CYPRESS COUNTY

CONSTRUCTION STANDARDS

November 2018

1 GENERAL

The following Construction Standards apply to all Construction within Cypress County. Generally, the Developer or the Developer's Engineer is responsible to ensure that the Contractor adopts these standards and that developments are constructed in accordance with these standards and specifications. Written documentation that these standards have been followed, and that quality control and quality assurance (QA and QC) has been completed, shall be submitted to the County as required. Contractors are expected to utilize competent, qualified personnel for materials testing.

When repairs or maintenance to existing infrastructure are made, Contractors shall also adopt these Construction Standards wherever possible, and shall provide quality control test results, or written recommendation for approval by a Professional Engineer when requested by the County. The absence of a County request for quality assurance or quality control testing does not relieve the Developer, Developer's Engineer or Contractor of their responsibility to provide quality work meeting these Construction Standards. The County shall be notified in advance of proposed testing and a representative may be present during testing.

There may be circumstances where the specifications provided herein do not meet the desired standard required for certain project specific conditions. In this case, it will be at the discretion of the County representative to determine the specification to be used, and whether any additional or supplemental specification will be necessary to complete the project as required. This will be of particular importance when determining which Asphalt Specification is to be used for roadway design. It is the preference of Cypress County to have the latest edition of the Alberta Transportation Asphalt Specification used for all new road construction in the County, and Contractors will be required to gain approval from the County to use any specification other than Alberta Transportation Asphalt Specification.

2 AGGREGATES GENERAL

2.1 GENERAL

This section specifies general requirements for supplying and processing of aggregates to be stockpiled or incorporated into work. Specific requirements for physical properties of aggregates not provided in this section are given in related work sections.

2.1.1 Source Approval

Source of materials to be incorporated into work or stockpiled requires approval from the Land Owner and/or Cypress County.

Inform the County of proposed source of aggregates and provide access for sampling at least two weeks prior to commencing production.

If, in opinion of the County, materials from proposed source do not meet, or cannot reasonably be processed to meet specified requirements, produce an alternative source or demonstrate that material from source in question can be processed to meet specified requirements.

Should a change of material source be proposed during work, advise the County two weeks in advance of proposed change to allow sampling and testing.

Acceptance of a material at source does not preclude future rejection if it is subsequently found to lack uniformity, or if it fails to conform to requirements specified, or if its field performance is found to be unsatisfactory.

2.1.2 Production Sampling

Aggregate will be subject to continual sampling during production.

Provide the County with ready access to source and processed material for purpose of sampling and testing.

Bear the cost of sampling and testing of aggregates in order to meet design gradations and specifications.

2.2 PRODUCTS

2.2.1 General

All imported backfill, granular material, gravel and screened rock shall be suitable for the uses intended.

Aggregate shall be sound, hard, durable material free from soft, thin, elongated, or laminated particles, organic material, or other deleterious substances.

Flat elongated particles are those whose greatest dimension exceeds five times their least dimension.

Fine aggregates satisfying requirements of applicable section shall be one, or a blend of following:

a) Natural sand

b) Manufactured sand and/or fines

c) Screenings produced in crushing of quarried rock, boulders, gravel or slag.

Course aggregates satisfying requirements of applicable section shall be one of following:

a) Crushed rock or slag.

b) Gravel composed of naturally formed particles of stone.

2.2.2 Materials

Gradation: To be within the limit and for the types of materials specified below, when tested to ASTM C117 and ASTM C136, and having a smooth curve without sharp breaks when plotted on a semi-log grading chart to ASTM E11

Production of Manufactured Fines: Manufactured fines are defined as that portion of the material passing the 5,000 sieve size which is produced by the crushing process.

In the event the manufactured fines in the total combined aggregate do not meet the requirement for the specified Asphaltic Concrete Mix, extra manufactured fines shall be produced by screening the pitrun material so that the screened material contains no more than 5% material passing a 5,000 sieve. This screened material shall then be crushed so that 100% passes the 10,000 sieve and a minimum of 95% passes the 5,000 sieve. All material produced by this crushing process shall be placed in a separate stockpile and designated as manufactured fines.

Moisture Content: As specified in specific sections.

Bedding Sand: Bedding sand shall be free from organic material and meet the following gradation:

Sieve Size (mm)	% Passing by Mass
12.500	100
5.000	90-100
1.250	55-85
0.315	10-35
0.080	0-5

The liquid limit shall not exceed 25 and the PlastiMD Index shall not exceed 6.

Granular Material (imported Sand): Imported sand shall be free from rubbish, rubble, organic material, vegetation, clay lumps and meet the gradation of bedding sand.

Granular Material (Imported Gravel): Imported gravel shall be a well graded mixture of sand and gravel meeting the following gradation:

Sieve Size (mm)	% Passing by Mass
80.000	100
50.000	80-100
25.000	50-75
5.000	25-55
0.080	2-10

Screened Rock: Screened rock shall be composed of sound, hard uncoated particles free from clay lumps, flaky particles, soft shale, friable materials, roots, vegetable matter and frozen lumps meeting the following gradation:

Sieve Size (mm)	% Passing by Mass
50.000	100
40.000	95-100
20.000	5-10
10.000	0-5
5.000	0-5

2.3 EXECUTION

2.3.1 Processing

Process aggregate uniformly using methods that prevent contamination, segregation, and degradation.

Split and combine aggregates if required to obtain gradation requirements specified. Use approved methods and equipment. Do not blend in stockpiles.

Blending to increase percentage of crushed particles or decrease percentage of flat and elongated particles is permitted.

Wash aggregates, if required to meet specifications. Use only equipment approved by the County.

2.3.2 Handling

Handle and transport aggregates to avoid segregation, contamination and degradation.

2.3.3 Stockpiling

Stockpile aggregates on site in location indicated or designated. Do not stockpile on completed pavement surfaces where damage to pavement may result.

Stockpile aggregates in sufficient quantities to meet project schedules.

Stockpiling sites shall be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials.

Except where stockpiled on acceptably stabilized areas, provide a compacted sand base not less than 300mm in depth to prevent contamination of the aggregate or, if permitted, stockpile aggregates on ground but do not incorporate bottom 300mm of pile into work.

Separate aggregates by substantial dividers or stockpile far enough apart to prevent intermixing.

Reject intermixed or contaminated materials. Remove and dispose of rejected materials as directed within 48 hours of rejection.

Stockpile materials in uniform layers of thickness as follows:

a) Max 1m for course aggregate and base course materials

b) Max 2m for fine aggregate and subbase materials.

c) Max 1.5m for other materials

Complete each layer over entire stockpile area before beginning next layer.

Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.

Coning of piles or spilling of material over edges of pile will not be permitted. Stacking conveyors will not be permitted for stockpiling road base and graded seal coat aggregates.

During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

2.3.4 Stockpile Clean-up

Leave stockpile site in a tidy, well drained condition, free of standing surface water. Remove any unused aggregates as directed.

END OF SECTION

3 TRENCHING AND BACKFILLING FOR UTILITIES

3.1 GENERAL

Trenching and backfilling to be carried out in accordance with Alberta Occupational Health and Safety Regulations, Part 10.

3.1.1 Work Included

Provide all labour, products and equipment for trenching and backfilling for utilities, including but not limited to:

a) watermains
b) sanitary sewers
c) storm sewers
d) manholes, valve boxes
e) lot service connections
f) shoring, sheet piling
g) dewatering

3.2 EXECUTION

3.2.1 Excavation

Excavate to lines and to design depth shown or as required by the County to provide satisfactory bearing. Excavate unsuitable soil from trench bottoms as required by the County. Backfill with screened rock material specified to the required level and compact to provide uniform bearing.

No additional compensation will be paid for any changes due to deterioration of excavations caused by activities or neglect of the contractor.

Level and clean excavation bottoms free from loose material and debris.

Where excavation is made below depth shown through error, fill to required depth with 20 MPa compressive strength concrete or screened rock at no additional cost to Owner.

Provide firm undisturbed earth or rock bearings for granular bedding below pipelines and structures.

Excavate for structures to widths sufficient for formwork construction. Place no concrete or masonry until the County has inspected excavation.

Where concrete is to be placed, thaw excavation bottom if frozen, and protect from further freezing.

Maximum lengths for open trenches are 30 meters ahead of pipe laying crew and 200 meters behind, unless otherwise permitted by the County.

Where pipelines are constructed through fills and embankments, surface elevations will generally at least be 250 mm above top of pipeline prior to excavation.

Where trenches are excavated in existing pavements, saw cut the pavement to neat lines.

All excavation to be in accordance with Alberta OH&S Guidelines with spoil pile offset a minimum of 1m from edge of excavation.

3.2.2 Rocks and Boulders

Remove boulders to provide 150 mm minimum clearance under pipes. Backfill with granular and compact at required level to provide suitable bearing, if boulders are less than 0.4 cubic meters.

Boulders larger than 0.4 cubic meters and material which cannot be removed with pick and bar will be classified as rock by the County. Notify the County when rock is encountered for classification and measurement.

Excavate rock to provide 150 mm minimum clearance on each side and under pipes. Backfill with granular and compact at required level to provide suitable bearing.

Prior to commencing blasting operations, obtain written approval from authorities having jurisdiction and from the County. Employ licensed workers only.

3.2.3 Shoring, Bracing and Sheet Piling

Provide all shoring, bracing and sheet piling required for support and protection of earth banks at excavations.

Erect all shoring, bracing and sheet piling independent of utilities and structures.

Shore and brace sides of trenches and excavations in accordance with Workers' Compensation Board Regulations.

Maintain during backfilling and remove in stages as backfilling progresses or as approved by the County.

Remove all shoring, bracing and sheet piling unless otherwise permitted by the County. If shoring is allowed to remain, cut off to a level at least 600 mm below finish grade.

Pre-fabricated cages or shields may be used, at the discretion of the County, to supplement or replace conventional shoring provided they conform with all applicable safety regulations, and permit the proper placing and tamping of bedding material under and around utility pipes.

3.2.4 Backfilling - General Requirements

Bedding of pipes and utilities and backfill to 300 mm above top of pipes and utilities is included in other sections.

Backfill trenches and excavations with excavated earth material. Remove all rocks larger than 200 mm in diameter from earth backfill.

Place and compact all backfill in maximum 300 mm deep loose layers, prior to compaction.

Compact site material used as trench backfill in all areas from 300 mm above top of pipe to 300 mm below bottom of granular base for roads to a density not less than 95% of Standard Proctor Density, as defined herein, and carried out at a moisture content of within 3% of optimum moisture content. Remove any free water in the trench prior to placing additional lifts. Note that if moisture content is too high and densities not initially attainable the contractor will make every reasonable attempt to dry the material by whatever means available (i.e. discing, spreading, etc.) should the County deem the material to be "unworkable" the use of imported granular backfill may be required. Compact the final 300 mm below road or lane granular base to not less than 100% of Standard Proctor Density.

Compaction results will be based on a minimum of one density test per 150 lineal meters of trench for each 1.5 meters of depth. If a density test indicates insufficient compaction at any depth, then two more densities, which are proportionally representative of trench length, will be taken at that depth. Then, if the average of the three tests is below the required density, the contractor will re-excavate and re-compact to meet the specified density.

Place and compact evenly around structures to prevent damage or displacement. Grade surface to direct water away.

Stockpile spread or remove excess excavated earth material where directed by the County.

Remove and dispose of boulders off site at no additional cost.

Where additional pipes are to be, or have been laid, crossing the trench being backfilled and at a higher elevation, take special care to ensure the backfill is compacted to a minimum of 97% of Standard Proctor Density from the lower pipeline up to the obvert elevation of the higher pipeline.

Where imported material is called for by written direction of the County, place the specified depth of granular material to the elevations provided and compact to specified Standard Proctor Densities.

Where filter fabric is called for by written direction of the County, place fabric to the overall dimensions specified.

3.2.5 Settlement

Be responsible for all settlement of backfill that may take place during a period of two (2) years after date of completion certificate.

When notified of any such settlement, promptly repair same, or make arrangement for others to do so at the contractor's expense. Failure to do so will result in the Owner making appropriate arrangements at the Contractor's expense and at no cost to the Owner.

Pay the cost of all damages that may be caused by such settlements, including but not limited to repair and/or replacement of concrete sidewalks, curb and gutter and asphaltic concrete pavement.

END OF SECTION

4 SUBGRADE PREPARATION

4.1 GENERAL

4.1.1 Work Included

The work described in this section pertains to the preparation and construction of the subgrade.

4.2 DEFINITIONS

4.2.1 Subgrade

Subgrade is that material immediately beneath the compacted granular course as detailed on the drawings.

4.2.2 Common Excavation

Common excavation shall consist of all materials such as earth, topsoil, organic material, muskeg, clay, hardpan, shale, silt, sand, gravel, fractured bedrock, cobbles and frozen material, removed from the roadway and placed in fill or embankment areas, or otherwise disposed as approved by the County. Excavation shall be to the lines and grades indicated on the plans, or as directed by the County. Schedule work to utilize all excavation materials completely. Borrowing materials will be authorized only after excavated materials have been utilized.

4.3 EXECUTION

4.3.1 Scarify and Compact

In excavation areas, the top 150mm of the subgrade shall be scarified and compacted to 95% Standard Proctor Density at optimum moisture content. In lieu of sub-grade preparation a geotextile filter fabric will be accepted.

