as follows:

- Just prior to placing the next run, the edge of the previously placed and compacted run shall be cut back to the extent that the compacted mix at the cut face complies with the requirements of this Specification.
- The cut off material shall be removed from the site and the joint area left clean.
- If necessary, the cut face of the previous run shall be maintained in a damp condition prior to placing the next run.

- The roller shall be partly supported on previously compacted run when compacting fresh mix placed against the cut face.

Transverse Joints: Transverse joints may be formed in the following circumstances:

- Just prior to the commencement of the days stabilising operation.
- Following any delay in excess of 2 hours in the continuity of the stabilising operation.

The joint shall be formed just prior to the recommencement of the stabilising operation by cutting back into the existing material to the extent that the compacted mix at the cut face complies with the requirements of the Specification. The cut-off material shall be removed from the site and the joint area left clean.

If necessary, the cut face of the existing material shall be maintained in a damp condition prior to recommencement of the stabilising operation.

The roller shall be partly supported on the existing material when compacting the fresh mix placed against the cut face.

Curing: Stabilised layers shall be protected against rapid drying by keeping the surface of the layer continuously damp until such times as a covering layer is placed.

If the stabilised layer is situated immediately beneath the pavement and a pavement layer or bituminous surfacing is not to be placed within five days of the completion stabilisation, then curing shall be affected by the application of Rapid Setting Bitumen Emulsion complying with the requirements of MR Form No. 305 for Grade CRS, applied at the rate of at least 0.5 Litre/m², within two days of the completion of compaction and trimming. The stabilised layer shall be kept continuously damp until the application of the bitumen emulsion or bituminous surfacing.

The Contractor shall repair all damage to the emulsion coat caused by construction traffic within 24 hours of the damage occurring at no cost to the Principal.

Testing: Refer to Testing Subsection and Appendix A, Schedule of Inspection and Testing Requirements.

7.0 ROADWORK ANCILLARIES

7.1 GENERAL

7.1.1 CROSS REFERENCES

General

Refer to the General requirements section.

Related sections

Refer to the following sections:

- General Requirements
- Roadbase and subbase
- Asphalt Road Surfacing
- Concrete Road Surfacing
- Sprayed Bituminous Surfacing
- Appendix A - Schedule of Inspection and Testing Requirements

7.1.2 APPLICATION OF THIS SPECIFICATION

This specification applies to work on privately owned property. Where works are on public property, or property which is to come under the control of a Statutory Authority (Council, State Road Authority etc), or where the works are to come under the control of a Statutory Authority (ie stormwater drainage in a future easement), works shall be carried out in accordance with the requirements of the relevant Statutory Authority.

7.1.3 INTERPRETATION

Definition

Associated elements: Includes kerbs, gutters, footpaths and crossings.

RMS: Road and Maritime Services.

7.2 QUALITY

7.2.1 INSPECTION

Refer to General Requirements section and Appendix A for inspection requirements.

7.2.2 TESTING

Refer to General Requirements section and Appendix A for testing requirements.

7.3 EXECUTION

7.3.1 TOLERANCES

Associated elements

Absolute level tolerance: ± 10 mm.

Maximum deviation from design alignment: 25 mm.

Maximum deviation from a 3 m straightedge placed on horizontal, vertical, or sloping surfaces required to be straight: 5 mm.

7.3.2 REINSTATEMENT

General

Reinstate surfaces next to new pavement and associated elements.

7.4 COMPONENTS

7.4.1 ASSOCIATED ELEMENTS

Base

Place and compact base under associated elements to 75 mm compacted thickness and to the full width of the element.

Subbase

General: Subbase as specified in the Roadbase and Subbase section.

Concrete

Standard: To AS 1379 Grade N25 or as shown on Drawings.

Formwork: Form elements using fixed forms or slip forming equipment.

Curing: If using the curing compound method apply the curing compound at a rate of at least 0.5 L/m².

Minimum curing time: 7 days.

Surface finish:

General: Provide exposed surfaces with uniform texture and free from depressions in which water can lie. Finish to be equivalent to steel float finish unless shown otherwise on drawings. Footpaths to be wood float finish with suitable steel float edging unless shown otherwise on the drawings. Confirm footpath finish with Contract Administrator before commencing work.

Formed surfaces: Remove the forms while the concrete is still green and rub the surface to a uniform texture free from blowholes. Finish to be equivalent to steel float finish unless shown otherwise on drawings.

Joints

Contraction joints: Weakened plane joints 3 mm wide extending at least one quarter the depth of the section, at approximately 3 m intervals, adjusted if necessary to avoid short closing lengths unless shown otherwise on drawings.

Expansion joints: Locate at junctions with fixed structures such as drainage structures and buildings, at tangent points of curves of less than 25 m radius, and at 12 m intervals elsewhere unless shown otherwise on drawings. Do not tool off joint arrises abutting the seal.

Fill: Select from preformed self-expanding cork, or bitumen impregnated fibre board joint filler.

Width: 15 mm.

Footpaths

Standard: Construct footpaths as detailed on the drawings and in accordance with the pavement legend on the drawings. Footpaths consisting of unit pavers shall be constructed in accordance with the Concrete Segmental Unit Paving specification.

Integral Kerbs and Medians

Integral kerbs and medians shall be constructed in accordance with the specification for Concrete Road Surfacing. Joints shall be formed to match joints in the concrete road pavement.

7.4.2 TRAFFIC CONTROL DEVICES

Standard

General: To AS 1742.

7.4.3 LINE MARKING

Line marking shall be installed as shown on the Civil drawings and in accordance with AS 1742.2, AS2890.1, AS2890.2, AS2890.5 and AS2890.6. Materials shall comply with the requirements of the relevant Statutory Authority or AS 4049 where works are on private property.

7.4.4 JUNCTIONS WITH EXISTING PAVEMENTS

General

Trimming: Where the pavement is to be joined to an existing pavement remove a strip of the existing pavement at least 300 mm wide for its full depth and trim the edge to an angle of approximately 45° in steps of maximum height 150 mm before placing new pavement material.

Existing sealed pavement: Trim the seal to a neat edge.

Minimum Blade height to be 2.5m.

7.4.5 ROAD SIGNAGE

Signage shall be installed as shown on the Civil drawings. Installation and materials shall comply with the requirements of the relevant Statutory Authority or AS 1742.2, AS2890.1, AS2890.2, AS2890.5 and AS 2890.6 where works are on private property.

Signs are to be no less than 2.5m above surface for clearance to vehicles and pedestrians as per the requirements of AS1742.2.

Signs in multistorey carpark, the height can be reduced to 2.2m above road level.

7.4.6 GUARDRAILS / CRASH BARRIERS

The guardrails shall be manufactured and installed in accordance with the requirements of the RMS's Road Design Guide - Section 6 Safety Barriers for Roads and Bridges, Austroads Bridge Design Code or AS 1170.1 as applicable.

Details of the proposed safety barriers shall be submitted to the Contract Administrator for approval prior to ordering the barriers (refer also to General Requirements Section, Proprietary Items).

Crash Barriers

Crash Barriers to be 1.3m from the ground in accordance with AS2890.1 and AS1170.1.

8.0 ASPHALT ROAD SURFACING

8.1 GENERAL

Asphalt Road Surfacing includes:

- Asphalt supply, placement and testing

8.1.1 CROSS REFERENCES

General

Refer to the General Requirements section.

Related Sections

Refer to the following sections:

- General Requirements
- Site Preparation
- Earthwork
- Road Base and Subbase
- Appendix A - Schedule of Inspection and Testing Requirements

8.1.2 APPLICATION OF THIS SPECIFICATION

General

This specification applies to works on privately owned property and is to be read in conjunction with AS 2150 and AS 2734, except that this specification shall take precedence where the requirements differ. Where works are on public property, or property which is to come under the control of a Statutory Authority (Council, State Road Authority etc), Asphalt Road Surfacing shall be carried out in accordance with the requirements of the relevant Statutory Authority.

8.1.3 INTERPRETATION

Definitions

Standard: To AS 1348.1.

Absolute level tolerance: Maximum deviation from design levels.

Relative level tolerance: Maximum deviation from a 3 m straightedge laid on the surface.

Relative compaction: The ratio between the field bulk density and the bulk density of the job mix when compacted in the laboratory.

RMS: Roads and Maritime Services.

8.2 QUALITY

8.2.1 INSPECTION

General

Refer also to General Requirements section and Appendix A.

Witness points

Give sufficient notice so that inspection may be made at the following stages:

- Materials or areas of work ready for tests.
- Automatic level control devices in place.
- Commencement of asphalt surfacing.

Hold Points

- Proof roll inspection and test certificates for underlying work (subgrade, basecourse etc).
- Surface prepared for priming, sealing or asphalt surfacing.

8.2.2 MIX TESTS

General

Refer also to General Requirements section and Appendix A.

Process Control Tests

Perform tests of the type and frequency necessary to adequately control the materials and processes used in the construction of the works. Tests described in the Compliance Assessment schedule are the minimum requirement.

Table 8.2.2-24: Compliance assessment schedule

Type of test	Test frequency	Test method
Mix properties	1 per 50T min 1 per lot	AS 2891
Aggregate properties	prior to supply	AS 1141.21, 22 and 23

Methods

Use wet preparation methods where applicable.

Sampling

Compliance assessment tests:

- Timing: Obtain materials samples from trucks at the mixing plant.

Mix Properties

Test for mix properties using one of the following methods as applicable:

- Tar mixes: To AS 2891.4.
- Bitumen mixes: To AS 2891 Clauses 3.1, 3.2 or 3.3.

Sampling

To AS 2891.1

Marshall Stability of Compacted Mix

To AS 2891.5

Compactive effort: 50 - blow.

Variations in Mix Properties

Ensure that the maximum variation between the mix property of each sample and the job mix value is in accordance with the Mix property table.

Table 8.2.2-25: Mix property table

Mix property	Maximum variation from job mix value
Aggregate passing 4.75 mm sieve or larger	± 4% by mass
Aggregate passing 2.36 to 0.3 mm sieves	± 3% by mass
Aggregate passing 0.15 mm sieve	± 2% by mass
Aggregate passing 0.075 mm sieve	± 1% by mass
Bitumen content	± 0.3% by mass
Added filler content	± 0.5% by mass
Mixing temperature	± 10°C

Plant site laboratory To AS 2150 Clause 9.1

8.2.3 COMPACTION TESTS

Density Tests

Test Lots: Each section of work performed in one continuous operation.

Frequency: Refer to the Asphalt compaction acceptance criteria table.

General: Perform a field bulk density test for each test site either

- on a core sample taken from the asphalt surfacing layer; or
- if the nominal layer thickness is > 50 mm, measured in situ using a nuclear gauge.

Sample preparation: To AS 2891.1.

Characteristic value of relative compaction: Calculate the value of relative compaction using the formulae in the **Relative compaction table**, in which X and S are the mean and the standard deviation, respectively of the individual relative compaction test values for the lot.

Table 8.2.3-26: Relative compaction table

Number of tests per lot	Characteristic value
6	$X - 0.92S$
10	$X - 0.88S$

Acceptance Criteria

The relative compaction of each lot of pavement must meet the criteria of the **Asphalt compaction acceptance criteria table**.

Table 8.2.3-27: Asphalt compaction acceptance criteria table

Number of test sites per lot: - Core sample tests	6*
- Nuclear gauge tests	10*
Lot value for relative compaction	Characteristic value
Minimum value: - Layer thickness up to 50 mm	96%
Layer thickness 50 mm or more	96%
	* or 1 test per 250 m ² whichever is greater

8.2.4 CONTRACTOR'S SUBMISSIONS

Tests

Compliance assessment: If compliance assessment tests are to be carried out by an independent testing authority, have the authority submit 3 copies of each test result.