No stones or boulders larger than 100mm in diameter shall be left within the top 200mm of the subgrade unless otherwise directed by the County.

4.3.2 Over-Excavation

Notify the County whenever unsuitable materials are encountered.

Materials which cannot be compacted to the specified density due to a high or low moisture content shall be dried or watered by the Contractor to their optimum moisture content in order to achieve the specified compaction.

All common excavation materials below subgrade elevation which, in the opinion of the County, are considered unsuitable shall be removed and disposed in a site located by the Contractor, and approved by the County.

4.3.3 Stockpiling of Material

To facilitate the Work, the Contractor may stockpile embankment material. Such material shall be piled at a location determined by the Contractor, approved by the County, and in such a manner that it will not endanger persons, the Work, or adjacent properties, and ensure proper drainage is maintained. If the construction site does not facilitate stockpiling, the Contractor shall haul material to an approved location.

4.3.4 Excavation Waste

All common and rock excavation deemed unsuitable for use in embankments, or in excess of that required for embankment, shall be disposed at locations determined by the Contractor and approved by the County.

All disposal areas shall be left in a neat and tidy condition satisfactory to the County. Excavation materials shall be graded smooth to promote surface drainage and not to impede existing surface drainage by the Contractor to the approval of the County.

4.3.5 Common Embankment (for site grading)

Embankment placed on lots and within the road right of way, but not under the road structure, shall be uniformally constructed to the typical cross-section and grades shown on the plans or as set out by the County, and shall include the formation, compaction and shaping of the embankment.

The full depth of fills shall be constructed of suitable material in layers not exceeding 200mm compactive depth. Each layer shall be compacted to 95% Standard Proctor Density (SPD) at optimum moisture content. All fills greater than 1.0m are to be compacted to 95% SPD.

Do not place material in free standing water. Drain all areas before placing materials.

Materials which cannot be compacted to the specified density due to high or low moisture content shall be dried or watered by the Contractor to their optimum moisture content as necessary to achieve the specified compaction.

4.3.6 Shaping and Finishing

The finished compacted subgrade shall be constructed to within 30mm of the design section. Localized soft spots that develop in the finished subgrade due to poor work shall be corrected by excavating the material to a depth approved by the County, and replacing it with suitable subgrade material compacted in place.

Subgrade shall be true to the design cross-section.

Maintain and keep ditches open and free from debris to permit ready flow of surface water, and until final acceptance of the Work.

4.3.7 Tests

Field density and moisture content tests shall be carried out by a representative approved by the County in accordance with the following ASTM standards:

Standard Proctor Compaction Test: ASTM D698, Methods (A) and (B)

ASTM D1556 or In-Place Density Test: ASTM D2167 or ASTM D2922 and D3017

The frequency of field density and moisture content tests shall be at minimum 1 test per 100 metres of constructed roadway and at various locations left and right of centre line, or as directed by the County.

Before approval by the County, the subgrade shall conform to the compaction requirements specified and shall show no visible subsidence or deflection under the wheels of a loaded gravel truck. Such trucks shall be provided by the Contractor, as the County requires, for proof rolling of the subgrade.

The following outlines the structural requirements for roadways and approaches which must be followed:

Surface Aggregate: Designation 4 Class 20 material, ¾ inch crush, AB. Infrastructure Spec., minimum 100 mm depth

Grade:	0.90 meter minimum non-organic material with 0.20 meters of clay cap
Compaction:	Upper 0.30 meters – 100% of Standard Proctor Density Below 0.30 meters – 98% of Standard Proctor Density
Moisture Content :	Optimum Moisture Content

END OF SECTION

5 GEOTEXTILE

5.1 GENERAL

This Section specifies requirements for the supply and installation of non-woven and woven geotextile filter fabric.

Non-woven geotextile filter fabric shall be used as a separate membrane for rip-rap or hydraulic filter for drainage systems.

Woven geotextile filter fabric shall be used when in the opinion of the County the foundation conditions are considered soft and unstable.

5.1.1 Mill Certificates

At least one week prior to the commencement of Work the Contractor shall submit a sample of the geotextile filter fabric to be used in the Work with copies of mill test data and Manufacturers Certificate of Compliance that the geotextile filter material delivered to the job site meets the requirements of this section.

5.1.2 Approval

The Contractor shall obtain written approval of the County for the geotextile filter fabric material to be used in the Work.

5.1.3 Delivery and Storage

During delivery and storage, protect the geotextile filter fabric from direct sunlight, ultraviolet rays, mud, dirt, dust, moisture, debris and rodents.

5.2 PRODUCTS

5.2.1 Material

The geotextile filter fabric shall be rot-proof, unaffected by the actions of oil or salt water and not subject to attacks by insects or rodents.

The geotextile filter fabric shall be supplied in rolls of minimum width of 3.0m and minimum 50m lengths.

5.2.2 Physical Properties

The non-woven and woven geotextile filter fabric shall meet the specifications and physical properties in accordance with the following table of minimum average roll value properties (MARV's) for each.

Specifications and Physical Properties		
	Non- Woven	**Woven**
Grab Strength	650 N	1275 N
Elongation (Failure)	50%	15%
Puncture Strength	275 N	275 N
Burst Strength	2.1 MPa	3.6 MPa
Trapezoidal Tear	250 N	475 N
Minimum Fabric Lap to be	300mm	1000mm

5.3 EXECUTION

Where geotextile fabric is specified, the sloped or horizontal surface shall be graded to provide a smooth, uniform surface. All stumps, large rocks, brush or other debris that could damage the fabric shall be removed. All holes and depressions shall be filled so that the fabric does not bridge them. Loose soils shall be replaced.

The fabric shall be laid parallel to the slope direction in one continuous length from toe of slope to upper extent of fabric. It shall be placed in a loose fashion; however creases, folds, wrinkles and tensile stresses shall be avoided. Adjacent strips of fabric shall be overlapped as specified, except where placed underwater, the minimum lap width shall be 1m. Overlaps shall be pinned using 6mm diameter steel pins fitted with washers and spaced at 1m intervals along the overlaps.

The top edge of the filter fabric shall be anchored by digging a 300mm deep trench, inserting the top edge of the fabric and backfilling with compacted soil.

Rip-rap placement shall commence at the base of the filter fabric area and proceed up the slope. The height of drop of rip-rap shall be limited to 1.0m or less, and the rip-rap shall not be allowed to roll down the slope. Heavy equipment will not be permitted to operate directly on the geotextile.

5.4 PROTECTION

After installation the filter fabric shall be covered with overlaying layer within 3 days of placement.

Do not permit passage of any vehicle or equipment directly on geotextile at any time.

Protect geotextile material from displacement and damage until and during placement of the rip-rap, granular material or the gabion mat.

Care shall be taken to prevent puncturing or tearing the geotextile. Any damage shall be repaired by use of patches that extend at least 1m beyond the perimeter of the tear or puncture.

Remove and replace damaged or deteriorated geotextile, as directed by the County.

END OF SECTION

6 RIP – RAP

6.1 GENERAL

6.1.1 Definition

Rip-rap is a protective covering consisting of hand-laid or randomly deposited rock, sacked concrete or sacked cement stabilized material which is placed on exposed surfaces for protection against erosion and wave action.

6.1.2 Work Included

Work of this Section consists of supplying, hauling, and placing of rip-rap as specified and as shown on Drawings.

6.1.3 Approval

The Contractor shall have the rip-rap material approved by the County in writing prior to delivery to the site. The approval of rock samples from a particular source or quarry site shall not necessarily be construed as approval of all material from that location.

Delivery and handling of rip-rap shall be subject to the County's approval and shall be as such as to minimize segregation and breakage and damage.

Material which has deteriorated or does not meet specified requirements shall be removed from site.

6.1.4 Quality Assurance

Sampling and testing of materials, as required by the County for testing the quality of rip-rap.

6.1.5 Job Conditions

Suspend placement operations whenever climatic conditions, as determined by the County, are unsatisfactory for placing rip-rap fill to requirements of this Specification.

Do not permit or cause material to slide or roll down slopes.

When placing rip-rap do not disturb satisfactorily placed material or structures already in place.

Sequence delivery of material to site in a manner to minimize stockpiling and in any event obtain approval from County to stockpile.

6.2 PRODUCTS

6.2.1 General

The rock supplied shall be hard, durable and angular in shape, resistant to weathering and water action, free of overburden, spoil, shale seams and organic material. No sandstone will be permitted. The minimum dimension of any single rock shall be not less than one third of its maximum dimension. The minimum acceptable unit weight of the rock is 2.5t/m^3 or as specified for the intended use.

The rock rip-rap shall be free from seams, cracks or other structural defects to meet the following specified size distribution.

		Class 1M	Class 1	Class 2	Class 3
Nominal Mass	**Kg**	7	40	200	700
Nominal Diameter	**or mm**	175	300	500	800
None heavier than:	Kg	40	130	700	1800
	or mm	300	450	800	1100
No less than 20% or more	Kg	10	70	300	1100
than 50% heavier than:	or mm	200	350	600	900
No less than 50% or more	Kg	7	40	200	700
than 80% heavier than:	or mm	175	300	500	800
100% heavier than:	Kg	3	10	40	200
	or mm	125	200	300	500

Percentages are by mass. Sizes are equivalent spherical diameters, and are for guidance only.

6.3 EXECUTION

6.3.1 Preparation

Prepare surfaces to receive rip-rap to lines and grades as shown on the Drawings.

6.3.2 Inspection

Do not place rip-rap until foundation to receive it has been approved by the County.

6.3.3 Installation

The rock rip-rap shall be placed on a non-woven geotextile filter fabric unless otherwise noted on the drawings or in the specifications.

The hand laid rock rip-rap erosion protection shall be placed in the areas indicated on the drawings or as designated by the County.

Place rip-rap by suitable mechanical equipment so that no intermixing of foundation material and rip-rap is allowed to occur during placing and that minimum breakage of rock fragments will occur and that the mass is stable.

Rip-rap need not be compacted but shall be dumped and graded off to same regular surface and in such manner that larger rock fragments are uniformly disturbed and smaller rock fragments fill voids between larger pieces.

Hand placing will be required only to extent to secure results specified above in the areas where mechanical equipment cannot operate adequately.

Do not place rip-rap against structures until permission is obtained from the County.

The rip-rap stones shall be placed on the surface to be covered as shown by the plans or as directed by the County, on slopes not exceeding 1½ H: 1V starting with the larger stones on the bottom row. Rip-rap shall be placed on the prepared surface such that the weight of the stone is carried by the subgrade and not by the underlying stones. Rip-rap shall be placed proceeding upward from the bottom. Voids between rip-rap shall be filled with broken rock fragments.

Care shall be taken not to puncture the geotextile filter fabric when placing the rip-rap. Any damaged filter fabric shall be repaired or replaced as requested by the County.

END OF SECTION

7 WATERMAINS

7.1 GENERAL

7.1.1 Work Included

Provide all labour, products and equipment required for the work, including but not limited to:

a) bedding under and over pipe
b) watermains and appurtenances
c) testing watermains
d) flushing and disinfecting watermains
e) connection to existing systems
f) thrust blocks

7.1.2 Quality Standards and Assurances

Products, workmanship and testing shall conform to standards specified in this section.

All products and workmanship may be subject to inspection by the County.

Perform all tests required by the specification and by authorities having jurisdiction.

Notify the County and authorities in ample time before testing to permit inspection and allow tests to be witnessed.

Do not cover any work before inspection and testing unless authorized by the County in writing.

Remove or repair defective products or work which fails to meet specified requirements as directed by the County, at no additional cost to Owner.

7.2 PRODUCTS

7.2.1 Polyvinyl Chloride (PVC) Water Pipe

Polyvinyl chloride water pipe shall be equivalent to cast iron pipe outside diameter meeting CAN3-B.137.3 M86 (AWWA C900).

Pipe shall be Class 150 (dimension ratio 18) and pipe must be blue in colour.

Pipe joints shall be integral gasketed bell ends. Couplings shall be permitted only for closures or special connections.

Gaskets shall conform to AWWA C111.

An affidavit of compliance shall be provided if requested.

7.2.2 Water Pipe Fitting

PVC fittings, tees & bends, shall be to CAN3-B.137.3, pressure Class 150, which are designed to accommodate the pipe for which they are used.

PVC fittings shall be gasketed bell end type similar to pipe except where adaptors are required in which case flanged or threaded joints may be permitted subject to approval by the County. Gaskets to conform to AWWA C111.

Cast ductile iron couplings to be robar couplings or approved equal complete with ANSI 303 stainless steel nuts & bolts compatible with outside diameters of pipes to be joined in locations approved or specified by the County.

7.2.3 Gate Valves (NRS)

Valves shall be iron body, bronze mounted, double disc or solid-wedge, with full 360 degree rubber to cast iron resilient seat gate valves approved for potable water use, meeting AWWA Specification C509-80 and the following:

- Valves to be bronze mounted with a grade of bronze completely resistant to de-zincification by water having a ph of 9.0
- Valve ends shall be consistent with the type of joint used for pipe and fittings except where otherwise detailed.
- Valves to be supplied with either bronze or type 304 stainless steel stems.
- Working pressure 1035 kPa.
- Valve interior to be epoxy coated for corrosion protection.
- Valves shall close by turning clockwise and be a non-rising stem type and be equipped with a 50 mm square operating nut. Valve stem shall be equipped with "O-Ring" type seals.
- Exterior to be factory coated.
- All exterior bolts and nuts must be T304 or type 3145.5 stainless steel.

7.2.4 Valve Boxes

Valve boxes shall be Norwood Foundry Type A, or equal. Valve box shall consist of a cast iron bonnet of sufficient size to fit over the valve, and an adjustable cast iron top box with lid.

Valve boxes shall be of suitable length for depth of bury specified for mains with possible adjustment of 300 mm up or down from this length.

Valve box extensions shall be cast iron suitable for use with the valve box to be installed.

All cast iron surfaces to have a bituminous coating for corrosion resistance.

7.2.5 Hydrants

Following standards are to be confirmed with the County Administrator and the applicable Area Fire Marshal during the design stage.

Hydrants are to be of the post type, dry barrel hydrant with compression shut-off conforming to AWWA Specification C502-80, having the following features:

- Working pressure of 1035 kPa.
- Two hose connections at 180 deg., 63 mm ID with threads to Alberta Mutual Standard.
- One pumper connection, 100 mm OD, outlet nozzles to be fastened by a thread connection.
- 150 mm riser barrel, 125 mm bottom valve.
- Minimum distance from flange to bonnet will be 600 mm.

- Main connection to be 150 mm ductile iron size rubber gasketed bell end joint.
- Self-Draining hydrants (or as determined by site condition)
- Number 6 operating nut with five sides.
- Hydrant to open counter-clockwise.
- All hydrants shall be painted red.
- Ground line breakway system: 2.75 m from invert to flange, including a 450 mm top extension spool section with hydrant rod coupled at extension.
- Minimum 710 mm from top of operating nut to bottom of base flange.
- All exposed nuts and bolts to be T304 or type 3145.5 stainless steel.
- Interface between removable parts of main valve and hydrant body shall be bronze to bronze.
- Hydrants shall be of the same type and make as presently used in Cypress County (McAvity, M67-B).
- All hydrants to maintain and isolation valve on the hydrant lead a minimum of 2m from hydrant.
- Set hydrants and hydrant isolation valves on pressure treated timber blocking as per the details.
- Ensure hydrant stock and valve box are truly vertical.
- Locate hydrants and valves as per the drawings within the following tolerances: 50 mm horizontal, 15 mm vertical.
- Face pumper nozzles to roadway with hose nozzles parallel to roadway. No portion of the hydrant or nozzle cap shall be within 150 mm of the sidewalk.
- Concrete thrust blocks will be required at hydrants and hydrant valves as detailed.
- Ensure that regular maintenance of hydrants is carried out for the duration of the maintenance period. Pay all costs for maintenance such as repainting, draining prior to freeze-up, etc.

7.2.6 Insulation

Rigid insulation shall be expanded polystyrene type 4 Styrofoam Highload 40 or equivalent.

7.2.7 Watermain Plugs

Watermain plugs shall be of standard manufacture to suit type of pipe and pipe joint specified.

7.2.8 Air Relief Valve & Flushing Chamber

Valve and chamber shall conform to the detail drawing referenced or attached.

7.3 EXECUTION

7.3.1 Pipe Installation

Carefully lower pipe and fitting into trench using proper appliances. While suspended, inspect for defects. Remove foreign materials from inside of pipe. Unless otherwise directed, lay pipe from lower end of line upward.

Lay pipe true to line and establish grading using laser level or measurement rod and sight rails.

Cut pipe accurately to bring valves, fittings and hydrants to correct position.

At all hydrants, plugs, tees, crosses, bends of 22 degrees or more and all other points of concentrated thrust, provide reaction blocking as detailed to prevent movement. Place reaction blocking against solid undisturbed ground. Details are based on soil load values of 7323 kg per square meter, or more. Where soil will not provide this load value, provide bands and clamps to take reaction. Refer also to special thrust block details. Place blocking to provide access to pipe and fittings for repairs or extensions of line.

Install turned wood or plastic plugs, properly sized, in pipe and fittings to prevent ingress of water, mud, dirt and debris at all times. Do not use rags, clothing or other means.

Install slip type rubber gasket joints to manufacturer's directions. If requested, provide copies of manufacturer's directions on site for reference and obtain technical assistance from manufacturer or representative.

Ensure that valve box can be adjusted up or down at least 300 mm. It is intended that valve boxes installed at this time to finished crushed gravel elevation, will be raised at the time of paving without having to supply a new upper extension.

7.3.2 Bedding Pipes

Excavate trenches to widths not less than 300 mm greater than pipe diameter. Maximum width at top of pipe zone shall not exceed outside pipe diameter plus 600 mm, plus allowance for timbering, if required.

Excavate below bottom of trench at joints as required to provide working space. Body of pipe to rest on minimum 100 mm firmly compacted sand bedding throughout its length.

Place sand bedding for PVC pipe as per trench bedding and installation and backfill Class B granular surround as detailed in the structural drawing attached. If site material meets bedding sand specification requirements, it may be used to replace the top 300 mm of bedding sand.

For trench in rock, bed pipe on minimum of 150 mm of compacted sand.

7.3.3 Setting and Jointing Valves

Check and ensure stuffing glands on valves are properly packed before installation.

Set valves accurately in position, set valve box carefully over hood with shaft vertical and cap at proper level plus or minus 50 mm from elevations provided by the County.

Anchor valves to prevent movement under unbalanced pressure conditions when recommended by pipe manufacturer.

Check operation of valves in presence of the County before testing and after testing.

7.3.4 Thrust Blocks

Do concrete work in accordance with Section 21 – Curb, Gutter and Sidewalks.

Cement to be sulfate resistant Portland cement.

Place concrete thrust blocks between undisturbed ground, tees, plugs, caps, bends, reducers, hydrants, and fittings.

Keep joints and couplings free of concrete.

Do not backfill over concrete within 24 hours after placing.

7.3.5 Tracer Wire

Tracer wire to be 14 gauge continuously conducting copper wire complete with white coloured insulation of a minimum 1/64" thickness. Wire shall be taped to the pipe with standard electrical tape as required to facilitate proper installation.

7.3.6 Testing Watermains

Watermain testing may be carried out when all the following conditions have been met:

a) a section of watermain not exceeding 365 meters in length has been completed.

b) the section has been carefully filled with water and allowed to sit for at least 24 hours.

c) reaction or thrust blocking within the section has reached 15.0 MPa design strength.

If all the conditions have been met, apply a constant pressure of 1035 KPa for a minimum of two hours to mains, hydrants, valves and services. Make good all defects at no additional cost to Owner. Ensure all water service connections are turned off at curb stops to avoid damage to private plumbing.

Conduct leakage tests after completion of pressure testing. Conduct leakage tests at 1035 KPa in accordance with AWWA C600-82 procedures. Allowable leakage will be calculated using the following formula:

Allowable leakage = $N \times D \times P^{0.5} \div 128320$ = Litres per hour

Where N = Number of joints; D = nominal diameter of pipes (mm); and P = average test pressure (kPa).

If test leakage in any section is greater than permitted by AWWA Standards, locate and repair defective pipe joints until leakage is within permitted allowance. Test pipelines in sections not exceeding 365 m in length.

Provide all equipment and labour for tests.

7.3.7 Flushing and Disinfecting Watermains

After completing satisfactory hydrostatic tests and before placing into service, flush all mains to remove as much foreign matter as possible from system. Flush at minimum velocity of 0.8 meters per second as required by AWWA C651-99 procedures (250 mm line requires 2 - 50 mm openings to provide the required flushing velocity).

After flushing, disinfect mains by pumping chlorine solution into mains through a special main cock at beginning of line near source of water. Do not use hydrants at point of application for disinfectant.

Introduce disinfectant according to AWWA C651-99 and to approval of the County and Provincial Ministry of Health.

Conform to AWWA C651-99 for quantity of disinfectant, method of distribution throughout system and final flushing.

After final flushing and before placing watermain in service, the Contractor will collect samples in sterile bottles from an approved sampling point. The sampling is to be witnessed by local authorities as necessary. Samples will be submitted to Provincial Ministry of Health for testing and test results forwarded to Local Authorities. Bacteriological testing will be provided.

If initial disinfection fails to produce satisfactory results, repeat disinfection until satisfactory samples are obtained.

Dechlorination of the chlorinated water may be required in some circumstances before discharging the water to the environment in order to meet the regulatory requirements of Cypress County or Alberta Environment. Dechlorination, if required, is to be performed by adding neutralizing chemicals (AWWA C651-86, Appendix B) to the chlorinated water as it is flushed from the system and before it enters the receiving environment.

Chlorinated water may be discharged into a sanitary sewer if available. Prior to discharging into sanitary sewer, you must receive written approval from Cypress County.

7.3.8 Markers

A 50 mm by 100 mm stake, from 600 mm below ground to 600 mm above ground level shall be placed at each water valve, the top 600 mm to be painted blue.

END OF SECTION

8 SANITARY SEWER MAINS

8.1 GENERAL

8.1.1 Work Included

Provide all labour, products and equipment required for the work, including but not limited to:

a) bedding under and over piping
b) sanitary sewers and appurtenances
c) manholes and appurtenances
d) cleaning sewers
e) testing sewers
f) connection to existing systems

8.1.2 Quality Standards and Assurances

Products, workmanship and testing shall conform to standards specified in this section.

All products and workmanship are subject to inspection by the County.

Perform all tests required by the specifications and by authorities having jurisdiction.

Notify the County and authorities a minimum of 48 hours before testing to permit inspection and to allow tests to be witnessed.

Do not cover any work before inspection and testing unless authorized by the County in writing.

Remove or repair defective products or work which fails to meet specified requirements as directed by the County.

8.2 PRODUCTS

8.2.1 Sewer Pipe

Non-reinforced pipe and fittings to CAN/CSA-A259.1 Class 3, designated for flexible rubber gasket joints to CAN/CSA-A257.3.

Reinforced concrete pipe meeting ASTM Specification C76- CSA-A257.2-M92.

PVC pipe and fittings - DR 35 meeting ASTM Specification D3034 and CSA-B182.2 and CSA-B182.1 may be utilized for mains up to and including 375 mm diameter with prior approval of the County.

Cement - sulfate resisting Portland for all concrete pipe, meeting Type 50 CSA-A5.

8.2.2 Pipe Joints

For all sewers - as recommended by pipe manufacturer, to produce watertight joints with infiltration within specified limits.

Concrete pipe - rubber gasket to ASTM C443, and CAN/CSA A257.3-M92

PVC - rubber gasket to ASTM 03212 or ASTM F477.

8.2.3 Pre-cast Concrete Manhole Units

To meet requirements of ASTM C478 and CSA A257.4 to dimensions shown on drawings.

Cement - sulfate resisting Portland, CSA A5, Type 50.

Pre-cast bases to be minimum 20.7 MPa concrete.

8.2.4 Concrete Blocks and Bricks

Solid concrete, conforming to CSA A165.1 and 165.2 and ASTM C139, not less than 128 mm thick for block, standard dimensions for brick, true to shape, free from cracks and surface defects, compressive strength not less than 17.2 MPa, absorbing not more than 8% water by weight during 24 hours immersion test performed after drying.

Cement - sulfate resisting Portland CSA A5, Type 50.

8.2.5 Mortar

For pipe joints and all other parts of the work, one part sulfate resisting Portland cement to two parts clean sand, by volume.

8.2.6 Cast Iron Frame, Covers and Grates

For manholes and catch basins, close-grained grey cast iron, meeting ASTM A48, Class 20, true in form and dimension, free from faults, sponginess, cracks, blowholes and other defects. Cast steel to conform to ASTM A27, grade 70-36. Substitution of ductile iron meeting ASTM A445 for cast iron or cast steel shall be subject to approval of County.

Machine or grind frames, covers and grates to even non-rocking bearing surfaces.

Hot dip in asphaltic varnish.

Manhole covers and frames:

a) Sanitary - Norwood Foundry Model F-39, or NF-80, or approved equal

8.2.7 Manhole Steps

Manhole steps shall be 19 mm diameter, epoxy coated safety rungs spaced at a maximum distance of 400 mm center to center for full height.

Safety steps to be spaced at a maximum 400mm with the first step 600mm from frame and cover and 300mm above benching.

8.2.8 Safety Platforms

Safety platforms shall be aluminum grates to MSU Mississauga or approved equal.To be installed according to manufacturer’s recommendations.

To be installed on manholes greater than 5.0 meters in depth when measured from the top of the frame to the lowest invert.

8.2.9 Concrete

Ready-mixed concrete, sulfate resisting, Portland cement CSA A5, Type 50, 20 Mpa compressive strength at 28 days of age, to CSA A23.1

8.2.10 Reinforcing Steel

CSA G30.12 or G30.13, 34.5 Mpa minimum yield, Grade 50 all deformed except where noted otherwise. Use Grade 40 for ties.

8.2.11 Sewer Pipe Tests and Rejection

Include all costs for testing, supply and delivery of specimens to testing laboratory and replacing defective material.

The County reserves the right to select, either on site or at the manufacturer's stockpile, 0.5% of total length of each category of pipe for testing, minimum number of lengths as follows:

a) for each category of over 100 lineal meters – 4 lengths

b) for each category of over 50 lineal meters and less than 100 lineal meters – 2 lengths

c) for each category of less than 50 lineal meters – 1 length.