Certificate of compliance: If a certificate of compliance is acceptable as an alternative to testing a manufactured material, submit the manufacturer's certificate together with the results of recent tests undertaken by the manufacturer, showing compliance with test criteria.

Materials

Proposed job-mix: Submit the following details before commencing production:

- Combined aggregate particle size distribution.
- Test certificates for aggregate for resistance to abrasion, particle shape and strength.
- Binder content expressed as a percentage of the total mix.
- The filler content expressed as a percentage by mass of the combined aggregates.
- The asphalt mix properties.
- The proposed mixing temperature.

Delivery dockets: Submit a delivery docket at the time and place of asphalt mix delivery showing

- empty and loaded mass of the vehicle;
- date and time of loading;
- supplier and location of mixing plant;
- registration number of the vehicle;
- size and type of asphalt mix;
- class of binder;
- temperature of load at mixing plant; and
- laboratory stamp or other mark certifying compliance with the specified properties.

Execution

General: Submit proposals for the methods and equipment to be used the roadworks, including the following:

- Staging of the work, access and traffic control methods.
- Disposal of surface water, control of erosion, contamination and sedimentation of the site, surrounding areas and drainage systems.
- Methods and equipment for each operation.
- Sources of materials.
- Material stockpiles.

8.3 MATERIALS

8.3.1 ASPHALT MATERIALS

Asphalt Materials

Primer: Medium cut back bitumen to AS 2157, containing no fluxing oil.

Primer grade:

- Primer: AMC1
- Primer seal: AMC3

Tack coat mix: 3:2 bitumen emulsion:water.

Bitumen emulsion:

- To AS 1160.
- Designation: ARS/170-60.

Coarse Aggregate

- To AS 2758.5

Type: Clean, sound, hard, durable, angular crushed stone, gravel or slag, of uniform quality, free from deleterious matter.

- Crushed river gravel: At least 2 fractured faces to at least 75% by mass of all sieve fractions.
- Crushed slag: Air-cooled blast furnace slag of uniform quality, generally free from vesicular, glassy or other brittle pieces.
- Resistance to polishing (wearing course): >

Fine Aggregate

Type: Clean, sound, hard, durable particles of natural sand or particles derived from crushed stone, gravel or slag, free from injurious coating or particles of clay, silt, loam or other deleterious matter.

Table 8.3.1-28: Aggregate properties table

Property	Test method	Value
Resistance to abrasion	AS 1141.23	≤ 30 for wearing course ≤ 35 for binder course and corrective course
Particle shape	AS 1141.21	≤ 25 for wearing course ≤ 30 for binder course and corrective course
Wet strength	AS 1141.22	> 50 kN
Wet/dry strength variation	-	$\leq 35\%$

Binder

Type: Bitumen Binder, Class 450.

Mineral Filler

Mineral fillers shall comply with AS 2357.

Reclaimed Asphalt Pavement (RAP)

If RAP is used, all properties of the final mix including the aggregate material properties must comply with this specification.

Combined Aggregate Grading

Provide a quantity of mineral filler at least 2% by mass of the combined aggregates, and the combined aggregate grading shall comply with Table 1 of AS 2150.

8.3.2 ASPHALT MIX DESIGN

Requirements

General: Design the asphalt mix using the Marshall method.

Asphalt mix design: As shown on the drawings

Mix Properties

Marshall stability: Table 5 of AS 1250 (50-blow).

Marshall flow: 4.0 mm maximum.

Voids in total mix (maximum theoretical density based on apparent specific gravity of aggregates):

- Wearing courses: 3% - 5%.
- Binder courses and 7 mm mixes: 4% - 6%.

Voids in aggregate filled with bitumen:

- Wearing courses: 75% - 85%.
- Binder courses and 7 mm mixes: 70% - 80%.

Binder content, percentage by mass of total mix:

- nominal mix size 5 to 10 mm: 5% - 7%
- nominal mix size 14 mm: 4.5% - 6.5%
- nominal mix size 20 mm: 4% - 6%
- nominal mix size 28 mm to 40 mm: 3.5% - 5.5%

8.3.3 POLYMER MODIFIED BITUMEN

Refer to Roads and Traffic Authority NSW QA Specification 3252.

8.4 ASPHALT SURFACING

8.4.1 TOLERANCES

Surface Level

General: Provide a finished surface which is free draining and evenly graded between level points.

Edges abutting gutters: Within ± 5 mm of the level of the actual gutter edge.

Tolerances: The tolerances in the **Asphalt surface level tolerances table** apply to the finished level of each layer, unless overridden by the requirements (including tolerances) for the finished level and thickness of the surface course.

Table 8.4.1-29: Asphalt surface level tolerances table

Item	Level tolerance:	
	Absolute	Relative
Longitudinal direction	± 10 mm	5 mm
Transverse direction	± 10 mm	10 mm

Thickness

Asphalt surface course: The following tolerances apply to variations in the compacted layer thickness from the specified thickness:

- Any one sample: + 10 mm, - 5 mm.
- The mean thickness of the core samples in a lot: + unspecified, - 0.

8.4.2 PREPARATION

Cleaning

Immediately before priming or tack coating remove loose stones, dust and foreign material from the base surface using a power broom or blower. Keep traffic off the cleaned surface.

Protection

Protect adjacent surfaces during spraying. Protect freshly sprayed surfaces from contamination.

Priming

Timing: Prime the base surface as soon as possible after compaction and finishing.

Engineers to note: Application rate should be increased if the surface is going to be trafficked.

Application rate (L/m²): 1

Potholes

Trim to a regular shape and a uniform depth of at least 75 mm, tack coat the edges and patch with asphaltic concrete.

8.4.3 TACK COATING

Tack Coating

Apply tack coat 30 - 120 minutes before asphalt surfacing is placed. Cover the surface uniformly to achieve a rate of 0.10 - 0.30 L/m² of residual binder. Brush out any pools of tack coat which may form in surface depressions before the emulsion breaks.

8.4.4 SPREADING ASPHALT SURFACING

Preconditions: Place asphalt surfacing in dry weather on a dry pavement surface at a pavement temperature not less than 10°C.

Method: Unless otherwise permitted, place asphalt surfacing by mechanical spreader, operated at the lowest uniform rate consistent with the continuous operation of the mixing plant. Place the mix with a minimum of delay after delivery. Keep the temperature of the mix in the hopper of the spreader at not less than 120°C. Do not reheat.

Hand Spreading: The Contract Administrator may approve hand spreading in areas where machine spreading is impracticable. In such cases deposit the mix outside the area on which it is to be spread, distribute it into place and spread and level it without segregation, using suitable lutes.

Operations: Spread the mix in layers covering the full width of the carriageway, or, if approved, in lanes of width normally not less than 3 m, to a surface parallel with the finished pavement surface, and to a depth as required by the specified compacted thickness. Layers placed in adjoining lanes shall have the same compacted thickness.

8.4.5 COMPACTING ASPHALT SURFACING

Generally: Work to generally be in accordance with AS 2734 section 8. Before commencing compaction, correct any irregularities in line or level. Trim lane edges to a straight line. Compact asphalt surfacing uniformly as soon as it will support rollers without undue displacement, and complete rolling while the mix temperature is above 80°C (initial passes to be compacted before temperature drops below 105°C). Operate rollers with the driving roll or wheels nearer the spreader, and at a speed slow enough to avoid displacement of the mix and not greater than 5 km/h. Disengage vibratory mechanisms before stopping or reversing direction. Operate steel wheeled rollers with minimum wetting of rolls. Operate pneumatic tyred rollers without wetting the tyres except during the initial stages of rolling, when only sufficient water is to be applied to the tyres to prevent adhesion of the mix until the tyres have gained heat. Make adjacent roller passes of different lengths.

Initial Rolling of Layers Less Than 100 mm Compacted thickness: Use a vibratory steel wheeled roller. Roll transverse and/or longitudinal joints first. Longitudinal joints should be compacted using a pass which extends 200 mm onto the previously laid mix. Transverse joints should be compacted with the roller travelling in the direction of the joint in non-vibratory mode. The first pass should extend 200 mm onto the new mix with subsequent passes extending 200 mm further onto the new mix until half the drum width is on the new mix. Continue rolling longitudinally, commencing on the lower side and proceeding to the higher side of the spreader run. The roller shall overhang the unsupported edges of the run by about 100 mm. Overlap each longitudinal pass on the previous pass by about 100 mm.

Initial Rolling of Layers 100 mm Compacted thickness Or Greater: Perform the initial rolling of transverse and longitudinal joints and of unsupported edges using a vibratory steel wheeled roller as described above.

Elsewhere, perform the initial rolling using either a self propelled, pneumatic tyred, multi wheeled roller or a vibratory steel wheeled roller. Roll transverse and/or longitudinal joints first. Proceed from the lower side of the spreader run to the higher side, but delay rolling within 200 mm of an unsupported edge to minimize possible displacement of the asphalt surfacing.

Reform initial rolling of the 200 mm strip adjacent to the unsupported edge with the steel wheeled roller. The first pass shall cover about half the width of the unrolled strip; the second pass shall cover the remainder of the width and may overhang the edge of the material by not more than 100 mm. Where a steel wheeled roller is used, overlap each longitudinal pass on the edge of the previous pass by about 100 mm. If a self propelled pneumatic tyred multi wheeled roller is used, overlap each longitudinal pass on the previous run by a minimum of about 1 m.

Secondary Rolling: Perform secondary rolling as soon as possible after initial rolling with a self propelled pneumatic tyred roller. Roll longitudinally commencing on the lower side and proceed to the higher side of the spreader run. Each roller pass shall overlap the previous pass.

Final Rolling: Perform final rolling with a steel wheeled non vibrating roller to eliminate all roller marks.

Echelon Paving: When paving in echelon, leave the edge of the run common to adjacent spreaders unrolled for a width of 200 mm until the longitudinal joint has been constructed. Roll this strip together with the edge of the adjacent spreader run. Commence rolling before the temperature of the material along the edge of the first spreader run has fallen below 95°C.

Avoidance of Surface Defects: Do not leave rollers stationary on asphalt surfacing which is still warm. Keep roller wheels free from any build up. Immediately correct surface defects resulting from rolling.

Inaccessible Areas: Compact asphalt surfacing in areas inaccessible to the specified rollers using small vibrating rollers or hand operated mechanical compactors of types approved by the Superintendent.

Surface Finish: Provide a surface uniform in appearance and free from depressions in which water can lie.

8.4.6 JOINTS

Joins

General: Minimise the number of joints. Make joints that are well bonded and sealed and provide a smooth riding surface across the joint.

Transverse joints: Construct a transverse joint if the operation is stopped for more than 20 minutes or the pavement temperature falls below 90°C. Construct to a straight vertical face for the full depth of the layer, and offset in adjoining spreader runs and layer to layer by at least 2 m.

Longitudinal joints: Offset joints from layer to layer by at least 150 mm. Position longitudinal joints in the wearing course to coincide with the lane line.

Method of Construction

Longitudinal joints: Form exposed edges of each spreader run while hot to a straight line with a dense face inclined between vertical and 45° to the vertical for the full depth of the layer. Tamp the unsupported longitudinal edges of spread material to raise the level of the asphalt surfacing slightly to secure maximum edge compaction from subsequent rolling. Do not damage the unsupported longitudinal edge by rolling, except that, on 10 mm courses, the Superintendent may permit such an edge to be rolled over. Make good longitudinal edges which contain segregated or open textured material, or which have been damaged by traffic or rolling by cutting back to expose a new straight dense inclined face. Do not cut with a diamond saw.