Where the County has selected full sized pipe specimens for load tests, deliver these specimens to an approved testing laboratory. Results of the tests shall be mailed directly to the County in triplicate as well as be forwarded in digital format. Pipe will be accepted, based on certified factory tests, provided they are done under supervision of an independent testing agency. All pipe tests shall be performed in accordance with ASTM Specifications.

Should any specimens fail to meet test requirements, test two additional selected specimens for each failure. Pipe will be acceptable only if all re-test specimens meet requirements. Should test results be unsatisfactory, all or part of pipe supplied may be rejected and acceptance withheld until satisfactory tests of pipe in place are conducted.

Inspect pipe on delivery and reject any that fails to meet specified requirements. Replace rejected pipe with satisfactory pipe without delay. Mark all rejected pipe plainly as "Rejected" and immediately remove from site.

The County may require submission of a manufacturer's report verifying satisfactory random testing of the pipe designated for this project.

8.3 EXECUTION

8.3.1 Bedding Sewers

Excavate trenches to widths not less than 300 mm greater than pipe diameter. Maximum width at top shall not exceed outside pipe diameter plus 600 mm.

Bed pipe per trench bedding and initial backfill Class "B" granular surround conditions for plastic pipe and Granular Foundation from concrete pipe, as detailed in the standard drawings attached.

Obtain County approval for all materials to be used in the pipe bedding zone.

8.3.2 Laying and Jointing Pipe

Commence laying at lower end of line, lay pipes and specials true to line and grade, socket ends up grade, joints close and evenly butted all around pipe. Take special care to prevent sagging of spigot end in hub and provide true, even invert surface throughout entire length of sewer. Excavate at end of each pipe to provide rest for socket, sufficient to permit proper jointing. Clean pipe interior, remove all dirt, mud and other extraneous materials.

8.3.3 Cleaning Sewer Mains

On completion of construction of mains and services, flush and string, (in readiness for CCTV inspection) all mains until all deposits of earth or other material are removed. If new system connects to an existing system, plug outgoing line at manhole at junction and remove dirt and debris at that manhole. Do not permit debris from new construction to enter existing system. Pay all costs for repairs where damages occur due to negligence. Pay all costs of water from the municipal authority.

During flushing operations, check all manholes. If depth of flow in any manhole is greater than should be anticipated, bucket main and remove obstructions in pipe line. Pay all costs for required repairs.

Whenever practicable, flush out in runs not over 250 meters. Remove all foreign material from each run before proceeding with next.

8.3.4 Testing

General

1. All Sanitary Sewer Mains shall be inspected by CCTV after backfilling of the trench to finished grade. CCTV inspection shall be performed by the Contractor on all Sanitary Sewer Mains, unless otherwise directed by the Engineer. The Contractor shall employ a qualified CCTV Contractor acceptable to the Owner.
2. Sewer Mains shall be flushed prior to the CCTV Inspection. The CCTV Inspection shall be performed immediately after the Sewer Mains have been flushed.
3. All CCTV inspection shall be carried out in the presence of the Engineer, who shall be given at least two (2) working days advance notice of any testing to be carried out.
4. Two (2) copies of the CCTV video in DVD format and report (to NASSCO Standards) shall be submitted to the Engineer. Reports to be in a format complying with PACP codes developed by NASSCO.
5. Acceptance of the Sewer CCTV Inspection shall be based on the County's review of all submitted material.

CCTV Testing Equipment

1. The CCTV Contractor shall provide all equipment and materials necessary to conduct the inspection as specified herein.
2. The CCTV Operator shall be certified by NASSCO and certification shall be supplied prior to commencing the work.
3. The CCTV equipment shall be a self-contained camera and monitoring unit connected by cable. It must be waterproof and be capable of lighting the entire pipe. Picture capabilities must be of quality to show the entire pipe periphery and display accurate colors. There must be capability of providing measurement within the line to an accuracy of 0.1% or 0.3m whichever is greater. Picture quality must be such to produce a continuous 600 line resolution picture showing the entire periphery of the pipe. The following capabilities and items must be available:
    1. A direct voice communication
    2. A solid state camera with pan and tilt capabilities mounted on a crawler

3. Self-contained electrical power

4. Proper safety equipment to protect employees and the general public

5. Position camera lens centrally in the pipeline with a positioning tolerance of ±10% off the vertical centreline axis of the pipeline

4. The camera's rate of progress shall be uniform during inspection and shall not exceed the following limits:

    1. 0.10 m/s for pipe diameters less than 200 mm

    2. 0.15 m/s for pipe diameters 200 mm and larger but not exceeding 310 mm

    3. Camera to be stationary when panning and tilting defects or pipe features

CCTV Report

1. A CCTV log shall be maintained during the inspection reporting any defects based on PACP Codes developed by NASSCO or any other defect affecting the overall performance of the Sewer Main. The location of the defect shall be referenced from the manhole where the CCTV camera was inserted. A color photo of the defect shall be required as well as a pan and tilt clearly showing defect.

2. The log shall include service connections with comments of condition. The CCTV report shall also contain a pan and tilt of each service connection.

3. Manhole identity shall be noted clearly as indicated on the drawings.

4. Two (2) copies of the final inspection report with corresponding video referenced to the text, along with two (2) copies of the video media (DVD), shall be submitted within two weeks after compilation of inspection.

5. Pipe condition comments made in the report shall be in NASSCO Industry Terminology.

CCTV Cleaning

1. The Contractor is responsible for cleaning and flushing all lines prior to CCTV inspection.

CCTV Miscellaneous

1. The Contractor shall be responsible for all works performed by the subcontractor, for traffic control and any other related work incidental to the completion of CCTV inspection.

CCTV Inspection and Acceptance

1. The location of all deficient work will be recorded and the Contractor will be required to repair, restore or otherwise make good, to the satisfaction of the Engineer, any deficient work including the repair of alignment problems, cracked or broken pipe, deformed pipe, leaks or any other faults not conforming with these specifications or the pipe manufacturers which the CCTV inspection revealed.

2. After the deficiencies are repaired and corrected and before final acceptance, the Owner reserves the right to have the faulty areas re-inspected at the Contractor's expense.

8.3.5 Manholes

Construct manholes as shown on drawings, unless otherwise permitted in writing by the County. Submit full details of any proposed alternative construction with bid.

For cast-in-place concrete for manholes, conform to CSA A23.1.

Place manholes accurately, plumb, in alignment and at exact plan location.

Construct manholes watertight and complete, including finishing flow bottoms, as work proceeds. Do not lay pipe in advance more than two manholes ahead of last completed manholes.

Shape bottoms accurately for necessary flows as shown on drawings or as directed by the County. In manholes with sewers 610 mm in diameter and smaller, form invert through manhole with half-round pipe. In manholes containing lot services, shape bottoms to provide slopes required to ensure no build-up of sewage occurs in manholes.

Place stubs for future lines accurately and plug watertight. Shape flow bottoms to suit future lines.

At all bends through manholes, provide 50 mm drop in invert from inlet to outlet.

Support pipes at manholes to prevent shearing or settlement. Where not detailed use concrete fill, concrete or timber beam, or suitably compacted gravel.

During construction, plug pipes at manholes to prevent entry of concrete and mortar. Remove plugs immediately after construction is completed.

Set covers accurately within 15 mm of correct grade. On sloping streets, set covers to match slopes.

Set all precast concrete sections, bricks, blocks and frames in mortar. Tool joints smooth and point all voids after setting.

All sanitary manhole barrels are to be sealed with rubber neck to prevent infiltration.

END OF SECTION

9 STORM WATER MAINS

9.1 GENERAL

9.1.1 Work Included

Provide all labour, products and equipment required for the work, including but not limited to:

a) bedding under and over piping
b) storm water mains and appurtenances
c) manholes, catchbasins and appurtenances
d) cleaning sewers
e) testing sewers
f) connection to existing systems

9.1.2 Quality Standards and Assurances

Products, workmanship and testing shall conform to standards specified in this section.

All products and workmanship are subject to inspection by the County.

Perform all tests required by the specifications and by authorities having jurisdiction.

Notify the County and authorities in ample time before testing to permit inspection and to allow tests to be witnessed.

Do not cover any work before inspection and testing unless authorized by the County in writing.

Remove or repair defective products or work which fails to meet specified requirements as directed by the County.

9.2 PRODUCTS

9.2.1 Pipe

Products listed in this section are generally accepted by Cypress County. Any deviation or alternative product will require approval from Cypress County.

Non-reinforced pipe and fittings to CAN/CSA-A259.1 class 3, designated for flexible rubber gasket joints to CAN/CSA-A257.3.

Reinforced concrete pipe meeting ASTM Specification C76-70 CSA-A257.2-M92.

PVC pipe and fittings - DR 35 meeting ASTM Specification D3034 and CSA-B182.2 and CSA-B182.1 may be utilized for mains up to and including 375 mm diameter with prior approval of the County.

Ribbed PVC pipe and fittings to meet CSA B182.4, ASTM F794 with pipe stiffness of 320 kPa as measured in accordance with ASTM D2412. Maximum long term deflection is less than 7.5%

Cement - sulfate resisting Portland for all concrete pipe, meeting Type 50 CSA-A5.

9.2.2 Pipe Joints

For all sewers - as recommended by pipe manufacturer, to produce watertight joints with infiltration within specified limits.

Concrete pipe - rubber gasket to ASTM C443 and CSA A257.3.

PVC - rubber gasket to ASTM 03212 or ASTM F477.

9.2.3 Pre-cast Concrete Manhole Units

To meet requirements of ASTM C478 and CSA A257.4 to dimensions shown on drawings.

Cement - sulfate resisting Portland, CSA A5, Type 50.

Manhole steps shall be 19 mm diameter, galvanized iron safety rungs spaced at a maximum distance of 400 mm center to center for full height.

Pre-cast bases to be minimum 20.7 MPa concrete.

9.2.4 Concrete Blocks and Bricks

Solid concrete, conforming to CSA A165.1 and 165.2 and ASTM C139, not less than 128 mm thick for block, standard dimensions for brick, true to shape, free from cracks and surface defects, compressive strength not less than 17.2 MPa, absorbing not more than 8% water by weight during 24 hours immersion test performed after drying.

Cement - sulfate resisting Portland CSA A5, Type 50.

9.2.5 Catch Basins

To meet requirements of ASTM C478 and CSA A257.2, 910 mm diameter reinforced concrete riser, reinforced pre-cast concrete base slab, to details shown on drawings.

Cement - sulfate resisting Portland CSA A5, Type 50.

9.2.6 Catch Basin Lead Pipes

Catch basin lead pipes shall be:

a) Non-reinforced concrete pipe to meet CSA A257.1

b) PVC pipe DR 35 to meet ASTM D3034 or approved equivalent.

Pipe diameter shall be 250mm diameter for single catch basins and 300mm diameter for twinned catch basins with a minimum grade of 2%.

9.2.7 Mortar

For pipe joints and all other parts of the work, one part sulfate resisting Portland cement to two parts clean sand, by volume.

9.2.8 Cast Iron Frame, Covers and Grates

For manholes and catch basins, close-grained grey cast iron, meeting ASTM A48, Class 20, true in form and dimension, free from faults, sponginess, cracks, blowholes and other defects. Cast steel to conform to ASTM A27, grade 70-36. Substitution of ductile iron meeting ASTM A445 for cast iron or cast steel shall be subject to approval of the County.

Machine or grind frames, covers and grates to even non-rocking bearing surfaces.

Hot dip in asphaltic varnish.

Manhole covers and frames:

a) Storm - Norwood Foundry Model F-39, or approved equal

Catch basin covers and frames:

a) Rolled monolithic curb and gutter - Norwood Foundry Model F-33

b) Round Top Catch Basin - Norwood Foundry Model F-49

c) Side inlet - Norwood Foundry Model F-51.

9.2.9 Manhole Steps

Safety type, 19 mm diameter solid steel bar, epoxy coated after fabrication.

Safety steps shall be spaced at 400mm maximum with 600mm maximum from the rim and 300mm max from the benching.

9.2.10 Safety Platforms

Safety platforms shall be aluminum grates to MSU Mississauga or approved equal.

To be installed according to manufacturer's recommendations.

To be installed on manholes greater than 5.0 meters in depth when measured from the top of the frame to the lowest invert.

9.2.11 Concrete

Ready-mixed concrete, sulfate resisting, Portland cement CSA A5, Type 50, 20 MPa compressive strength at 28 days of age, to CSA A23.1

9.2.12 Reinforcing Steel

CSA G30.12 or G30.13, 34.5 MPa minimum yield, Grade 50 all deformed except where noted otherwise. Use Grade 40 for ties.

9.2.13 Sewer Pipe Tests and Rejection

Include all costs for testing, supply and delivery of specimens to testing laboratory and replacing defective material.

The County reserves the right to select, either on site or at the manufacturer's stockpile, 0.5% of total length of each category of pipe for testing, minimum number of lengths as follows:

a) for each category of over 100 lineal meters - 4 lengths

b) for each category of over 50 lineal meters and less than 100 lineal meters - 2 lengths

c) for each category of less than 50 lineal meters - 1 length.

Where the County has selected full sized pipe specimens for load tests, deliver these specimens to an approved testing laboratory. Results of the tests shall be mailed directly to the County in triplicate as well as forwarded in digital format. Pipe will be accepted, based on certified factory tests, provided they are done under supervision of an independent testing agency. All pipe tests shall be performed in accordance with ASTM Specifications.

Should any specimens fail to meet test requirements, test two additional selected specimens for each failure. Pipe will be acceptable only if all re-test specimens meet requirements. Should test results be unsatisfactory, all or part of pipe supplied may be rejected and acceptance withheld until satisfactory tests of pipe in place are conducted.

Inspect pipe on delivery and reject any that fails to meet specified requirements. Replace rejected pipe with satisfactory pipe without delay. Mark all rejected pipe plainly as "Rejected" and immediately remove from site.

The County may require submission of a manufacturer's report verifying satisfactory random testing of the pipe designated for this project.

9.3 EXECUTION

9.3.1 Bedding Sewers

Excavate trenches to widths not less than 300 mm greater than pipe diameter. Maximum width at top shall not exceed outside pipe diameter plus 600 mm.

Bed pipe per trench bedding and initial backfill Class "B" granular surround conditions for plastic pipe and granular foundation for concrete pipe, as detailed in the standard drawings attached.

a) obtain the County's approval for all materials to be used in the pipe bedding zone.

9.3.2 Laying and Jointing Pipe

Commence laying at lower end of line, lay pipes and specials true to line and grade, socket ends up grade, joints close and evenly butted all around pipe. Take special care to prevent sagging of spigot end in hub and provide true, even invert surface throughout entire length of sewer. Excavate at end of each pipe to provide rest for socket, sufficient to permit proper jointing. Clean pipe interior, remove all dirt, mud and other extraneous materials.

Weeping tile shall be tied directly to storm sewer/manhole as per Section 10 – Lot Service Connections. There shall be No storm sewer connections of any kind permitted to a sanitary main or sanitary manhole.

9.3.3 Cleaning Sewer Mains

On completion of construction of mains and services, flush and string, (in readiness for C.C.T.V. inspection) all mains until all deposits of earth or other material are removed. If new system connects to an existing system, plug outgoing line at manhole at junction and remove dirt and debris at that manhole. Do not permit debris from new construction to enter existing system. Pay all costs for repairs where damages occur due to negligence. Pay all costs of water from the municipal authority.

During flushing operations, check all manholes. If depth of flow in any manhole is greater than should be anticipated, bucket main and remove obstructions in pipe line. Pay all costs for required repairs.

Whenever practicable, flush out in runs not over 250 meters. Remove all foreign material from each run before proceeding with next.

9.3.4 Testing

General

1. All Storm Sewer Mains shall be inspected by CCTV after backfilling of the trench to finished grade. CCTV inspection shall be performed by the Contractor on all Storm Sewer Mains, unless otherwise directed by the Engineer. The Contractor shall employ a qualified CCTV Contractor acceptable to the Owner.
2. Sewer Mains shall be flushed prior to the CCTV Inspection. The CCTV Inspection shall be performed immediately after the Sewer Mains have been flushed.

3. All CCTV inspection shall be carried out in the presence of the Engineer, who shall be given at least two (2) working days advance notice of any testing to be carried out.

4. Two (2) copies of the CCTV video in DVD format and report (to NASSCO Standards) shall be submitted to the Engineer. Reports to be in a format complying with PACP codes developed by NASSCO.

5. Acceptance of the Sewer CCTV Inspection shall be based on the County's review of all submitted material.

CCTV Testing Equipment

1. The CCTV Contractor shall provide all equipment and materials necessary to conduct the inspection as specified herein.

2. The CCTV Operator shall be certified by NASSCO and certification shall be supplied prior to commencing the work.

3. The CCTV equipment shall be a self-contained camera and monitoring unit connected by cable. It must be waterproof and be capable of lighting the entire pipe. Picture capabilities must be of quality to show the entire pipe periphery and display accurate colors. There must be capability of providing measurement within the line to an accuracy of 0.1% or 0.3m whichever is greater. Picture quality must be such to produce a continuous 600 line resolution picture showing the entire periphery of the pipe. The following capabilities and items must be available:

    1. A direct voice communication
    2. A solid state camera with pan and tilt capabilities mounted on a crawler
    3. Self-contained electrical power
    4. Proper safety equipment to protect employees and the general public
    5. Position camera lens centrally in the pipeline with a positioning tolerance of ±10% off the vertical centreline axis of the pipeline

4. The camera's rate of progress shall be uniform during inspection and shall not exceed the following limits:

    1. 0.10 m/s for pipe diameters less than 200 mm
    2. 0.15 m/s for pipe diameters 200 mm and larger but not exceeding 310 mm
    3. Camera to be stationary when panning and tilting defects or pipe features

CCTV Report

1. A CCTV log shall be maintained during the inspection reporting any defects based on PACP Codes developed by NASSCO or any other defect affecting the overall performance of the Sewer Main. The location of the defect shall be referenced from the manhole where the CCTV camera was inserted. A color photo of the defect shall be required as well as a pan and tilt clearly showing defect.

2. The log shall include service connections with comments of condition. The CCTV report shall also contain a pan and tilt of each service connection.

3. Manhole identity shall be noted clearly as indicated on the drawings.

4. Two (2) copies of the final inspection report with corresponding video referenced to the text, along with two (2) copies of the video media (DVD), shall be submitted within two weeks after compilation of inspection.

5. Pipe condition comments made in the report shall be in NASSCO Industry Terminology.

CCTV Cleaning

1. The Contractor is responsible for cleaning and flushing all lines prior to CCTV inspection.

CCTV Miscellaneous

1. The Contractor shall be responsible for all works performed by the subcontractor, for traffic control and any other related work incidental to the completion of CCTV inspection.

CCTV Inspection and Acceptance

1. The location of all deficient work will be recorded and the Contractor will be required to repair, restore or otherwise make good, to the satisfaction of the Engineer, any deficient work including the repair of alignment problems, cracked or broken pipe, deformed pipe, leaks or any other faults not conforming with these specifications or the pipe manufacturers which the CCTV inspection revealed.

2. After the deficiencies are repaired and corrected and before final acceptance, the Owner reserves the right to have the faulty areas re-inspected at the Contractor's expense.

9.3.5 Manholes

Construct manholes as shown on drawings, unless otherwise permitted in writing by the County. Submit full details of any proposed alternative construction with bid.

For cast-in-place concrete for manholes, conform to CSA A23.1.

Place manholes accurately, plumb, in alignment and at exact plan location.

Construct manholes watertight and complete, including finishing flow bottoms, as work proceeds. Do not lay pipe in advance more than two manholes ahead of last completed manholes.

Shape bottoms accurately for necessary flows as shown on drawings or as directed by the County. On manholes with sewers 610 mm diameter and smaller, form invert through manhole with half-round pipe. At manholes containing lot services shape bottoms to provide slopes required to ensure no build-up of sewage occurs in manholes.

Place stubs for future lines accurately and plug watertight. Shape flow bottoms to suit future lines.

At all bends through manholes, provide 50 mm drop in invert from inlet to outlet.

Support pipes at manholes to prevent shearing or settlement. Where not detailed, use concrete fill or suitably compacted gravel.

During construction, plug pipes at manholes to prevent entry of concrete and mortar. Remove plugs immediately after construction is completed.

Set covers accurately within 15 mm of correct grade. On sloping streets, set covers to match slopes.

Set all precast concrete sections, bricks, blocks and frames in mortar. Tool joints smooth and point all voids after setting.

All sanitary manhole barrels are to be sealed with rubber neck to prevent infiltration. Gaskets for storm manholes only, may be omitted at the discretion of the County.

END OF SECTION

10 LOT SERVICE CONNECTIONS

10.1 GENERAL

10.1.1 Work Included

Provide all labour, products and equipment required for the lot service connections, including but not limited to:

a) water service piping

b) sewer service piping

c) corporation cocks, connection to main

d) curb stops, service boxes, service markers

10.1.2 Quality Standards and Assurances

Products and workmanship shall conform to applicable municipal and provincial standards and to specifications.

All products and workmanship will be subject to inspection by the County.

Perform all tests required by authorities having jurisdiction. Test water and disinfect services with mains.

Notify the County and authorities in ample time before testing to permit inspection and to allow tests to be witnessed.

Do not cover work before inspection and testing unless authorized by the County in writing.

Remove or repair defective products or work which fails to meet specified requirements as directed by the County.

10.2 PRODUCTS

10.2.1 Service Pipe, Fittings

Underground copper service pipe - type K soft copper for a diameter of 25 mm and less, and Type K copper and approved PVC materials for diameters greater than 25 mm.

Municipex/Kitec – For sizes of 50mm or less.

Main or corporation cocks – Compression type AWWA thread.

Curb stops – Copper to copper ball valve with a drain. Curb stops 38 mm or larger shall be ball bearing type.

Couplings – Standard Brass Compression type.

Service Boxes – Epoxy coated extension type for a maximum extension of 3.5 m, complete with stainless steel operating rod, brass clevis and brass or stainless steel key. Service box to be supported on a pressure treated preserved wood plank or brick.

Service Clamps – Bronze double strap conforming to Smith-Blair 323 or approved stainless steel AWWA Boss.

2.3 kg Zinc Anode Protection to be installed as indicated on Drawing No. 8-300.

Service boxes to be adjustable from 2.4 m to 3.0 m bury, unless otherwise noted on drawings.

10.2.2 Sewer Service Pipe

PVC, SDR 35 minimum.

10.2.3 Sewer Saddles

Manufactured tee saddles, gasketed joints secured with double steel clamps.

10.2.4 Sand Bags

Bags to be new material and in a condition acceptable to the County. Sand to be clean and free from debris, conforming to imported sand requirements as specified in section 02161 Trenching and Backfilling for Utilities.

10.2.5 Rigid Foamed Urethane Insulation

Density (ASTM D1622) not less than 28.8 kg/cubic meter. (Nominal 32.0 kg).

Closed cell content (ASTM D2856) not less than 90%.

Water absorption (ASTM D2842) not greater than 0.34 kg/square meter.

Initial thermal conductivity (ASTM D2326) (K Factor) not greater than watts/meter degree Celsius.

Dimensional stability (ASTM D2126)

Compressive strength (ASTM D1621) not less than 206.8 kPa at 10% deflection.

10.3 EXECUTION

10.3.1 Water Services

Use tapping machine to drill, tap and thread corporation main stop into main. Use special care to prevent cuttings falling into main. Wherever possible, tap main under pressure and obtain written approval from the County to do otherwise.

Lay copper service pipe to designated location and connect to existing service lines. Service connections shall be tapped into the upper portion of the watermain at an angle of at least 45 degrees from the horizontal. Tappings shall have a minimum spacing of at least 600 mm. Attach curb stop and set service box to grade where required.

Brace boxes securely to keep plumb during backfilling. Test for operation both before and after pressure test.

Where curb stop is located under sidewalk, concrete slab or other structure, set top of extension service box flush with surface and fill hole around pipe neatly with concrete.

Use service clamps on all services tapped into 150 mm mains and on 25 mm and larger services tapped into 200 mm to 300 mm lines. In all other cases, use service clamps where size of main stop is larger than recommended for size of main.

Place water service lines at least 2.7 m below final finished grade elevations, unless otherwise directed.

Lay water service lines in same trench with sewer service line. Install sanitary services on left side of water service as viewed from main towards property line. Install storm sewer service on right side of water service as viewed from main towards property line. Paint last 1 m of sanitary service pipe red. Paint last storm service pipe green. Make all connections to existing services using appropriate couplings.

Lot service connections to residential lots (R.1 and R.2) shall be installed inside property line to easement line for lane servicing; and to property line, or easement line if an easement exists, for street servicing. (as shown on the drawings) Water services connections to residential lots (R.1 and R.2) shall be 0.15 m short of the easement line for lane servicing and 0.15 m outside property line or easement line if an easement exists, for street servicing.

The County may require the delivery of curb stop risers to the public works yard. The Contractor shall confirm this requirement with the County and shall provide evidence of a receipt signed by the Public Works employee accordingly.

10.3.2 Sewer Services

Connect services to mains with manufactured tee or wye fittings placed in mains, or by cutting into mains and installing manufactured tee saddles or wye saddles and 45 degree bends. Take care to avoid cracking pipe and remove all cuttings from pipe. Secure joint between saddle and main with mortar or other means acceptable to the County.

Do not allow spigots or other obstructions to project into main. Lay service pipe to an even gradient as directed.

Install service lines as detailed, at locations and to grade designated by grade sheet provided in field. Install services at right angle to main, unless otherwise specified.

Bends permitted only at two (2) locations – 45 degree bend with wye or 22.5 degree bend with tee connection at main, 45 degree bend at top of riser and 22.5 degree bend maximum at property line for house service connection between these points.

Support service lines adequately to prevent dislocation, buckling or settlement. When water lines must be laid below sewer lines, ensure that backfill over water lines is adequately compacted to prevent settlement or dislocation of sewers.

When a connection cannot be made directly to a house service line, plug end of sewer service to prevent entry of water and dirt.

Install service risers only where noted on the lot grading plan. Ensure adequate support for the riser section utilizing sandbags or screened rock.