Overlap the screed of the spreader on the adjacent run by 25 mm to 50 mm. At joints constructed against cold edges, the overlapping asphaltic concrete shall be removed to waste or crowded back at the joint but not

thrown on to the layer being spread. Treat joints as "cold" when the temperature of the first run has fallen below 60°C. Tack coat cold contact surfaces.

Transverse joints: Construct transverse joints at right angles to the direction of spreading and cut to a straight vertical face for the full depth of the layer. Unless otherwise approved, construct transverse joints if the spreading operation is stopped for 20 minutes, or if the pavement temperature falls below 90°C, whichever occurs sooner. Before placing asphalt surfacing to construct transverse joints, tack coat cold contact surfaces uniformly and thinly.

Abutting Structures

Place asphalt surfacing to match the level of abutting surfaces such as kerbs, gutters, edge strips, manholes, or adjoining pavement in the same manner as for longitudinal and transverse joints. Fill spaces left unfilled between the spreader run and abutting edges with sufficient material to the proper height before compaction.

Matched Junctions

General: If asphalt surfacing is to match an existing pavement, bridge deck, rail or other fixture, place the material to provide a smooth riding surface across the junction. Where necessary, remove sufficient of the existing pavement for this purpose. Where it is necessary to taper the thickness of a layer to provide a smooth riding junction, terminate the layer at a chase cut into the existing pavement about 20 mm deep and 400 mm wide. Where necessary, remove coarse particles from a layer of tapering thickness using hand raking.

Tack coat: Where the thickness of the layer tapers to less than twice the nominal size of the mix, tack coat the area upon which material of such thickness is to be placed uniformly at an application rate 0.50 - 0.75 L/m².

Surface Finish

Provide a surface uniform in appearance and free from depressions.

8.4.7 DEFECTIVE SURFACING

Defective Compaction

Asphalt surfacing rejected due to inadequate compaction is to be removed.

Defective Layer Thickness

Minimum criterion for retention:

- Mean thickness of the core sample in the lot: > the required layer thickness less 5 mm.

Rejection

Extent: Remove areas of rejected asphalt surfacing, including defective joints and finish, to the full depth of the layer, and replace with complying pavement.

Joints: Treat edges of remedial work as specified for cold joints.

8.5 COMPLETION

8.5.1 COMPLETION

Traffic on pavement

Do not allow traffic on pavements until they have cured sufficiently to support traffic without damage. Construction traffic should not be allowed on the pavement unless it is confirmed that the wheel loads for the vehicles are less than the design capacity of the pavement and the vehicles will not mark the pavement.

9.0 CONCRETE ROAD SURFACING (CONCRETE PAVEMENT)

9.1 GENERAL

9.1.1 GENERAL

Concrete Pavement includes:-

- Reinforcement fixing
- Joint installation
- Concrete supply, placement and testing
- Concrete curing

9.1.2 CROSS REFERENCES

General

Refer to the General Requirements section.

Related Sections

Refer to the following sections:

- General Requirements
- Site Preparation
- Earthworks
- Roadbase and Subbase
- Appendix A - Schedule of Inspection and Testing Requirements

Scope: This section specifies the requirements for concrete pavements including concrete base and lean mix concrete subbase.

9.1.3 APPLICATION OF THIS SPECIFICATION

This specification applies to work on privately owned property. Where works are on public property, or property which is to come under the control of a Statutory Authority (Council, State Road Authority etc), or where the works are to come under the control of a Statutory Authority (ie stormwater drainage in a future easement), works shall be carried out in accordance with the requirements of the relevant Statutory Authority.

9.1.4 STANDARDS

General

Materials and construction: To AS 3600, AS 4671.

Concrete: To AS 1379.

INTERPRETATION

Definitions

Standard: To AS 1348.1.

Absolute level tolerance: Maximum deviation from design levels.

Relative level tolerance: Maximum deviation from a 3 m straightedge laid on the surface.

RMS: Roads and Maritime Services.

9.2 QUALITY

9.2.1 INSPECTION

Witness Points

Give sufficient notice so that inspection may be made at the following stages:

- Materials or areas of work ready for tests.
- Automatic level control devices in place.
- Commencement of concrete placing.

Hold Points

- Concrete formwork, reinforcement and dowels in position.
- Proof roll inspection and test certificates on underlying work (subgrade, subbase etc).

9.2.2 TESTS

General

Refer to General Requirements Section for general testing and quality assurance requirements.

Concrete Testing: Sample, test and assess concrete for compliance with the specified quality parameters to AS 1379 Section 5 and Appendix B, including the requirements for project assessment except frequency of testing shall be as set out below.

Table 9.2.2-30: Compressive Tests

NUMBERS OF BATCHES PER DAY	NUMBER OF SAMPLES
1	1
2 TO 5	2
6 TO 10	3
11 TO 20	4
For each additional 10 batches, one additional sample shall be taken	

Drying Shrinkage - Drying shrinkage - to relevant Australian Standards Maximum permissible drying shrinkage measured as a percentage change after 56 days (to AS 1012.13).

- Duration of air drying: 56 days
- Limits: Maximum strain: Refer Section 3.2, Table 1
- Sampling frequency: Prior to supply then every 500 m3 for each type of concrete.
- Number of specimens for sample: 3
- Acceptance criterion: Average strain of three specimens from each sample shall not exceed the required value.

Curing Compound - The Contractor shall allow for the cost of a minimum of three random samples to be tested for water retention in accordance with AS 3799. Samples shall be taken from the material delivered to site during the period of the works as directed by the Superintendent and shall be tested by an approved NATA registered laboratory.

Trial Mix

Prepare a trial mix of the proposed mix design, to AS 1012.2. Test the trial mix for the following properties:

- Properties related to consistence: To AS 1012.3.
- Air content: To AS 1012.4.
- Mass per unit volume: To AS 1012.5.
- Compressive strength: To AS 1012.9. Prepare at least 8 specimens to AS 1012.8. Test at least 2 specimens after 7 days and the remainder after 28 days.
- Flexural strength: To AS 1012.11. Prepare at least 8 specimens to AS 1012.8. Test at least 2 specimens after 7 days and the remainder after 28 days.

- Drying Shrinkage: as specified above.

Discharge Slump Tests

General: Carry out slump tests at approximately one quarter and three quarter points of the load during discharge.

Maximum slump variation: 25 mm.

Standard: To AS 1012.3.

Flexural Strength Assessment Of Concrete

Standard: To AS 1012.8 and AS 1012.11.

Dowels

Pre-embedment testing: Fix and test dowels before embedment by subjecting either end to a load of 80 kg in any direction normal to the bar.

9.2.3 SAMPLES

General

Submit samples of the following at least one month before use in the works:

- Granular materials: One 20 kg sample of concrete aggregate.

Identification

Attach a tag to each sample showing relevant information including description, source and nominal size of material.

9.2.4 CONTRACTOR'S SUBMISSIONS

Tests

Compliance assessment: If compliance assessment tests are to be carried out by an independent testing authority, have the authority submit 3 copies of each test result.

Certificate of compliance: If a certificate of compliance is acceptable as an alternative to testing a manufactured material, submit the manufacturer's certificate together with the results of recent tests undertaken by the manufacturer, showing compliance with test criteria.

Dissemination of production information: Submit copies of the reports.

Curing compounds: If it is proposed to use a liquid membrane-forming curing compound submit certified test results for water retention to AS 3799 Appendix B.

Materials

Reinforcement: Submit the manufacturer's certificate of compliance with AS 4671, or submit test certificates from an independent testing authority.

Execution

General: Submit proposals for the methods and equipment to be used for the roadworks, including the following:

- Staging of the work, access and traffic control methods.
- Disposal of surface water, control of erosion, contamination and sedimentation of the site, surrounding areas and drainage systems.
- Methods and equipment for each operation.
- Sources of materials.
- Material stockpiles.
- Methods of concrete manufacture.
- Temperature control, curing and protection methods for concrete.

Trial mix design report: Six weeks before commencing production, submit a report for each mix design containing the information required in AS 1012.2, the individual and combined aggregate particle size distribution, and the records and reports for the tests.

Mix design variation: If a variation is proposed, submit a further mix design report.

Joint sealants: Submit the proposed installation method and sealant performance.

Concrete placing: Submit proposals for size of the area to be placed and the spacing of planned construction joints before placement commences.

Slip placing: If it is intended to construct pavement by slip forming, submit evidence of the availability of suitable equipment and the contractor's ability to produce a pavement complying with requirements.

Curing: Submit details of the proposed curing methods.

Repair materials: Submit proposals for epoxy resin/grout and elastomeric sealant.

Crack repair: Drill 100 mm diameter core holes along unplanned cracks in the finished pavement, and submit the cores for examination.

Formed weakened plant joints: Before concrete placing submit details of the proposed equipment.

Records of measurement

Submit certified records of work performed for items required to be measured for payment.

9.3 MATERIALS

9.3.1 REINFORCEMENT

Standard: To AS 3600 Cl19.2, AS 4671.

Identification

Supply reinforcement which is readily identifiable as to grade and origin.

Dowels

Standard: To AS 4671, Grade 250R.

General: Each dowel in one piece, straight, cut accurately to length with ends square and free from burrs. Apply 2 coats of bitumen emulsion to half the dowel, including the end.

Dowel end tolerances: Ensure that deformation of an end from its true circular shape does not exceed 1 mm nor extend more than 1 mm from the end.

Protective Coated Reinforcement

Extent: If an element is specified to contain protective coated reinforcement, provide the same coating type to all that element's reinforcement and embedded ferrous metal items, including tie wires, stools, spacers, stirrups, plates and ferrules, and protect other embedded metals by a suitable coating.

Galvanizing: To AS 1650.

Minimum coating mass:

For wire: Type A.

- For reinforcement: 600 g/m².
- Preparation: Pickling to AS 1627.5.

Passivation: After galvanizing, passivate the coating by immersion in a bath of 0.2% sodium dichromate solution.

Damage: If damage occurs to the coating, either

- replace the damaged reinforcement; or
- if approved, repair to AS 1650 Appendix F.

Unencased reinforcement: Provide protection for "starter bars" and the like left projecting from cast concrete for future additions.

9.3.2 CONCRETE MATERIALS

Aggregate (Coarse and Fine)

Standard: To AS 2758.1.

Aggregate size (maximum):

- For fixed form placement: 40 mm.
- For slip form placement: A size compatible with the paving machine.

Washing: Wash aggregate as necessary or as directed to achieve requirements for soluble salt content or concrete drying shrinkage.

Concrete mix design

Requirement: Refer to Table 9.3.2-31 below.

Standard: To AS 1379.

Restrictions on chemical content: To AS 3600 clause 4.9.

Bagged cement: Do not use bagged cement more than 6 months old.

Material Requirements: Use materials complying with Australian Standards. Do not use breccia or dolerite in concrete mix and limit fly ash content to 20% by weight of cementitious content.

Table 9.3.2-31: Mix design requirements

			External Concrete Pavements	Lean Mix Concrete Subbase
Material	Cement Type		GP	GPor GB
Properties	Max Fly Ash (% of Cement Content)		20	50
	Min Content of Cementitious Material		310	250
	Max. W/C		0.5	-
	Strength (MPa)	Compressive - F'c 28	32	5 (max. 15)
		Flexural - Ft 28	4.4	-
	Initial Slump (mm)		65 ± 15	60 + 20
	Aggregate		Max. Nominal Coarse Size 20 mm.	Max. Nominal Coarse Size 40 mm
	Shrinkage limits		600 micro strain limit at 56 days	450 micro strain at 21 days

9.3.3 CONCRETE

Mix Design Variation

Do not vary the design mix, method of production or source of supply of constituents.