10.3.3 Markers

A 50 mm by 100 mm marker stake, from invert elevation to 600 mm above ground level shall be placed at the end of each water service line, the top 600 mm to be painted blue. Place a 100mm diameter white PVC pipe over the water service box from 600mm below ground to 600mm above ground.

10.3.4 Cross Connections

Due care and attention will be required to mitigate any cross connections of the storm and sanitary services.

Should a cross connection be discovered it will be rectified at no cost to Cypress County.

END OF SECTION

11 ADJUSTMENT OF APPURTENANCES

11.1 GENERAL

11.1.1 Valve and Curb Boxes Adjustments

Valve box tops and curb box tops shall be adjusted so that the top of the box is set exactly to the required elevation. The Contractor shall shorten or lengthen the boxes and stems as required and block the boxes to prevent any settlement. The adjustments shall be made so that the boxes are plumb and the valves operate effectively. The rock guard and operating nut are to be located no closer than 300mm below the proposed finished grade.

Valve box extensions shall be 75mm, 100mm, and 150mm cast iron conforming to ASTM A48 Class 25 and to be completely coated with asphaltic type varnish to prevent corrosion.

11.1.2 Manhole and Catch Basin Adjustments

Manhole and catch basin frames shall be adjusted so that the top of the cover is set exactly to the required elevation. Where it is necessary to raise manhole frames it shall be done with approved precast rings or blocks meeting the requirements of the current issue of ASTM C478 or infra-riser rubber or steel riser rings. Joints between slab top blocks, and frame shall be mortared, and the joints finished flush and smooth. Joints between slab top, precast rings, and frame shall be made watertight utilizing preformed bituminous gaskets or other approved sealant. Under no circumstances shall the depth from the rim of the manhole to the first ladder rung be more than 800mm.

11.1.3 Damaged Appurtenances

The Contractor shall replace any appurtenances damaged by his work or forces. Any existing damaged appurtenances found within the proposed work zone shall be replaced by the Contractor as approved by the County at an agreed lump sum price.

11.1.4 Final Adjustment Elevations

The tops of valve boxes, manholes, and catch basins shall be set to the design elevations, or as approved by the County. Generally, the following shall apply for setting the final elevations of the tops of the appurtenances.

a) in asphaltic pavement, 25mm below the finished surface elevation for manhole frames.

b) in concrete curb & gutter, 10mm below gutter elevation for catch basin frames.

c) in gravel roadways/lanes, 50mm below the surface.

d) in landscape areas, 50mm above the final surface, providing a smooth transition to match the surrounding areas.

END OF SECTION

12 CULVERTS

12.1 GENERAL

12.1.1 Definition

Culverts shall mean galvanized corrugated steel pipes acting as drainage conduits to conduct the flow of surface drainage water.

12.1.2 Terminology

- CSP shall mean Corrugated Steel Pipe.
- CSP Arch means Corrugated Steel Pipe Arch.
- SPCSP means Structural Plate Corrugated Steel Pipe

12.1.3 References

The latest version of the publications listed below form part of this Specification to the extent specified in this Section:

- CSA Standard G401

Corrugated Steel Pipe Institute (CSPI):

- 501-78 Metric Specification for Corrugated Steel Pipe Products.

12.1.4 Quality Assurance

Supply, fabricate and install CSP culverts strictly in accordance with manufacturer's instructions and recommendations and as specified.

12.1.5 Product Delivery and Handling

Deliver to site, handle and store pipes, sections, fittings and hardware in a manner to prevent distortion or bending and damage to metal or galvanized coating.

12.1.6 Job Conditions

Protect CSP pipes before, during and after installation and protect installed work and materials.

In the event of damage, make repairs or replacements necessary to the County’s approval.

12.2 PRODUCTS

12.2.1 Materials

Culvert pipe shall be galvanized corrugated steel pipe complying with CSA Standard G401.

Culvert pipes up to 600mm diameter shall have a wall thickness of 1.6mm and larger pipe up to and including 900 mm diameter, shall have minimum 2.0 mm wall thickness.

Specified wall thicknesses shall not include the thickness of galvanized coating.

The zinc coating mass shall be not less than 1100g/m^2 when tested by the single spot test.

Corrugation profile for the pipes shall be 68 x 13 mm.

End sections (square or bevelled as indicated), couplers, fittings and hardware shall match the culvert pipe.

12.3 EXECUTION

Trench shall be properly drained and free of unsuitable material prior to placing and compaction of bedding material.

12.3.1 Trenching and Excavation

The excavation for the culvert base shall be carried to a depth of not less than 150 mm below the invert grade, as established by the County and shall be of sufficient width to permit pipe assembly and to accommodate operation of compaction equipment on either side of the culvert.

12.3.2 Culvert Bedding

Place minimum 150 mm thick layer of compacted granular material on bottom of excavation. Place material in uniform layers not exceeding 150 mm thickness, and compact each layer to at least 95% Standard Proctor Density before placing succeeding layer. Any soft and yielding or other unsuitable material below this level shall be removed to the depth required by the County and backfilled with approved granular material compacted to a uniform density of 95% of Standard Proctor Density throughout the entire length of the culvert.

The base for culverts installed along main water courses or through yielding areas shall consist of gravel bedding compacted to the excavated depth and extending over a width of three (3) times the diameter of the pipe. The depth of this base shall be not less than 300 mm. An impervious compacted bedding material shall be provided for a minimum length of 3 m or three (3) times the diameter of the pipe, whichever is greater, at the inlet end of the culvert to achieve a seal against seepage.

Trench line and grade requires the County's approval prior to placing bedding material or pipe.

Do not backfill until pipe grade and alignment are checked and accepted by the County.

12.3.3 Laying Corrugated Steel Pipe Culverts

Commence pipe placing at downstream end on the prepared granular bedding with separated sections securely joined together by means of a coupling band.

The couplers are to match thickness and corrugations of the pipe.

Corrugations of pipes and couplers must mate before tightening and joints shall be tapped with a mallet during tightening to ensure proper seating of couplers.

Do not allow water to flow through pipes during construction except as permitted by the County.

All culverts shall be laid so that the horizontal seams fall at the sides of the culverts.

The pipe shall be laid true to line and grade as established by the County and the pipe shall be carefully handled to prevent damage to the galvanized coating. Damaged pipe sections shall be immediately reported to the County and repaired and replaced according to his direction. Damaged protective coating shall receive two coats of zinc rich paint.

Centreline of culvert shall not vary from the designated horizontal alignment by more than 75 mm. Invert grade shall not vary from the designated invert grade elevation by more than 12 mm provided positive flow is maintained.

12.3.4 Culvert Backfill

After assembly of the culvert on the bedding, the culvert shall be backfilled with approved granular and random backfill. Backfill shall be brought up on both sides of the culvert simultaneously in 150mm lifts and shall be compacted with a method approved by the County to a minimum density of 95% Standard Proctor.

The backfill shall be spread and compacted in 150 mm layers and special care shall be taken to ensure proper filling and compacting under the haunches and within the culvert corrugations. Heavy equipment shall not be allowed over the culvert until a minimum of 0.5 m of fill is obtained above the crown of the pipe.

12.3.5 Rock Rip – Rap

In rural areas the ends of the culvert shall be finished with the placement of rock rip–rap as shown in the standard details. Within the hamlets the riprap is not to be used as an end treatment for culverts.

12.3.6 Adjustment and Cleaning

Inlet and outlet ends and waterway through the pipe shall be kept free from debris or foreign matter, to prevent restriction to flow of water through the culvert.

END OF SECTION

13 GRANULAR SUB-BASE

13.1 GENERAL

13.1.1 Work Included

The work described in this section pertains to granular sub-base material as detailed on the drawings.

13.2 PRODUCTS

13.2.1 Granular Sub-base

Granular sub-base is the material lying above the subgrade and below the base course. The gradation to be utilized shall be as designated by the County.

13.2.2 Gradation

The granular sub-base material shall consist of rock, gravel, and sand consisting of hard, clean, durable material, free from coatings of silt, clay or other deleterious materials and contain no organic matter.

The following gradation shall apply to pit run granular sub-base courses:

Sieve Size (mm)	% Passing by Mass
150.000	100
80.000	80-100
25.000	50-80
5.000	25-55
0.080	2-10

13.2.3 Approval

Preliminary approval of the material as represented in the test results shall not constitute general acceptance of all material in the deposit or source of supply, and acceptance shall be subject to confirming field tests taken at the discretion of the County. Materials may be considered unsuitable, even though particle sizes are within the limits of the gradation sizes required, if any characteristic precludes satisfactory compaction or if the material fails to provide a roadway suitable for traffic. The acceptability of the final material will be determined by the County.

13.2.4 Quality

The material shall consist of durable rock or gravel. The granular sub-base shall not contain any organic or other deleterious materials. The material shall have a minimum California Bearing Ratio of 55% at the specified compaction as determined by the current issue of ASTM D1883.

13.3 EXECUTION

13.3.1 Placement

The granular sub-base material shall not be placed until the underlying subgrade has been inspected and approved by the County.

Unless otherwise specified, the granular material shall be placed in uniform layers not exceeding 200mm in thickness before compaction. The material shall be placed by mechanical spreaders or deposited in windrows and levelled with a suitable motor grader.

13.3.2 Compaction

The material shall be compacted by rolling with a pneumatic-tired or vibrating roller of a type approved by the County. The material shall be compacted near optimum moisture content to 100% Standard Proctor Density. +/- 2% from Optimum Moisture Content.

If the moisture content exceeds the optimum during compaction, the material shall be aerated by mechanical means until the material has been dried sufficiently to obtain the specified density.

If the moisture content is below optimum, water shall be added by an acceptable applicator and in such quantities to achieve specified compaction.

13.3.3 Shaping and Finishing

A motor grader shall be used in conjunction with the compaction equipment to keep the finished surface of each layer even and uniform. The finished surface of the granular sub-base shall conform to the required cross-section and grades as shown on the drawings or as directed by the County, within a tolerance of 30mm. The sub-base material shall be uniform and show no signs of segregation.

13.3.4 Tests

Field density, moisture content and sieve analysis tests will be carried out by the representative of the County to ensure that the material is satisfactory.

The frequency of field density and moisture content tests shall be 1 test per approximately 100 metres of constructed roadway and at various locations offset left and right of centre line, or as directed by the County.

All sieve tests should comply with the gradation limits as stated in above.

The Contractor will, as the County requires, provide a loaded test vehicle with a minimum 18,200kg gross vehicle weight and operator for visual checks of rutting, weaving, and soft spots.

END OF SECTION

14 GRANULAR BASE COURSE

14.1 GENERAL

14.1.1 Work Included

The work described in this section pertains to base course gravel as detailed on the drawings.

14.2 PRODUCTS

14.2.1 Gradation

Granular base material shall consist of crushed rock and/or crushed gravel and sand consisting of hard, clean, durable material, free from coatings of silt, clay or other deleterious materials, and containing no organic matter. The base course aggregate shall meet the following gradation requirements when tested to ASTM C136 and C117, (AASHTO T11 and T27):

Sieve Size (mm)	% Passing by Mass
20.000	100
16.000	84-94
10.000	63-86
5.000	40-67
1.250	20-43
0.630	14-34
0.315	9-26
0.160	5-18
0.080	2-10

A minimum of 60% by weight of the material retained on the 5,000 sieve shall have at least 2 fractured faces. Other properties shall be as follows:

Liquid Limit:	maximum 25, ASTM D423-66
PlastiMD Index:	maximum 6, ASTM D424-59 Los Angeles Abrasion
Gradation "B":	35% maximum loss by mass, ASTM C131-76
Sand Equivalent:	minimum of 35%, ASTM D2419-74

14.2.2 Approval

Preliminary approval of the material as represented in the test results shall not constitute general acceptance of all material in the deposit or source of supply, and acceptance shall be subject to confirming field tests taken at the discretion of the County.

Materials may be considered unsuitable even though particle sizes are within the limits of the gradation sizes required, if particle shapes are thin or elongated, if any other characteristic precludes satisfactory compaction or if the material fails to provide a roadway suitable for traffic.

The acceptability of the final material will be determined by the County.

14.2.3 Quality

The material shall consist of durable rock or gravel. The base course shall not contain any organic or other deleterious materials. The material shall have a minimum California Bearing Ratio of 55%, as determined by the current issue of ASTM D1883 at the specified compaction.

14.3 EXECUTION

14.3.1 Placement

The granular base course material shall not be placed until the underlying subgrade or granular sub-base course has been inspected and approved by the County. The subgrade or sub-base shall be shaped to cross section shown on the drawings, or as directed by the County, and shall be maintained free of ruts, waves, and undulations by whatever means are necessary.

Unless otherwise specified, the granular material shall be placed in uniform layers not exceeding a 200mm compactive depth. The material shall be placed by mechanical spreaders or deposited in windrows and levelled with a suitable motor grader.

When called in the contract temporary material shall be placed from the granular base course level to the lip of gutter, with a 1% crown. The following year this material shall be excavated, reshaped and re-compacted prior to paving. Any additional material shall be used as sub-base material in lanes or as directed by the County.

14.3.2 Compaction

The material shall be compacted by rolling with a pneumatic-tired or vibrating roller of a type approved by the County. The material shall be compacted near the optimum moisture content to 100% Standard Proctor Density.

For temporary material, compaction shall be 95% Standard Proctor Density.