Ready Mixed Concrete

The concrete supplier is to provide the concrete mix design to the Superintendent for approval prior to manufacture.

Standard: To AS 1379, by the batch production process. Deliver in agitating trucks.

Elapsed delivery time: Concrete is liable to be rejected if the elapsed time between the wetting of the mix and the discharge of the mix at the site exceeds the criteria in the **Elapsed delivery timetable**.

Table 9.3.3-32: Elapsed delivery timetable

Concrete temperature at time of discharge (°C)	Maximum elapsed time (hours)
Less than 24	2.00
24 - 27	1.50
27 - 30	1.00
More than 30	0.75

Delivery docket: For each batch, supply a docket listing the information required by AS 1379 clause 1.7.3, and the following additional information:

The concrete element or part of the works for which the concrete was ordered.

The total volume of water added at the plant.

Do not add water or any other material to the concrete after leaving the batch plant if not detailed in mix design.

Site Mixed Supply

Manufacture: Mix concrete in an approved plant located on the construction site and complying with the relevant requirements of AS 1379.

Emergencies: Mixing by hand is not permitted.

Alternative supply: Ensure an approved alternative source of supply is readily available at the time of each concrete pour.

Accuracy of batching (% by mass)

Cement: ± 1 .

Aggregates: ± 2 .

Water: ± 1 .

Admixture: ± 3 .

Admixture

Introduce in solution in a portion of the mixing water. Ensure a uniform distribution of the admixture in the batch within the mixing period.

Mixing

Mixing time: Measure the mixing time after solid materials are in the mixer, provided that mixing water is introduced before a quarter of the mixing time has elapsed. Increase mixing time if necessary to obtain the required uniformity and consistence of concrete. Do not overmix such that additions of water are needed.

Uniformity: Differences specified in AS 1379 apply to samples taken from 3 locations in a batch. Do not exceed 2% difference in moisture content of the 3 samples.

Transport

General: Transport and discharge the concrete without segregation.

9.3.4 JOINTING MATERIALS

Types: Use jointing materials, including sealants, mastics, primers, gaskets, compressible fillers, and joint covers, as recommended by the material manufacturers for the location and type of joint, compatible when used together, and non-staining to concrete in visible locations.

The Contractor is to submit the proposed product for review.

Foamed materials (compressible fillers): Closed-cell or impregnated types which do not absorb water.

Bond breaking: Use back-up materials for sealants, including backing rods, which do not adhere to the sealant. They may be faced with a non-adhering material.

Compressible Filler: Compressible filler, thickness as designated on drawings. To comply with RMS QA Specification 3204.

Sealants: Sealants shall be Dow Corning 888 Silicone Joint Sealant unless otherwise specified on the drawings.

Self-expanding cork joint filler

General: Preformed self-expanding cork in factory bonded lengths, with taped top surface. To comply with RMS QA Specification 3204.

Length: Equal to the paving lane width for transverse joints, or 4 m for longitudinal joints.

Properties

Table 9.3.4-33: Cork joint filler properties table

Property	Requirement
Accelerated weathering:	No evidence of disintegration

Resistance to test fuel (48 hours' immersion in test fuel):	No evidence of; - dislodgment of cork particles by test treatment - dislodgment of cork particles when the faces of the material are rubbed with fingers - loss of resilience i.e. may be broken into pieces more easily
Dimension tolerance (unexpanded state):	Width: ± 1.5 mm Depth: ± 3.0 mm

Table 9.3.4-34: Cork joint filler properties schedule

Property	Requirement	
	Minimum	Maximum
Density (kg/m ³)	335	-
Lateral restraining pressure in water at 27°C $\pm$ 1°C (kPa): - After 6 hours' immersion	-	60
- After 24 hours' immersion	-	180
Lateral free swell in water at 27°C $\pm$ 1°C (% of initial width): - After 24 hours' immersion	25	-
- After 168 hours' immersion	30	-
Longitudinal free swell in water at 27°C $\pm$ 1°C after 168 hours' immersion (% of initial length)	-	2
Longitudinal shrinkage on drying for 12 days at 40°C - 50°C after 168 hours' immersion in water (% of initial length)	-	2

Property	Requirement	
	Minimum	Maximum
Lateral expansion in boiling water after 1 hour's immersion (expanded width as % of initial width)	140	-
Compression and recovery: - Pressure required to compress to 50% of uncompressed width (kPa)	350	10,500
- Recovery after 1 hour following compression to 50% of uncompressed width (recovered width as % of uncompressed width)	90	-
Extrusion of free edge following compression to 50% of uncompressed width with three edges restrained (mm)	-	6

Preformed elastomeric seals

Standard: To ASTM D2628.

General: Vertical sidewalls, marked durably on the top surface every 300 mm $\pm$ 2 mm at the time of manufacture.

Depth: Adequate to retain the seal in the joint, but not greater than 50 mm when the seal is compressed laterally to 50% deflection.

Lubricant adhesive: A compound of the same base polymer as the seal, blended with suitable volatile solvents of viscosity suitable to the installation equipment, with the following properties:

- Average net mass per litre: 0.784 kg $\pm$ 5%.
- Film tensile strength: 15 MPa minimum.
- Elongation before breaking: 750% minimum.

Shelf life: Show date of manufacture on the container. Use within nine months of manufacture.

Properties testing:

Table 9.3.4-35: Force deflection requirements table

Nominal width of seal	Deflection (% of nominal width)	Required force (N/m)
10 mm and smaller	20	350 minimums
	50	2,100 maximums
12 mm and larger	20	350 minimums
	50	2,100 maximums
After heat aging: The same specimens heat aged in an oven for 70 hrs at 100°C under 50% deflection:		
10 mm and smaller	20	175 minimums
	50	2,100 maximums
12 mm and larger	20	260 minimums
	50	2,100 maximums

Inert Form Strip

Type: Fibreboard or polystyrene foam strip consisting of two parts:

- Removable upper section equal in depth to the preformed elastomeric seal.
- Permanent lower section.

Use: Use only with preformed elastomeric seals. After forming, remove the upper section of the inert form strip and insert the preformed elastomeric seal.

9.4 EXECUTION

9.4.1 TOLERANCES

Finished Levels

General: Provide a finished surface which is free draining and evenly graded between level points.

Edges abutting gutters: Within ± 5 mm of the level of the actual gutter edge.

Rigid pavement surface:

- Absolute tolerance: ± 10 mm.
- Relative tolerance: 5 mm.

Thickness

The following tolerances apply to variations in the compacted layer thickness from the specified thickness:

- Concrete surface course: + unspecified, - 5 mm.

Joint Locations (Rigid Pavement)

Maximum horizontal deviation from required alignment: 15 mm.

9.4.2 FORMWORK

Fixed Formwork

Requirement: Design and construct formwork so that concrete, when cast in forms, will have the dimension, shape, location and surface finish required by the Contract.

Tolerances on position:

- Absolute level tolerance: ± 5 mm (maximum departure of top surface from the required level).
- Relative level tolerance: 5 mm (maximum departure of top surface from a 3 m straightedge).
- Horizontal tolerance: ± 10 mm (maximum departure of face from a plane surface).
- Verticality: 3 mm departure from vertical.

Release agent: Before placing reinforcement, apply a release agent compatible with the contact surfaces, to the interior of the formwork, except where the concrete is to receive an applied finish for which there is no compatible release agent. Where necessary clean the reinforcement to remove all traces of release agent.

Re-use: Clean and recoat the forms each time before placing concrete.

Keyways

Form the keyways of keyed construction joints using timber dimensioned accurately in accordance with the drawings. Do not reuse timber keyway forms.

Stripping time

To AS 3600 Clause 19.6.2 where these requirements are more stringent than the relevant requirements of AS 3610.

9.4.3 FIXING REINFORCEMENT

Standard: To AS 3600 clause 19.2.

All fabric reinforcement to be a minimum of SL92 unless noted otherwise.

Splicing: As shown on drawings. Where not specified on drawings to AS 3600 clause 13.2.

Concrete cover: As shown on drawings. Where not specified on drawings to AS 3600 clause 4.10 or AS 3735 clause 4.4 as applicable.

Requirement: Supply and fix reinforcement, including the necessary tie wires, support chairs and spacers.

Welding reinforcement: Obtain permission before welding. Do not weld reinforcement which does not comply with AS 4671. Do not weld reinforcement within 75 mm of a section which has been affected by bending or re-bending.

Starter bars: Prior to the concrete placing, all starter bars shall be positioned and secured by the Contractor, to ensure correct location and alignment of bars. Costs associated to redesign and/or relocate starter bars that have not been positioned and secured adequately shall be at the Contractor's expense.

Fixing requirements: Secure the reinforcement against displacement by tying at intersections with annealed iron wire ties not smaller than 1.25 mm diameter, or by approved clips. Bend the ends of wire ties away from nearby faces of forms so that the ties do not project into the concrete cover.

Mats: For bar reinforcement in the form of a mat, secure each bar at alternate intersections, and at other points as required.

Beams: Tie ligatures to bars in each corner of each ligature. Fix other longitudinal bars to ligatures at not more than 1000 mm intervals.

Bundled bars: Tie bundled bars together so that the bars are in closest possible contact. Use tie wire not less than 2.5 mm diameter at centres not more than 24 times the diameter of the smallest bar in the bundle.

Provision for concrete placement: If spacing or cover of reinforcement does not comply with AS 3600 clauses 8.1.7 and 4.10.2 respectively notify the Superintendent and obtain instructions prior to placing concrete.

Reinforcement Supports

Support types: Use purpose-made concrete, metal or plastic supports. For exposure classification A1, provide a protective coating to ferrous metal which extends to the surface of the concrete. For exposure classifications more severe than A1 use plastic supports of adequate strength and of a shape appropriate to the location, or concrete supports of the same concrete quality as the concrete element.

Supports over membranes: Prevent damage to waterproofing membranes or vapour barriers. Place a metal or plastic plate under each support to prevent puncturing.

Support spacing: Not more than 60 bar diameters for bars and 750 mm for fabric.

Dowels and Tie Bars

Location: Across joints at the required spacings and vertical locations correctly aligned parallel to the finished pavement surface and perpendicular to the joint in plan (except where the joint is not perpendicular to the long axis of the concrete pavement, in which case the engineer's advice shall be sought). If the construction methods require alterations to the designed spacing, use a closer spacing with additional dowels or tie bars.

Placing in fixed-form paving: Use the bonded-in-place method. Embed the unpainted half of the dowels in the slab placed first. Dowels to be securely fixed in place prior to placing concrete (refer Tests subsection).

Placing in longitudinal joints in slip-form paving. Place using machine or vibrate into the plastic concrete using a suitable template.

Movement: Do not distort or displace beyond the alignment tolerances under testing or during construction. Do not remove and replace dowels in pre-formed holes.

Dowel Placement Tolerances

Horizontal and vertical location: $\pm$ half the diameter of the dowel.

Alignment: Locate bars in the joint within 2 mm in 300 mm and adjacent bars which do not differ in alignment by more than 2 mm in 300 mm.

9.5 PLACING AND CURING

9.5.1 CONCRETE PLACING

Standard: To AS 3600 Clause 19.1.3 and 19.1.4.

Preparation: Moisten the subbase sufficiently in advance of placing to ensure a firm, uniformly moist surface at the time of placing. Remove loose sand and other debris from the surface of the subbase. Do not operate construction equipment on the prepared subbase after approval to place concrete has been given.