If the moisture content exceeds the optimum during compaction, the material shall be aerated by mechanical means until it has dried sufficiently to obtain the specified compaction.

If the moisture content is below the optimum, water shall be added by an acceptable applicator and in such quantities to achieve the specified moisture content. Moisture content shall be +/- 2% moisture content.

14.3.3 Shaping and Finishing

A motor grader shall be used in conjunction with compaction equipment to keep the finished surface of each layer even and uniform.

The finished surface of the granular base course shall conform to the required cross-section and grade as shown on the drawings or as directed by the County, within a tolerance of plus or minus 20mm.

The granular base course shall be uniform and show no signs of segregation of the material placed.

14.3.4 Tests

Field density, moisture content and sieve analysis tests will be carried out by the representative of the County to ensure that the material is satisfactory.

The frequency of field density and moisture content tests shall be 1 test per approximately 100 metres of constructed roadway and at various locations offset left and right of centre line, or as directed by the County.

The Contractor will, as the County requires, provide a loaded test vehicle with a minimum 18,200kg gross vehicle weight and operator for visual checks of rutting, weaving, and soft spots.

END OF SECTION

15 HOT MIX ASPHALTIC CONCRETE

15.1 GENERAL

It is the preference of Cypress County to have the latest edition of the Alberta Transportation Standard Specification for Highway Construction 3.50 Asphalt Concrete Pavement (EPS) used for all new hot mix asphaltic concrete road construction within the County.
https://open.alberta.ca/publications/7027236

There may however be circumstances where it not be feasible to use the Alberta Transportation Specification in which case the following asphalt specification will govern with the required approval from the County.

15.1.1 Description

.1 This section specifies requirements for the Hot Mix Asphalt (HMA) concrete paving under a Quality Assurance Specification framework.

.2 The Work includes the supply of aggregates, asphalt binder, Reclaimed Asphalt Pavement (RAP) and anti-stripping agent (where applicable), asphalt plant mixing, transporting, placement, compaction, and finishing, all to the requirements of this specification.

.3 This section includes the material requirements, material certification, quality control testing, HMA mix design preparation and submission, HMA production tolerances, HMA construction requirements, quality assurance testing, quality assurance appeals, product acceptance and rejection, data analysis, reporting, and measurement and payment as required by the project.

15.1.2 Related Sections

.1 Prime, Tack, and Fog Coats – Section 18.

.2 Asphalt Binder – Section 16.

.3 Performance Graded Asphalt Binder – Section 17.

.4 Hot Mix Asphalt Concrete Trails – Section 19.

15.1.3 Definitions

.1 Acceptance is the process undertaken by the Engineer in which the available Quality Control and Quality Assurance test data is reviewed and the Work is inspected by Project Engineer to ensure that it meets the requirements of the specifications. Recommendation for acceptance may be provided by Project Engineer.

.2 Asphalt Binder Content is the as determined asphalt binder content of the HMA or RAP (if used) regardless of the type and grade of asphalt binder or PG asphalt binder.

.3 Asphalt Concrete is the final HMA that has been placed, compacted, and finished on a prepared surface in conformance with the plans and specifications.

.4 Contractor is the Party that enters into an agreement to provide the required materials and to perform the Work on the project at a predetermined price or rate.

.5 Engineer as referred to in this specification, shall be the County representative or representative designated by the County.

.6 Job Mix Formula (JMF) establishes the proportioning of the aggregates and RAP (if

used), combined aggregate gradation, approved asphalt binder type and content, type and amount of anti-stripping agent (where applicable), and the mixing temperature to be used for the production of the HMA.

.7 Hot Mix Asphalt is a high quality, thoroughly controlled mixture of crushed aggregates, or a combination of crushed aggregates, RAP, natural fines, manufactured fines, asphalt binder, anti-stripping agent and other additives (where applicable), which are combined, heated, discharged from a HMA mixing plant, transported and subsequently placed, compacted, and finished for use in HMA asphalt concrete.

.8 Lot is a portion of the Work being considered for Acceptance and is 1 day of HMA production, per mix type. At the Engineer's written discretion, any portion of the Work may be deemed to be a Lot.

.9 Pre-Production Quality Control is the QC of materials and processes conducted by the Contractor, in accordance with this specification, prior to HMA plant mixing.

.10 Production Quality Control is the QC of materials and construction conducted by the Contractor, in accordance with this specification, during and after HMA plant mixing.

.11 Project Engineer shall be the County representative or their designated representative or shall mean the licensed professional engineer retained by the Developer.

.12 Quality Assurance (QA) is the planned and systematic activities, on the part of a purchaser or owner or designate, implemented in a quality system so that the quality requirements for a material, product and/or service are verified or confirmed.

.13 Quality Assurance Specification is a specification whereby the methods of construction are not completely defined and require Contractor QC and Project Engineer QA and Acceptance of the Work. The Contractor is responsible for QC and the Project Engineer will monitor the Contractor's control of the process that produces the Work. The Project Engineer will undertake QA and Inspection to accept the Work.

.14 Quality Control (QC) is the operational techniques and activities, on the part of a material, product or service provider, used to achieve and maintain the material, product or service to the required quality.

.15 Slurry Seal is a homogenous mixture of crushed aggregate, mineral filler, additives (as required), emulsified asphalt, and water designed to be a slurry. At the discretion of the Engineer, it may be applied to a pavement as a surface treatment in order to fill minor cracks and moderately segregated areas or to restore HMA to a uniform surface texture.

.16 Theoretical Maximum Specific Gravity as determined by ASTM D2041 and referred to herein as Maximum Theoretical Density (MTD).

15.2 PRODUCTS

15.2.1 HMA Mix Types

.1 HMA mix types are selected on a project specific basis, as required by the nature of the project and the required HMA concrete quantities. Mix type designations and typical applications are as follows:

.1 Mix type S1 - Surfacing HMA for high traffic applications, including arterial and industrial classified roadways, using either 120-150(A) premium grade asphalt binder and/or Performance Grade (PG) 64-28 or PG 58-28 asphalt binder, as

identified in the contract:

.1 PG 64-28 asphalt binder would be preferred for applications with high truck traffic and/or slower speed roadways with frequent signalized intersections.

.2 120-150 (A) premium grade or PG 58-28 asphalt binder would be utilized for lower truck traffic applications and/or roadway sections with no, or few signalized intersections.

.2 Mix type S2 - Surfacing HMA for low to medium traffic applications, such as local and minor collector roadways, and for Hot Mix Asphalt Concrete Trails using 150-200 (A) premium grade or PG 58-34 asphalt binder, as identified in the contract.

.3 Mix type B1 - Base course HMA for all traffic applications using 150-200 (A) premium grade or PG 58-34 asphalt binder, as identified in the contract.

.4 Mix type M1 - Maintenance HMA for patching, levelling course, and thin overlay of low traffic roadways, using 150-200 (A) premium grade or PG 58-34 asphalt binder, as identified in the contract.

15.2.2 Materials

.1 Asphalt Binder to the requirements of Section 16 Asphalt Binder.

.2 PG Asphalt Binder to the requirements of Section 17 Performance Graded Asphalt Binder.

.3 Aggregates:

.1 Coarse aggregate is material retained on the 5 000 μm sieve; fine aggregate is material passing the 5 000 μm sieve.

.2 Aggregates must be crushed stone or gravel consisting of sound, hard, durable, angular particles, that are free from injurious quantities of flat and elongated particles, soft shale, clay lumps, organic material, frozen material, and all other deleterious materials.

.3 Aggregate gradations are to be within the limits specified and are to be determined by Alberta Transportation (AT) Test method (ATT) ATT-26. The percent passing all sieve sizes is to be reported to the nearest 0.1%.

.4 Aggregate must be processed to meet the following:

.1 Natural fines must be pre-screened from the pit-run and separately stockpiled with 100% passing the 5 000 μm sieve.

.2 Material delivered to the crushing plant must be pre-screened and must contain not more than 5% passing the 5 000 μm sieve.

.3 Material produced by the crushing operation must be separated into coarse aggregate and fine aggregate stockpiles. The coarse aggregate fraction must not have more than 10% of the material passing the 5 000 μm sieve. The fine aggregate fraction or manufactured fines must have 100% of material passing the 5 000 μm sieve.

.4 Blend sand must consist of natural or manufactured sand with 100% of the material passing the 5 000 μm sieve.

.5 Physical properties of aggregates to meet the requirements in Table 1:

Table 1 - Aggregate Physical Property Requirements

REQUIREMENT	TEST STANDARD	ALL MIX TYPES
Los Angeles Abrasion (% Loss)	ASTM C131	30.0 max.
Flat and Elongated Particles 5:1 ratio (% by mass)	ASTM D4791	10.0 max.
Magnesium Sulphate Soundness (% Loss) Coarse Aggregate: Fine Aggregate:	ASTM C88	12.0 max. 12.0 max.
Sand Equivalent (mechanical method)	ASTM D2419	45 min.
Lightweight Particles (%), see Note 1	ASTM C123	1.5 max.
Detrimental Matter, (%)	AT TLT107	2.0 max.
Plasticity Index (Fine Aggregates)	ASTM D4318	Non-Plastic

Note 1: The heavy liquid must be a solution of zinc bromide in water with a specific gravity of 2.40.

.6 Blended Aggregate Requirements:

.1 The combined aggregate gradation requirements, including RAP (if used) must meet the requirements of Table 2:

Table 2 - Blended Aggregate Gradation Requirements

SIEVE SIZE (μm)	% PASSING SIEVE SIZE			
	MIX TYPE S1	MIX TYPE S2	MIX TYPE B1	MIX TYPE M1
25 000	-	-	100	-
20 000	100	-	100 - 97	-
16 000	100 - 97	100	100 - 83	-
12 500	100 - 90	100 - 97	92 - 70	100
10 000	90 - 67	95 - 80	84 - 61	100 - 97
5 000	65 - 45	70 - 45	65 - 38	75 - 55
2 500	53 - 31	57 - 31	52 - 26	59 - 35
1 250	42 - 21	45 - 21	41 - 18	45 - 24
630	33 - 15	36 - 15	31 - 13	36 - 16
315	24 - 9	28 - 9	22 - 9	26 - 10
160	15 - 6	18 - 6	14 - 6	18 - 7
80	8 - 4	8 - 4	7 - 3	9 - 4

.2 Coarse Aggregate Fracture of the combined aggregate including RAP (if used) of all material retained on the 5 000 μm sieve by mass must be as indicated in Table 3:

Table 3 - % Coarse Aggregate Fracture Requirements

	MIX TYPE S1	MIX TYPE S2	MIX TYPE B1	MIX TYPE M1
SIEVE SIZE (μm)	**2 FACE min.**	**2 FACE min.**	**2 FACE min.**	**2 FACE min.**
-25 000 to +16 000	90	-	70	-
-16 000 to +10 000	90	80	75	-
-10 000 to +5 000	95	85	80	65
Combined +5 000	90	85	75	65

.3 Manufactured fines content of the total combined aggregate including RAP (if use) of all material passing the 5 000 μm sieve (by mass) must be as follows:

.1 Mix type S1 - 75% minimum.

.2 Mix type S2 - 70% minimum.

.3 Mix type M1 - 65% minimum.

.4 Mix type B1 - 65% minimum.

.4 The Manufactured fines content of the total combined aggregate including RAP (if used) is to be determined in accordance with AT's Transportation Laboratory Tests (TLT) TLT 314.

.4 Reclaimed Asphalt Pavement:

.1 RAP must not contain any other additives including, but not limited to, sulphur, crumb rubber, asphalt rubber, asbestos, Recycled Asphalt Shingles (RAS), paving fabrics, reinforcement grids, or other deleterious materials.

.2 Stockpile a minimum of 100% of total amount of RAP required before commencing the HMA mix design.

.3 The maximum RAP portion by mass of total aggregates must be less than 15% for all mix types and the ratio of virgin asphalt binder to total asphalt binder must be greater than 80% for mix type S1, S2, and M1 and greater than 75% for mix type B1.

.4 For mix types incorporating RAP 50% of the RAP material passing the 5 000 μm sieve will be considered to be manufactured fines.

.5 The maximum size of the RAP must be less than 25 000 μm immediately prior to feeding into the HMA mixing plant.

.5 Delivery and Storage:

.1 Stockpile a minimum of at least 50% of total amount of each individual aggregate required before commencing the HMA mix design.

.2 Stockpile a minimum of 100% of total amount of RAP required before commencing HMA production.

.3 Aggregate stockpile volumes must be maintained to ensure a minimum of 5,000 tonne of HMA mixing plant production or the entire remaining project quantity, whichever is less.

15.2.3 HMA Mix Design

.1 A HMA mix design for each mix type required on the project must be prepared and submitted to the Engineer for review and accepted at least 10 working days prior to the start of HMA production. The Contractor must use a qualified engineering and materials testing service licensed to practice in the Province of Alberta to prepare the HMA mix design.