A debonding treatment should be applied to the surface of the subbase prior to installing reinforcing. The debonding treatment for cement treated subbase is described in the Roadbase and Subbase section. Lean mix concrete subbase should be debonded with wax emulsion curing compound applied at a rate of 0.2L/m² (in addition to the curing treatment). Wax emulsion curing compound to comply with AS 3799 Type 2 Class A.

Approval: The size of the area to be placed and the spacing of planned construction joints shall be subject to approval before placement commences.

Temperature Limits: The temperature of the concrete when placed in the forms shall be not less than 10°C and not more than 32°C.

Placing Records: Quality Assurance documentation shall include a record of each concrete pour including:

- date;
- the portion of work;
- specified grade and source of concrete;
- delivery dockets for each batch;
- the time at which each batch is completely discharged;
- slump measurements;
- volume placed;
- details of compressive strength samples (i.e. cylinder numbers etc).

Rain: Concrete exposed to rain before it has set, including during mixing, transport or placing shall be rejected.

9.5.2 COLD WEATHER PLACING

Requirement: Maintain the temperature of the freshly mixed concrete within the limits shown in the **Cold weather placing table**. "Outdoor" air temperature applies to the air temperature at the time of mixing and to the predicted or likely air temperature at any time during the subsequent 48 hours.

Table 9.5.2-36: Cold weather placing table

Outdoor air temperature	Temperature of concrete	
	Minimum	Maximum
Not less than 5°C	10°C	32°C
Less than 5°C	18°C	32°C

Additives: Do not use calcium chloride, salts, chemicals or other material in the mix to lower the freezing point of the concrete.

Frozen materials: Do not allow frozen materials or materials containing ice to enter the mixer, and keep free of frost and ice any forms, materials, subbase and equipment coming in contact with the concrete.

High early strength cement: In severe weather conditions high early strength cement may be used, subject to approval, to enable the concrete to develop sufficient strength to permit formwork removal within the specified time, but not as a substitute for the heating of materials or for adequate protection of placed concrete against low temperatures. Do not use high alumina cement.

Heating: Heat the concrete materials, other than cement, to a temperature not greater than the minimum necessary to ensure that the temperature of the placed concrete is within the limits specified in this clause. The temperature of water shall be not greater than 60°C when it is placed in the mixer.

9.5.3 HOT WEATHER PLACING

Requirement: The provisions of this clause apply to concreting when the surrounding shade outdoor temperature is greater than 32°C.

Mixing: Do not mix concrete when the outdoor shade temperature on the site exceeds 38°C, unless otherwise approved and then only subject to such conditions as may be imposed.

Handling: Take precautions to prevent premature stiffening of the fresh mix and to reduce water absorption and evaporation losses. Mix, transport, place and compact the concrete as rapidly as possible.

Placing: Before and during placing maintain the formwork and reinforcement at a temperature not greater than 32°C by protection, cold water spraying, or other effective means. When placed in the forms, the temperature of the concrete shall not exceed the criteria in the **Hot weather placing table**.

Table 9.5.3-37: Hot weather placing table

Concrete element	Temperature limit
Normal concrete in footings, beams, columns, walls and slabs	32°C
Concrete in large mass concrete sections; or concrete of strength 40 MPa or greater, in sections exceeding 600 mm in thickness	27°C

Temperature control methods: Acceptable methods of maintaining the specified temperature of the placed concrete include

- using chilled mixing water;
- spraying the coarse aggregate with cold water;
- covering the container in which the concrete is transported to the forms;
- cooling the concrete by liquid nitrogen injection prior to placing; and
- a combination of these methods.

9.5.4 PLACING IN FIXED FORMS

Spreading: Place concrete uniformly over the width of the slab or lane and so that the face is generally vertical and normal to the direction of placing. Hand spread concrete with shovels, not rakes. Do not use vibration to move concrete. Do not allow concrete to free fall more than 1500 mm. Do not allow cold joints to form within a pour. Place concrete such that each section is blended into the previously placed concrete by the compaction process.

Vibration: Compact concrete by internal mechanical vibration of sufficient amplitude to produce noticeable vibrations at 300 mm radius, using vibrators capable of transmitting at least 5000 impulses per minute when under load. Insert vibrators into the concrete to the depth which will provide the best compaction, but not deeper than 50 mm above the surface of the subbase, and for a duration sufficient to produce satisfactory compaction, but not longer than 30 seconds in any one location. Do not allow vibrators to come in contact with partially hardened concrete or the reinforcement embedded in it.

Vibrating beam type vibrators of adequate power to compact the whole depth of the concrete may be used. Supplementary immersion type vibrators should be used at slab edges, thickening etc.

Vibrators: There shall be one vibrator in full working order on the site for each 12 cubic metres or part thereof of concrete placed per hour.

Finishing: Immediately after placement, spreading and compaction of the plastic concrete, start finishing operations, comprising transverse finishing, longitudinal straightedge finishing and broom finishing, in that order. Complete as soon as possible, and prior to the concrete attaining initial set.

Transverse finishing: By mechanical vibrating screed equipped with handles and having twin beams at least 300 mm longer than the width of lane being finished, and a screed edge at least 100 mm wide. Alternatively, a counter rotating tube screed of suitable design may be used. Make at least two passes with the screed over each section of pavement.

Straightedge Finishing: After the transverse finishing is completed, but while the concrete is still plastic, eliminate minor irregularities and score marks in the pavement surface, particularly across formed contraction joints, by means of hand-operated long handled aluminium floats.

Broom Finishing: When most of the water glaze or sheen has disappeared and before the concrete becomes non-plastic, texture the whole surface of the pavement at right angles to the main traffic direction by means of coarse brooms at least 500 mm wide with bristles of nylon or flexible wire. Wash brooms regularly to remove slurry.

Finished Pavement Surface: Provide a surface uniform in appearance and free from depressions in which water can lie.

Surface Texture: Average texture depth: 2.0 - 2.5 mm.

9.5.5 SLIP FORM PLACEMENT

Slip Forming: Approval to construct pavement by slip forming shall be subject to the availability of suitable equipment and the Contractor's demonstrated ability to produce a pavement complying with the requirements of the Contract.

Spreading: Place the plastic concrete in a uniform layer over the width of the slab being placed. Prevent damage to the existing surface and edge of previously constructed concrete.

Vibration: By suitable internal vibrators or surface type equipment with vibrating beam or beams of adequate power to fully compact the whole depth of the concrete.

Slab edges: Use supplementary immersion type vibrators adjacent to slab edges if necessary to ensure that the sides of slabs present a uniform dense appearance free from honeycombing or areas deficient in fines over at least 95% of the surface.

Finishing: Produce a surface equal to that specified in PLACING IN FIXED FORMS.

9.5.6 CURING

Standard: To AS 3600 Clause 19.1.5.

Generally

Protect fresh concrete from premature drying and from excessively hot or cold temperatures. Maintain the concrete at a reasonably constant temperature with minimum moisture loss for the curing period.

Temperature

Maintain the concrete at a temperature $> 5^{\circ}\text{C}$ for at least 7 days.

Curing methods

Curing compound method: Spray the entire surface including edges using a mechanical sprayer, at a uniform application rate of at least 0.35 L/m^2 .

Respray defective areas within 30 minutes. Respray within 3 hours after heavy rain. Apply as a continuous coating without visible breaks or pinholes.

- Curing compounds: To AS 3799, Type 2, white pigmented or containing aluminium reflective pigments.

Covering sheet method: Immediately after finishing operations cover concrete using damp hessian or cotton mats overlapped at least 150 mm and anchored against displacement by wind or other interference. Keep the mats continuously damp until covered by the covering sheet material. Repair tears and the like immediately.

- Covering sheet materials: White opaque polyethylene film, or white burlap-polyethylene sheet, or equivalent material to ASTM C171.
- Joint sawing: Sheet materials may be removed for the minimum distance and period to permit joint sawing, provided the concrete is kept moist by other means.

Moist curing method: Immediately after finishing operations keep the concrete surface continuously damp by spraying constantly with water, fog, or mist, using suitable spraying equipment.

Minimum curing time 7 days.

Lean Mix Concrete Subbase

Wax emulsion curing compound complying with AS 3799 Type 2 Class A applied at a rate of 0.2 L/m^2 using suitable spray equipment.

9.5.7 PROTECTION

General

Concrete pavement: Keep traffic, including construction plant, off the pavement entirely during curing, and until the pavement is at least 14 days old. Protect concrete from damage from any cause including construction

traffic, mortar splashes and stains, timber stains, rust stains, chemical attack additives, curing compounds, rain and running water.

Note that the pavement is designed for the wheel loads specified by the RMS for “general access” vehicles, and construction loadings on pavements must not exceed these limits. In the case of concrete pavements less than 160 mm thickness, wheel loadings must not exceed 1 tonne (2 tonne per axle). This capacity of the pavement for loading from point loads or solid wheeled vehicles must be checked at the Contractor’s expense.

9.5.8 FINISHING

General

Immediately after placement and spreading and compaction of the plastic concrete, start finishing operations, comprising transverse finishing, longitudinal straightedge finishing and broom finishing, in that order. Complete as soon as possible, and before the concrete attains initial set.

Transverse Finishing

Use either

- mechanical vibrating screed equipped with handles and twin beams at least 300 mm longer than the width of lane being finished, and a screed edge at least 100 mm wide; or
- a counter rotating tube screed of suitable design.

Passes

Make at least two passes with the screed over each section of pavement.

Straightedge Finishing

After the transverse finishing is completed, but while the concrete is still plastic, eliminate minor irregularities and score marks in the pavement surface, particularly across formed contraction joints, using hand-operated long handled aluminium floats.

Free Edge Finishing

All free edges to be finished with a steel trowel to eliminate broken edges and the sides of slabs present a clean finished appearance.

9.5.9 DEFECTIVE CONCRETE

General

Cracked or otherwise defective concrete can only be repaired or retained when approved by the Contract Administrator. Proposed repair methods must be approved by the Contract Administrator. If directed by the Contract Administrator, remove and replace defective concrete.

High Areas

Method: Reduce by rubbing or grinding, or both, as follows:

- Concrete < 36 hours old: Rub using carborundum brick and water. Discontinue rubbing as soon as contact with the coarse aggregate is made, and reduce further, if necessary, by grinding the concrete after it hardens.

- Hardened concrete (>14 days old): Machine grind.
- Retexturing: Retexture areas which have been surface ground, by cutting grooves 5 mm wide x 5 mm deep, at 25 mm centres.

Upper limit of surface ground areas: 10% of the area of a single slab, or 3% of the total surface area of the concrete pavement. Surface grinding will only be permitted where the minimum cover to the reinforcement can be maintained.

Thickness Deficiencies

Retention: Thickness deficiency exceeding the required tolerance must not exceed 10 mm.

9.6 REINSTATING ADJACENT SURFACES

General

Existing pavement: Reinstate surfaces next to new pavements and associated elements. Where an existing flexible road pavement has been disturbed, trim it back to a straight and undisturbed edge 250 - 300 mm from and parallel to the new concrete for the full depth of the slab. Backfill with asphalt rammed solid, using suitable rammers.

9.7 JOINTS

9.7.1 CONCRETE JOINTS

Generally

All pavements to have a maximum of 5 m joint spacing unless noted otherwise. Expansion joints to be located at a maximum of 30 m spacing unless shown otherwise on drawings. Construct expansion, contraction and construction joints straight and plumb in the locations and of the types shown on the drawings. Make transverse joints normal to longitudinal joints. Extend transverse expansion and contraction joints continuously from edge to edge of the pavement through interconnected slabs. In addition to this specification, refer also to the requirements of Technical Note TN47 - Joints in Concrete Road Pavements by the Cement and Concrete Association of Australia.

Transverse Construction Joints

Planned location: Terminate each day's placing operation at a transverse construction joint located to coincide with a planned expansion joint.

Unplanned joints: If placement is interrupted for 30 minutes or longer, form a tied transverse construction joint within the middle third of the distance between planned joints but no closer than 1.5 metres to the nearest planned joint. If necessary, remove placed concrete back to the required location.

Joint preparation: Before fresh concrete is placed at a construction joint, roughen and clean the hardened concrete surface of the joint, so that all loose or soft material, free water, foreign matter and laitance is removed. Just prior to placement, use wet to dry epoxy on the hardened concrete surface.

Finish at construction joints: Butt joint the surfaces of adjoining pours. Make the joint straight and true and free from impermissible blemishes relevant to its surface finish class.

Expansion joints abutting adjacent structures: Unless shown otherwise on the drawings provide 10 mm thick bitumen impregnated fibre board wherever the pavement abuts adjacent structures.

9.7.2 FORMED JOINTS

Full Depth Joints

Form the edge of the concrete placed first to provide a smooth, vertical face. After stripping and cleaning fix the joint filler with a suitable waterproof adhesive to the face of the slab, and place the adjoining concrete after the adhesive has set.

Keyed Joints

Refer Clause 4.2, keyways.

9.7.3 SAWN JOINTS

Weakened Plane Joints

General: Saw the hardened concrete to at least one quarter slab depth, and to a uniform width in the range of 3 - 5 mm.

Timing: Concrete saw cutting for pavement contraction joints shall be done as soon as the concrete sawing causes only slight edge ravelling. If no edge ravelling (straight corner edge) occurs, it may be too late to prevent uncontrolled cracking. Sawing too early will result in dislodgment of coarse aggregates or excessive ravelling of joint edges.

Sawing shall be performed by experienced personnel capable of determining the correct time to saw and the depth of cut allowing for blade wear.

Pavements will be liable for rejection if uncontrolled cracking occurs prior to or during saw cutting or excessive ravelling or aggregate dislodgment at joints occurs.

Sequence: Sawcut every second joint and then return backwards cutting the intermediate joints.

Cracking: If the concrete has already cracked near the location chosen for a joint, do not saw a joint in that location. If a crack develops ahead of the saw cut, discontinue sawing. If uncontrolled cracking occurs, suspend concrete placing.

Standby machines: Provide one standby sawing machine for each machine planned to be used.

Cleaning and protection: Immediately after each joint is sawn, flush the saw cut and adjacent concrete surface using water, until the waste from sawing is removed from the joint. Temporarily caulk the joint using plastic or rubber tubing, or a suitable "Tee" shaped extrusion. Leave the caulking in place until grooving and sealing commences.

Rebated Groove Joints

General: Saw straight, parallel sided grooves for joint seals on top of and centred on the sawn weakened plane joints.

Timing: Commence sawing after the curing period has ended, immediately before joint sealing. Saw during daylight hours and when the concrete temperature is at least 10°C.

Cracking: If cracks occur beneath initial saw cuts, increase the width of the groove by an amount equal to the width of the crack.

9.7.4 DOWELLED AND TIED JOINTS

Dowelled Joints

Formed or sawn joints reinforced with dowels and sealed.

Tied Joints

Formed or sawn joints reinforced with tie bars. Omit grooves and sealing unless shown on the drawings.

9.7.5 JOINT SEALING

General: Install sealants strictly in accordance with the Manufacturer's instructions. Where the Manufacturer's instructions contradict the drawings or specifications obtain advice.

Joint Preparation

General: The concrete at the sides of the joint must be sound, well compacted and cut to a smooth, even edge. Immediately before installation of the sealer ensure that the joint space is dry, clean and free from loose material. Remove laitance, curing compound and protrusions of hardened concrete from the sides and upper edges of the joint.

Formed full depth and rebated groove joints: After form stripping and when the concrete has cured sufficiently, clean formed arises using a rotary saw.

Sawn joints: Remove loosened material from the joint using compressed air or high pressure water jet.

Installing Self Expanding Cork Seals

Jointing: Join the factory-bound lengths of seal together by skiving and gluing with suitable waterproof adhesive. Make the seal continuous for the full length or width of the slab, in longitudinal and transverse joints respectively.

Ambient conditions: Install the seal only when the concrete in the vicinity of the joints is surface dry and the surface temperature in the range 20 - 30°C. Protect the seal from moisture before installation. Do not pre-soak.

Seal location: Install seals so that the top surface is flush with, or ± 5 mm below, the finished concrete surface.

Formed joints:

- **Tape removal:** Do not remove tape from the top surface of the seal until adjoining concrete has attained final set.
- **Full depth and rebated groove joints:** Fix the seal to the edge of the hardened concrete with a suitable waterproof adhesive and place the adjoining concrete after the adhesive has set.
- **Weakened plane joints:** Install the seal simultaneously with forming the crack inducing groove.

Sawn rebated groove joints: Coat one side of the seal with a suitable waterproof adhesive. Ease the seal, as a loose fit, into the joint and use gentle side pressure to adhere the coated side of the seal to the joint face. Approximately 24 - 48 hours after installation, remove the tape from the top surface of the seal and water thoroughly. Repeat watering for 5 days or until the cork has expanded to fill the groove completely.

Installing Preformed Elastomeric Seals

Apply a bead of lubricant adhesive to the top edge of each side of the joint, then install the seal by easing it into the joint, using a suitable roller, to finish 4 - 6 mm below the finished concrete surface.

9.8 COMPLETION

9.8.1 COMPLETION

Traffic on Pavement

Do not allow traffic on pavement until concrete is sufficiently cured to support traffic without damage. Refer also to Clause 5.7 – Protection.

10.0 SPRAY SEAL ROAD SURFACING

10.1 GENERAL

10.1.1 CROSS REFERENCES

General

Refer to the General Requirements section.

Related Sections

Refer to the following sections:

- General Requirements
- Site Preparation
- Earthwork
- Roadbase and Subbase
- Appendix A - Schedule of Inspection and Testing Requirements

10.1.2 APPLICATION OF THIS SPECIFICATION

This specification applies to work on privately owned property. Where works are on public property, or property which is to come under the control of a Statutory Authority (Council, State Road Authority etc), or where the works are to come under the control of a Statutory Authority (ie stormwater drainage in a future easement), works shall be carried out in accordance with the requirements of the relevant Statutory Authority.

10.1.3 INTERPRETATION

Definitions

Standard: To AS 1348.1.

Absolute level tolerance: Maximum deviation from design levels.

Relative level tolerance: Maximum deviation from a 3 m straightedge laid on the surface.

RMS: Roads and Maritime Services.

10.2 QUALITY

10.2.1 INSPECTION

General

Refer also to General Requirements section and Appendix A.

Witness Points

Give sufficient notice so that inspection may be made at the following stages:

- Materials or areas of work ready for tests.
- Commencement of bituminous spraying.

Hold Points

- Proof roll inspection and test certification on underlying work (subgrade, basecourse etc).

10.2.2 TESTS

General

Refer also to General Requirements section and Appendix A.

Process Control Tests

Perform tests of the type and frequency necessary to adequately control the materials and processes used in the construction of the works. Tests described in the Process control schedule are the minimum requirement.

Table 10.2.2-38: Process control schedule

Type Of Test	Test Frequency	Test Method
Record Of Work	All Work	Bituminous Surfacing Records

Table 10.2.2-39: Compliance assessment schedule

Type of test	Test frequency	Test method
Aggregate precoating agent	Each lot	RMS Test Methods T230 and T238
Material properties of primer, binder and bitumen	Each lot	AS 2157, AS 2008
Cover Aggregate	Each lot	AS 2758.2 (refer materials subsection)

Bituminous surfacing records

Submit certified records of the work carried out, using forms similar to those in the AUSTROADS publication "NTR-07", Section 15.

Methods

Use wet preparation methods where applicable.

Sampling

Process control tests: Determine timing and location.

Compliance assessment tests:

- Timing: Obtain materials samples at the time of delivery to the site.
- Location: Sample from selected sample sites within designated uniform test lots, consisting of an area placed, or compacted or both in one day. Test lots must be uniform in terms of material properties and density.

10.2.3 SAMPLES

General

Submit samples of the following at least one month before use in the works:

- Granular materials: One 25 kg sample of each proposed type and size of cover aggregate. Also submit test certificates for grading, shape and durability.

Identification

Attach a tag to each sample showing relevant information including description, source and nominal size of material.

10.2.4 CONTRACTOR'S SUBMISSIONS

Tests

Compliance assessment: If compliance assessment tests are to be carried out by an independent testing authority, have the authority submit 3 copies of each test result.

Certificate of compliance: If a certificate of compliance is acceptable as an alternative to testing a manufactured material, submit the manufacturer's certificate together with the results of recent tests undertaken by the manufacturer, showing compliance with test criteria.

Execution

General: Submit proposals for the methods and equipment to be used the roadworks, including the following:

- Staging of the work, access and traffic control methods.
- Disposal of surface water, control of erosion, contamination and sedimentation of the site, surrounding areas and drainage systems.
- Methods and equipment for each operation.

- Sources of materials.
- Material stockpiles.

Spraying equipment: Submit a current certificate and calibration chart issued by the state road authority.

Hand spraying: If intended, submit proposals.

Spraying: Submit proposals for start, finish and width of each spray run.

10.3 MATERIALS

10.3.1 MATERIALS

Material Grades

Bitumen: To AS 2008.

- Class: >

Bitumen emulsion: To AS 1160.

- Designation: >

Primer and primerbinder: Medium cut back bitumen to AS 2157, containing no fluxing oil.

Cut back bitumen grade: To suit the prepared surface and the weather conditions.

- Primer: - AMC1
- Primerbinder: - AMC3

Cover Aggregate

Standard: To AS2758.2.

- Pavement class: - To be determined by engineer (refer Clause 5)
- Precoating: - Precoating requirements to be determined by testing for resistance to stripping in accordance with Clause 12

Particle size distribution:

- Nominal size (mm): - To be determined by engineer (refer Clause 9.1)
- Quality of work: - To be determined by engineer (refer Clause 9.1.1)
- Particle shape: - Clause 9.2.2 - particle shape
- Rock durability: - Clause 10.2 - wet strength and wet/dry strength variation

10.3.2 MEASURING MATERIALS

Bitumen and Cutter

General: Measure by volume at 15°C.

Temperatures higher than 15°C: Use the Bitumen volume conversion formula for primers and binders, where T is the temperature of the material at which the volume has been measured. For calculation purposes, assume that the conversion factors are the same for bitumen, bituminous mixes and cutter.

Bitumen volume conversion formula: $\text{Volume at } 15^{\circ}\text{C} = \text{Volume at } T^{\circ}\text{C} \times (1 - (T - 15)/1667)$, where T is the temperature of the material at which the volume has been measured.

10.4 SURFACING

10.4.1 TOLERANCES

Finished Levels

General: Provide a finished surface which is free draining and evenly graded between level points.

Relative level tolerance: 10 mm

Absolute level tolerance: ± 10 mm

Edges abutting gutters: Within ± 5 mm of the level of the actual gutter edge.

10.4.2 PRECOATING

General

General: Precoat sealing aggregates immediately before the aggregate is loaded into the spreader trucks, except for 7 mm cover aggregate which is to be precoat not less than 48 hours in advance of spreading.

Precoating Agents

General: Use precoating agents which have satisfied plate stripping tests with the binder and aggregate. Test results to include details of the application rate. Submit test results for approval prior to commencing work.

Application

General: Apply precoating agent thinly and evenly using a fine pressure spray to a moving stream of aggregate, or by other suitable means, so that particles are fully coated but without excess material.

Wet aggregate: If the aggregate is too wet to precoat, or contains enough moisture to cause uneven distribution of the precoating agent, dry the aggregate by turning the stockpile over. Do not use precoat aggregate containing moisture until the moisture has evaporated and the precoating agent has adhered efficiently.

Application rate: As determined by testing.

10.4.3 CUTTING BITUMEN

Generally

Heat sufficient bitumen for immediate needs only. Do not keep the material at spraying temperature for longer than 10 hours. Do not reheat.

Mixing and Heating (On Site)

Heat the bitumen at a rate not exceeding 40°C/h, and circulate cutback bitumen for 20 minutes to ensure thorough mixing.

Heating Devices

Use devices capable of uniform heating without damaging bituminous materials.

10.4.4 SPRAYING EQUIPMENT

Hand Spraying

Areas not accessible to the mechanical sprayer: Spray using hand spray equipment attached to the mechanical sprayer. Provide calibration chart for mechanical sprayers.

10.4.5 PREPARATION FOR SPRAYING

Cleaning

General: Immediately before spraying remove loose and foreign material on the finished base surface, including dust, debris and sand spread on primed surfaces, and until a mosaic of well embedded stone shows on the surface. Keep traffic off the cleaned surface.

Method: Use suitable power blowers or power brooms (or using hand methods where inaccessible to the power equipment).

Potholes

Trim to a regular shape and a uniform depth of at least 75 mm. Tack coat the sides, and patch with a suitable bituminous premix, sanded after completion. Allow sufficient time for the premix to cure before spraying the surface.

Corrugation: Tyne pavement to minimum 200 mm depth, reshape and recompact as per base course Specification.

Edge Break: Trim to a regular shape and a uniform depth of 75 mm and patch as per potholes. Refer extent of work to the Contract Administrator prior to commencement.

Edge Break Alternate method: Cut 150 mm wide by 150 mm deep key trench along edge of existing pavement. Ensure that edge of pavement is straight. Backfill full depth with Asphaltic Concrete. Reshape shoulder to correct levels.

10.4.6 SPRAYING OPERATIONS

Preconditions

Prime and seal in dry and reasonably calm weather on a dry pavement surface at a surface temperature of at least 15°C.

Protection

Protect adjacent surfaces during spraying. Place drip trays under spray bars when the sprayer is stationary. Clean bituminous materials from adjacent surfaces or, if this is not possible, replace and make good the surface. Protect freshly sprayed surfaces from contamination.

Spraying Generally

Completely and uniformly cover the surface to be treated. Prevent the spray overlapping previously treated areas, except that where part-width spraying is used, lap the longitudinal joint between adjacent runs by 50 mm.

Priming

Spraying temperature:

- Grade AMC1 primer: In the range 60 - 80°C.

Edges: At uncurbed edges, extend the primer 150 mm beyond the edge of the seal.

Sealing and Primer Sealing

Process: Allow at least 3 days between priming and sealing and between first and second seals. Incorporate the first course of aggregate thoroughly into the binder before a second course is applied. Remove loose particles from the sealed area by sweeping lightly, without disturbing embedded aggregate.

Spraying temperature ranges:

- Bitumen without cutter: 160 - 190°C.
- Primerbinder Grade AMC3: 95 - 115°C.
- Bitumen emulsion binder: Ambient temperature.

Application rates

Comply with the **Sprayed bituminous road surfacing schedule**.

Table 10.4.6-40: Sprayed bituminous road surfacing schedule

Operation	Primer or binder			Cover aggregate	
	Material	Grade or class	Application rate at 15°C (L/m ²)	Size (mm)	Application rate at 15°C (m ² /m ³)
Priming	Primer	AMC1	1.0	-	-
Primersealing	Primerbinder	AMC3	1.5	7 10	100 80
First sealing	Residual bitumen binder		1.0	14	80
Second sealing	Residual bitumen binder		0.5	7	160
Single sealing / resealing	Residual bitumen binder		0.75	10	120
			1.6	20	60
Bituminous emulsion sealing	Bituminous emulsion		1.1	7	160
			1.4	10	120

10.4.7 PLACING COVER AGGREGATE

Placing Cover Aggregate

Spreading: Immediately after the binder or primerbinder has been sprayed, cover with a uniform layer of dry aggregate.

Rolling: Immediately after spreading roll and drag broom the area until it is uniformly covered with aggregate thoroughly embedded in the binder. Roll uniformly over the whole area.

Steel Rolling

Roll using a maximum of two coverages of a steel-wheeled roller of maximum axle load 5 t. Discontinue steel rolling if aggregate shows signs of breaking down.

Pneumatic Tyred Rolling

Roller: After steel rolling, roll the area using a pneumatic-tyred roller of minimum mass 10 t and with tyre pressures adjustable in the range 550 - 700 kPa.

Rolling:

- Minimum rate: 4 roller hours per 4500 L of binder or primer binder sprayed.
- Timing: At least one roller pass within 2 minutes of covering, over the whole of the area. After an initial slow pass increase the speed of rolling to the maximum practicable for the area being sealed. Complete at least 25% of the rolling within 2 hours of covering, 50% within 24 hours of covering, and 100% within 3 days of covering. Roll during daylight hours.

Loose Aggregate

When the aggregate has been evenly spread and embedded, remove loose particles remaining on the pavement and apply additional aggregate as required.

Surface Finish

Provide an even, smooth riding and free draining surface.

10.4.8 DEFECTIVE SURFACING

Primer

Actual rate of application < 90% of that ordered: Make up the deficiency with a second spray run.

Actual rate of application > 110% of that ordered: Cover the surface with sand.

Binder and Primer Binder

Actual rate of application < 90% or > 110% of that ordered: Reseal the surface.

Minimum Criteria for Retention

Actual rate of application: 90 - 110% of that ordered.

10.4.9 JUNCTIONS WITH EXISTING PAVEMENTS

Junctions with Existing Pavements

Pavement base: Protect using a suitable temporary seal or primerseal.

Primed surface: Keep traffic off the primed surface for at least 3 days after spraying. Commence sanding 4 - 24 hours after spraying.

10.5 COMPLETION

10.5.1 COMPLETION

Traffic on pavement

Do not allow traffic onto pavement until work is complete. Construction traffic should not be allowed on pavement unless it is confirmed that the wheel loads for the vehicles are less than the design capacity of the pavement and the vehicles will not mark the pavement.

11.0 CONCRETE SEGMENTAL UNIT PAVING

11.1 GENERAL

11.1.1 CROSS REFERENCES

General

Refer to General Requirements section.

Related sections

Refer to the following sections

- General Requirements.
- Site Preparation.
- Earthworks.
- Roadbase and Subbase.
- Roadwork Ancillaries.
- Appendix A - Schedule of Inspection and Testing Requirements

11.1.2 APPLICATION OF THIS SPECIFICATION

This specification applies to work on privately owned property. Where works are on public property, or property which is to come under the control of a Statutory Authority (Council, State Road Authority etc), or where the works are to come under the control of a Statutory Authority (ie stormwater drainage in a future easement), works shall be carried out in accordance with the requirements of the relevant Statutory Authority.

11.1.3 STANDARDS

General

Concrete Paving Units: CMAA Document, Concrete Segmental Pavements – Guide to Specifying (T44).

Detailing: CMAA Document, Concrete Segmental Pavements – Detailing Guide (T46).

11.1.4 INTERPRETATION

Definitions

CMAA: Concrete Masonry Association of Australia.

Absolute level tolerance: Maximum deviation from design levels.

Relative level tolerance: Maximum deviation from a 3 m straightedge laid on the surface.

11.2 QUALITY

11.2.1 INSPECTION

General

Refer also to General Requirements section and Appendix A.

Witness Points

Give sufficient notice so that inspection may be made at the following stages:

- Materials or areas of work ready for tests.
- Base course completed prior to placing bedding sand.

Hold Points

Proof roll inspection and test certificates for underlying work (Subgrade, basecourse etc).

11.2.2 TESTS

General

Refer to General Requirements Section for general testing and quality assurance requirements and Appendix A.

Table 11.2.2-41:: Compliance assessment schedule

Type of test	Test frequency	Test method
Bedding sand	1 per supply source	AS 1152
Jointing sand	1 per supply source	AS 1152

11.2.3 SAMPLES

General

Submit samples of the following at least one month before use in the works:

- Granular materials: One 25 kg sample of each proposed type of sand.
- Paving Units: Representative samples of each proposed paving unit type/ colour.
- Laying: Where directed, prepare sample panels of the specified paving finishes.

11.2.4 CONTRACTORS SUBMISSIONS

Tests

Compliance assessment: If compliance assessment tests are to be carried out by an independent testing authority, have the authority submit 3 copies of each test result.

Certificate of compliance: If a certificate of compliance is acceptable as an alternative to testing a manufactured material, submit the manufacturer's certificate together with the results of recent tests undertaken by the manufacturer, showing compliance with test criteria.

Execution

General: Submit proposals for the methods and equipment to be used for paving works including the following:

- Staging of the work, access and traffic control methods.
- Disposal of surface water, control of erosion, contamination and sedimentation of the site, surrounding areas and drainage system.
- Methods and equipment for laying paving units.
- Sources of materials.
- Material stockpiles.

11.3 MATERIALS

11.3.1 CONCRETE PAVING UNITS

General

Concrete paving units Pavements shall comply with the requirements of Concrete Segmental – Guide to Specifying (T44), published by CMAA.

Rectangular Paving Units: Minimum thickness as shown on the drawings. Paving units to have a minimum 28 day compressive strength of 30 MPa.

Interlocking Paving Units: Paving units which key into each other on four sides. Paving units to have a minimum 28 day compressive strength of 45 MPa.

Colour: As specified by the Civil Engineer.

11.3.2 BEDDING SAND

Material: bedding sand shall consist of sharp particles (not rounded) and comply with the following grading:

Table 11.3.2-42: Bedding sand grading

Sieve Size (mm)	Percentage passing by mass
9.5	100
4.75	95-100
2.36	80-100
1.18	50-85
0.6	25-60
0.3	10-30
0.15	5-15
0.075	0-10

Moisture content: Bedding sand shall be placed with a uniform moisture content in the range of 4-8%.

Soluble salts: The bedding sand shall be washed free of soluble salts or other contaminants which can cause or contribute to efflorescence.

11.3.3 JOINT FILLING SAND

Material: Joint filling sand shall be a well graded sand complying with the following grading:

Table 11.3.3-43: Joint filling sand grading

Sieve Size (mm)	Percentage passing by mass
2.36	100
1.18	90-100
0.60	60-90
0.30	30-60
0.15	15-30
0.075	5-10

The sand shall be washed free of soluble salts or other contaminants which can cause or contribute to efflorescence.

Bedding sand is not suitable for filling joints.

11.4 EXECUTION

11.4.1 TOLERANCES

Basecourse

Basecourse shall be trimmed to +10, -0 mm of nominated design levels.

Surface Levels

General

Provide a finished surface which is free draining and evenly graded between level points.

Edges Abutting Gutters

The channels formed between abutting chamfered units shall finish with their inverts within +5, -0 mm of the gutter edge.

Table 11.4.1-44:: Unit Paving Surface level tolerances table

Item	Level tolerance:	
	Absolute	Relative
Longitudinal direction	+ 10 mm	10 mm
Transverse direction	+ 10 mm	10 mm

Joint Width

Joints shall be a uniform width in the range 2–4 mm.

11.4.2 SUBBASE AND BASECOURSE

Subbase and basecourse shall be constructed in accordance with the Roadbase and Subbase section. The basecourse shall be trimmed within +10, -0 mm of nominated design levels. The surface of the prepared basecourse shall not deviate by more than 10mm from the bottom edge of a three metre straightedge laid in any direction on an area of specified uniform gradient or crossfall. The basecourse surface shall drain freely without ponding.

Sand bedding material shall not be used as a levelling material to compensate for basecourses finishing outside the above tolerances (i.e. the thickness of sand bedding must not exceed the specified thickness).

The basecourse shall be primed with bitumen emulsion to achieve a residual bitumen cover not less than 0.3 litres per m² prior to placing the bedding sand.

11.4.3 SPREADING AND SCREEDING BEDDING SAND

Bedding sand is to be screeded in a single uniform layer to achieve a uniformly thick layer following compaction in the range 20-30 mm thick. The thickness of the bedding sand layer shall no where exceed 30 mm following compaction.

Any depressions in the screeded sand exceeding 5 mm shall be loosened, raked and re-screeded before laying the paving units.

11.4.4 LAYING PAVING UNITS

Unless otherwise shown on the drawings, lay paving units in a herringbone pattern. Lay paving units with a uniform joint width in the range of 2-4 mm. Paving units shall be placed so that units are not in direct contact with each other.

The first row shall be located next to an edge restraint or previously completed paving. In each row full units shall be laid first. Edge or closer units shall be cut using a power saw or mechanical or hydraulic guillotine. Such closer units shall consist of not less than 25% of a full unit and shall be cut to size to suit the specified joint widths.

The laying operation shall be organised to avoid the meeting of laying faces wherever possible. Wherever this is unavoidable a concrete edge restraint shall be provided to separate the two areas of paving. (The location of the edge restraint is to be agreed with the contract administrator prior to commencing work and the concrete shall be coloured as directed to match the pavers).

11.4.5 EDGE RESTRAINT

All paving edges must be restrained. Generally restraint is provided by kerbs or adjoining structures. At manholes or other penetrations, or where the paving abuts existing pavements edge restraint should be provided by a concrete surround or edge with a minimum depth of 110 mm and a minimum width of 150 mm. The edge restraint is to be constructed using concrete having a minimum 28-day compressive strength of 25 MPa. The edge restraint shall be supported on compacted basecourse which shall have a minimum compacted thickness of 100 mm below the edge restraint. The concrete in edge restraints should be coloured to match the pavers unless directed otherwise by the Contract Administrator.

Where the face of an edge restraint directly abuts paving units, it shall be vertical down to basecourse level to permit the gap between paving units and the edge restraint to be within nominated limits.

At surface low points (or drainage points) provide suitable drainage through the edge restraint to ensure that the bedding does not become saturated by trapped water. The drainage should consist of a 20 mm diameter hole through the edge restraint at bedding level with the opening covered with suitable filter fabric to prevent washing out of bedding material.

11.4.6 BEDDING COMPACTION

After laying the paving units, the sand bedding shall be fully compacted, and the surface brought to design levels by no less than two passes of a suitable heavy duty plate compactor. Compaction shall continue until lipping between adjoining units has been eliminated. Any units which are damaged during compaction shall be immediately removed and replaced.

All compaction shall be complete, and the pavement shall be brought to design profiles before spreading or placing sand filling in the joints.

The paving operations shall be arranged so that compaction proceeds progressively behind the laying face without undue delay, and such that compaction is completed prior to cessation of construction activity on any day. Compaction shall not be attempted within 1.0 m of the laying face except on completion of the pavement against an edge restraint.

11.4.7 FILLING JOINTS

Joint filling shall commence as soon as practicable after bedding compaction and prior to termination of work on any day.

Dry sand complying with the requirements of the materials subsection shall be used. Bedding sand is not suitable for joint filling.

Spread joint filling sand over the pavement and fill the joints by brooming. To ensure complete filling of the joints, both the filling sand and the paving units shall be as dry as practicable when sand is spread and broomed into the joints.

After filling the joints compact the pavement with one or more passes of the plate compactor as necessary and then refill the joints with sand. Repeat this process until the joints are completely filled.

11.4.8 PROTECTION OF PAVEMENT AND OPENING TO TRAFFIC

Traffic should not use the pavement until bedding compaction and joint filling are completed. Construction traffic should not be allowed on the pavement unless it is confirmed that the wheel loads for the vehicles are less than the design capacity of the pavement, and the vehicles will not mark the pavement.

Where a pavement may not be subject to traffic for some time after construction, a small surcharge of joint-filling sand shall be maintained over the pavement.

Particular care shall be taken to remove excess sand prior to opening to traffic.

Prior to acceptance for opening to traffic all surfaces and pavement structures shall be true to levels, grades, thicknesses and cross-sections shown on the drawings. All pavements shall be finished to lines and levels nominated to ensure positive drainage to all drainage outlets and channels.

APPENDIX A – SCHEDULE OF INSPECTION & TESTING REQUIREMENTS

ITEM	INSPECTION / TESTING REQUIREMENT
Existing Services - Locate existing services. - Building over, relocating or modifying existing services.	(2) (2) (5)
Erosion/stormwater control - Silt fences and hay bales installed prior to commencing earthworks and maintained during earthworks. - Temporary detention basins installed prior to commencing earthworks and maintained as required.	(2) (2)
Excavation/filling - Clearing and grubbing completed and topsoil stockpiled. - Prior to construction of batter profiles and protection, - Shoring and ground anchors. - Proof roll inspection of fill subgrades. - Geofabric in place prior to filling. - Material tests on filling materials. - Compaction tests on each layer of fill. - Proof roll inspection of completed earthworks.	(2) (2), (6) (1) (1) (4) (3) (1)
Service trenches	

ITEM	INSPECTION / TESTING REQUIREMENT
▪ Service trenches excavated prior to laying service. ▪ Material tests on bedding and trench backfill material. ▪ Backfilling of trenches. ▪ Compaction tests on bedding and trench backfill.	(2) (4) (2) (3)
Placing topsoil ▪ Cultivation of ground prior to placing topsoil.	(2)
Retaining walls ▪ Underlying work. ▪ Material tests/ certificates for concrete and reinforcing. ▪ Prepour inspections of base reinforcing and formwork. ▪ Site sampling of concrete. ▪ Prepour inspection of reinforced blockwork. ▪ Inspection of subsoil drains. ▪ Supply and compaction of granular backfill.	(2), (3), (4) (4) (1), (3) (3) (1) (1) (3), (4)
Subsoil drainage ▪ Material tests on filter material and trench backfill ▪ Trenches excavated prior to laying pipes	(4) (2)

ITEM	INSPECTION / TESTING REQUIREMENT
▪ Subsoil pipes layer prior to covering ▪ Subsoil filter layer and filter fabric complete ▪ Compaction testing on trench backfill	(2) (2) (3)
Stormwater lines (including downpipe connections) ▪ Material tests on bedding, pipe surround and trench backfill ▪ Manufacturers data submitted for pipe type ▪ Trenches excavated prior to laying pipe ▪ Compaction tests on pipe bedding ▪ Pipes laid prior to backfilling and pressure testing (including all downpipe connections etc) ▪ Compaction testing on pipe surround and trench backfill ▪ Connections to existing services	(4) (4) (2) (3) (1) (3) (1), (5)
Precast concrete box culverts ▪ Compaction testing and proof rolling inspection of subgrade under base slab ▪ Prepour inspection of base slab formwork and reinforcing ▪ Testing of concrete in accordance with Section 220 - Concrete ▪ Manufacturers certification for design and manufacture of precast box culvert units	(1), (3) (1) (4), (3) (4)

ITEM	INSPECTION / TESTING REQUIREMENT
▪ Sealing of joints prior to backfilling ▪ Material tests on backfill material ▪ Compaction testing on backfill	(1) (4) (3)
Concrete lined channels ▪ Compaction testing and proof roll inspection of subgrade under base slab ▪ Prepour inspection of reinforcing and formwork ▪ Testing of concrete in accordance with Section 220 - Concrete ▪ Material tests on backfill material ▪ Compaction testing on backfill	(1), (3) (1) (4), (3) (4) (3)
Pits and other structures ▪ Compaction testing and proof roll inspection of subgrade ▪ Manufacturers certificates for precast items ▪ Prepour inspection of formwork and reinforcing ▪ Testing of concrete in accordance with Concrete specification ▪ Inspection of completed concrete work prior to backfilling ▪ Material tests on backfill material ▪ Compaction testing on backfill	(1), (3) (4) (1) (4), (3) (1) (4) (3)

ITEM	INSPECTION / TESTING REQUIREMENT
Subgrade ▪ Underlying filling and services trench backfill approved ▪ Compaction tests on completed subgrade ▪ Proof roll inspection of completed subgrade	(2), (3), (4) (3) (1)
Lime stabilised subgrade ▪ Underlying work approved ▪ Layer to be stabilised compacted and trimmed ▪ Compactive dry density tests ▪ Material certificates/ tests for hydrated lime ▪ Spread rate/ temperature/ working time for mixing of lime ▪ Uniformity of mixing/ lime content ▪ Compaction of stabilised layer ▪ Proof roll inspection on completed subgrade	(2), (3), (4) (2), (3) (3) (4) (7) (3) (3) (1)
Subbase and base ▪ Underlying work approved ▪ Material tests/ certificates on subbase and base materials ▪ Compaction tests	(2), (3), (4) (4) (3)

ITEM	INSPECTION / TESTING REQUIREMENT
▪ Proof roll inspection of each completed pavement layer ▪ Application of wax emulsion to cement stabilised subbase	(2) (7)
Concrete pavements ▪ Underlying work approved ▪ Material tests/ certificates for concrete and reinforcing ▪ Prepour inspection of completed reinforcing, formwork, dowels etc. ▪ Site sampling of concrete ▪ Curing ▪ Cutting of sawn joints	(2), (3), (4) (4) (1) (3) (7) (7)
Joints ▪ Joint cleaned and prepared prior to priming ▪ Joint primed ▪ Material certification/ testing	(2) (2) (4)
Asphaltic concrete ▪ Underlying work approved ▪ Kerbs etc completed ▪ Placing asphaltic concrete	(1), (3), (4) (1), (3) (2), (3), (4), (7)

ITEM	INSPECTION / TESTING REQUIREMENT
Sprayed bituminous surfacing ▪ Materials tests/ certificates for aggregate, precoating agent, binder etc ▪ Underlying work approved ▪ Calculation of application rates etc ▪ Placing each coat of aggregate/ seal	(4) (1), (3), (4) (6) (2), (3), (4), (7)
Associated Elements (kerbs, footpaths etc) ▪ Material tests/ certificates for subbase, concrete etc, ▪ Placement of subbase ▪ Subbase, formwork etc completed prior to pouring concrete ▪ Placing concrete Guardrails ▪ Manufactures certificates, shop drawings etc ▪ Inspection of guardrail posts, prior to concrete encasement of footings	(4) (2), (3) (1) (2), (3), (7) (4), (7) (1)

Key

- 1) Engineer to inspect
- 2) Engineer to be notified to allow opportunity to inspect
- 3) Test results from independent testing authority to be supplied to Engineer prior to covering work

ITEM	INSPECTION / TESTING REQUIREMENT
4) Materials certificates/ testing to be supplied to Engineer prior to commencing work	
5) Approval of relevant Statutory Authorities required	
6) Submit Certification of Contractors design check	
7) Contractors records of work	