.2 The HMA mix design must follow the "Marshall Method of Mix Design" (Chapter 7) for sample preparation and "Volumetric Properties of Compacted Paving Mixtures" (Chapter 5) for HMA void properties as outlined in the latest edition of the Asphalt Institute's Manual Series No. 2 (MS-2) Asphalt Mix Design Methods. The HMA mix design must include 5 separate trial asphalt binder contents for each aggregate combined gradation and the trial asphalt binder contents must be in 0.50% increments reported to the nearest 0.01%. Short-term conditioning of the loose mix must follow "Laboratory Mixture Testing" (Chapter 4) in MS-2 and be for 2 hours +/- 5 minutes at the compaction temperature before the MTD (Gmm) and Bulk Specific Gravity of the compacted mix (Gmb) is determined for each of the 5 separate trial asphalt binder contents. The "best fit" smooth curve required to connect the plotted data points must be graphed as a second order polynomial.

.3 At the recommended design asphalt binder content the HMA must meet the requirements of Table 4:

Table 4 - HMA Physical Property Requirements

PROPERTY	REQUIREMENTS			
	MIX TYPE			
	S1	S2	B1	M1
Number of blows/face, see Note1	75	50	75	50
Marshall Stability (kN)	12.0 min.	8.0 min.	10.0 min.	5.3 min.
Marshall Flow (mm)	2.0 - 3.5	2.0 - 4.0	2.0 - 4.0	2.0 - 4.0
Air Voids (%), see Note 2 and 3	3.8 - 4.2	3.3 - 3.8	4.3 - 4.7	2.8 - 3.2
Voids in Mineral Aggregate (%)	14.0 min.	14.0 min.	12.5 min.	14.0 min.
Voids Filled With Asphalt (%)	65 - 75	70 - 80	60 - 70	70 - 80
Film Thickness (μm)	7.5 min.	7.5 min.	6.5 min.	7.5 min.
Retained Stability (%)	70 min.	70 min.	70 min.	70 min.
Tensile Strength Ratio (%)	75 min.	75 min.	75 min.	75 min.

Note 1: Compaction accomplished with a manually held and operated hammer.

Note 2: The recommended design asphalt binder content must be chosen such that the design Air Voids is the lowest value within the range indicated such that all the other mix design criteria are met.

Note 3: In addition, the Air Voids are to be determined by comparison to the MTD and by calculation utilizing the Specific Gravity of the compacted HMA mix (Gmb), Specific Gravity of the combined aggregates (Gsb), Specific Gravity of the asphalt binder (Gb), asphalt binder absorption of the combined aggregates (Pba), and the total asphalt binder content (Pb).

.4 Include the following data with the HMA mix design submission:

.1 Pit name and legal description of all aggregate sources.

.2 Source of RAP (if used).

.3 Gradations of individual aggregates and RAP (if used).

.4 For each aggregate and RAP (if used) the 2 face fracture counts for the sieve sizes indicated in Table 3.

.5 Los Angeles Abrasion for each coarse aggregate, Magnesium Sulphate Soundness, Sand Equivalent, Flat and Elongated Particles, Lightweight Particles, Detrimental Matter Content, Plasticity Index, and percent Manufactured Fines values.

.6 Bulk Specific Gravity (Gsb) and water absorption of the individual aggregates.

.7 RAP asphalt binder content (if used), Bulk Specific Gravity of the recovered RAP asphalt binder (Gb_{RAP}), MTD of the RAP, and the Bulk Effective Specific (Gse_{RAP}) of the RAP aggregate (based on the MTD of the RAP and RAP asphalt binder content).

.8 Asphalt binder manufacturer, Bulk Specific Gravity of the asphalt binder (Gb), and mixing and compaction temperatures based on temperature–viscosity properties of asphalt binder or the supplier's recommended mixing and compaction temperature for PG asphalt binders.

.9 Liquid anti-stripping agent supplier (if used), product identification, product specification sheet, and application rate. If hydrated lime is used as an anti-stripping agent the product identification, product specification sheet, and application rate. The hydrated lime must also be accounted for, as a mineral filler, when determining the blend percentages and combined aggregate gradation. In addition, details of the procedures to be used to uniformly incorporate the hydrated lime into the aggregates at the mixing plant to ensure consistent HMA production.

.10 Based on the individual aggregate results and the blend proportions the combined aggregate Bulk Specific Gravity (Gsb), combined aggregate Effective Specific Gravity (Gse), and Asphalt Absorption (Pba). For HMA containing RAP the Gse_{RAP} is to be used in the determination of the combined aggregate Gsb.

.11 Graph of the mix's MTD and all other associated mix properties.

.12 Recommended design asphalt binder content, reported to the nearest 0.01%, associated mix properties including the Tensile Strength Ratio (TSR) at the recommended design asphalt binder content, and virgin asphalt binder to total asphalt binder content ratio for mixes containing RAP.

.13 Ignition oven asphalt binder correction factor.

15.2.4 Job Mix Formula

.1 Subject to acceptance in writing by the Engineer, the individual aggregate gradations, the aggregate proportioning (including RAP and anti-stripping agent), target combined

aggregate gradation, recommended design asphalt binder content, design air void content, and mixing temperature from the mix design will become the JMF for the supply of the mix type for which it applies to.

.2 The Contractor must coordinate with the Project Engineer to produce a trial batch of HMA utilizing the proposed JMF that will be sampled and tested by the Project Engineer to verify the mix design. The Project Engineer will not accept the mix design and JMF until the results of the trial batch indicate the HMA is compliant with the specifications. If the initial trial batch fails to meet the requirements of the specifications an additional HMA plant trial batch will be required. Sampling and testing of the additional trial batch by the Project Engineer will be back charged to the Contractor.

.3 Production of HMA of any mix type for use on the project must not begin until the Engineer has in writing accepted the mix design and JMF.

.4 Once established, no alterations to the JMF will be permitted unless a new JMF is submitted by the Contractor and is accepted in writing by the Engineer. Any alteration to the JMF must not result in HMA properties that do not meet the requirements of this specification.

.5 If alterations to the JMF are in excess of any one of the following limits, HMA production must stop and a new HMA mix design must be submitted for acceptance in writing by the Engineer:

- +/- 5.0% passing the 5 000 μm sieve.
- +/- 1.5% passing the 80 μm sieve.
- +/- 3.0% in RAP blend (if used).
- +/- 0.30% asphalt binder content.

15.2.5 Production Tolerances

.1 All HMA must be produced to the JMF within the range of tolerances specified.

.2 Asphalt binder content to +/- 0.30% of the accepted JMF value.

.3 HMA mix temperature at point of mixing plant discharge must not vary from the JMF mixing temperature by +/- 15°C.

.4 Aggregate gradation from the JMF combined gradation must meet the requirements of Table 5 provided the as produced HMA combined gradation remains within the limits indicated in Table 2:

Table 5 - Aggregate Gradation Tolerances

AGGREGATE PASSING SIEVE SIZE (μm)	TOLERANCE (% BY MASS)
Max. Size to 5 000	+/- 5.0
2 500 & 1 250	+/- 3.0
630 & 315	+/- 2.0
160	+/- 1.5
80	+/- 1.5

.5 HMA Air Voids to +/- 0.5% of the JMF value, as calculated utilizing the Bulk Specific

Gravity of the compacted mix (Gmb) and the MTD (Gmm) of the loose mix.

.6 HMA mix properties including Marshall Stability, Marshall Flow, Voids in Mineral Aggregate, Voids Filled with Asphalt, Film Thickness, Retained Stability, and Tensile Strength Ratio (TSR) to the limits identified in Table 4.

.7 Coarse aggregate fractured face count to the limits identified in Table 3.

.8 Maximum moisture in HMA mix, at point of plant discharge must be less than 0.2% by mass of HMA mix.

.9 HMA mix temperature upon arrival on the project must not exceed the mixing temperature indicated in the JMF by 10°C.

15.2.6 Sampling and Testing

.1 The Project Engineer must have access to all production processes and materials used for the Work to monitor material quality as often as deemed necessary. Such inspection and testing will not in any way relieve the Contractor of the responsibility for meeting the requirements of the specifications.

.2 At least 21 working days prior to commencing Work, inform the Project Engineer of the proposed source of aggregates and provide access for sampling.

.3 Quality Control:

.1 The Contractor will be totally responsible for production of materials and construction that meet all specified requirements.

.2 QC is the responsibility of the Contractor throughout every stage of the Work from aggregate processing to the final accepted product. Tests performed by the Project Engineer will not be considered as QC tests.

.3 All QC materials testing must be conducted by qualified agencies and personnel. The Contractor will bear the cost of all QC testing and consulting services.

.4 Pre-Production QC testing and sampling and minimum frequencies are described in Table 6 Pre-Production Quality Control Requirements:

Table 6 - Pre-Production Quality Control Requirements

Quality Control Requirement	Minimum Frequency
Asphalt Binder Certification	1 per year per type or for each change in manufacturer
Aggregate Physical Properties, Table 1	1 per year or for each change in source
Crushed Coarse Aggregate(s) Gradation Analysis and Fracture Count	1 for every 1,000 tonne of each material type processed into stockpile but no less than 1 analysis for each production day
Manufactured Fines Gradation	
Natural Fines Gradation	
RAP Asphalt Binder Content, Extracted Aggregate Gradation and Fracture Count	1 for each 500 tonne delivered to stockpile or 1 for each location when delivery rate is less than 500 tonne
HMA Mix Design by Marshall Method, Section 15.3	1 per year and as required for a change in asphalt binder supply, aggregate gradation, aggregate source or as per Section 15.4.5, see Note 1
Plant Calibration	As required

Note 1: An accepted HMA mix design, from only the immediately preceding construction season, may be accepted in writing by the Engineer if there are no new production of aggregates or changes in materials for which the original HMA mix design was accept and provided that there are no changes to the previously approved JMF.

However, a new trial batch will be required to ensure that the HMA meets the JMF prior to acceptance by the Engineer.

.5 Pre-Production QC test data as specified in Table 6 must be reported to the Project Engineer for acceptance 3 weeks prior to commencing Work on the project or as requested.

.6 Production QC testing and sampling and minimum frequencies are described in Table 7 Production Quality Control Requirements:

Table 7 - Production Quality Control Requirements

Quality Control Requirements	Minimum Frequency
HMA Analysis (including Asphalt Binder Content, Aggregate Gradation, Marshall Density, MTD, and Void Properties), see Note 1	1 for every 500 tonne of each mix type supplied under this specification but at least 1 per day for each mix type, see Note 2
TSR	For each mix type, 1 per 5,000 tonne but at least 1 per project
HMA Mix Temperature	Minimum frequency not specified
Cold Feed Aggregate Analysis	Minimum frequency not specified
Compaction Monitoring (Core or Nuclear)	Minimum frequency not specified, see Note 3

Note 1: HMA air voids are to be determined by comparison to the MTD and by calculation utilizing the HMA mix design data. If the MTD air voids differ by more than +/- 0.5% of the calculated air voids undertake an analysis to determine the cause of the increased variation and report such to the Project Engineer. Utilizing the asphalt binder content and the combined aggregate Effective Specific Gravity (Gse) from the mix design calculate the MTD. If the calculated MTD differs from the as tested sample MTD by more than +/- 0.015 undertake an analysis to determine the cause of the increased variation and report such to the Project Engineer. The asphalt binder content is to be reported to the nearest 0.01%.

Note 2: Where an individual test indicates non-compliance, another test will be initiated immediately.

Note 3: Coring is subject to acceptance in writing by the Project Engineer.

.7 Production QC test data as specified in the first row in Table 7 must be reported to the Project Engineer within 1 working day of the HMA being placed on the project. The remainder of the production QC test data as specified in Table 7 must be reported to the Project Engineer within 7 workings days of the HMA being placed on the project.

.8 In addition, the Contractor must have monitoring procedures in place to provide daily “bulk” measurements of all materials used to produce HMA at the asphalt plant, including liquid anti-stripping agent or hydrated lime, as applicable, to verify the usage quantities match targeted values. If requested in writing by the Project Engineer, the Contractor must provide the daily bulk quantity checks within 1 working day of the HMA being placed on the project.

.4 Quality Control Compliance with Specified Tolerances:

.1 Asphalt Binder Content, Aggregate Gradation, and HMA Mix Properties:

.1 The test data derived by Production QC testing, described in Section 15.2.6.3.6, must be compared to the tolerances set forth in Section 15.2.5. The Contractor must suspend HMA mix production when 3 consecutive results, for any property, are outside of the specified tolerance limits.

.2 Supply of HMA must not commence again until it is demonstrated, to the satisfaction of the Engineer, that corrective action has been taken by means of a trial batch as indicated in Section 15.2.4.2.

.3 Following initial JMF acceptance, suspension of paving operations under Section 15.2.6.4.1, or the request for a new JMF under Section 15.2.4.5, the produced HMA may be subject to rejection, at the written discretion of the Engineer until such time as 3 consecutive Production QC results indicate that all required HMA properties are within the specified tolerance limits.

.2 HMA Temperature

.1 HMA plant mix that does not meet temperature requirements at the point of plant discharge may be subject to rejection, at the written discretion of the Project Engineer.

.5 Quality Assurance:

.1 Within this specification, certain requirements, limits and tolerances are specified regarding supplied materials and workmanship. Compliance with these requirements will be determined from QA testing as described in this section. All QA materials testing must be conducted by qualified agencies and personnel.

.2 QA testing is the responsibility of the Project Engineer and the materials testing laboratory undertaking the QA testing must be independent of the materials testing laboratory undertaking QC testing for the Contractor.

.3 Initial QA testing will be undertaken free of cost to the Contractor and QA results indicated in the first row of Table 8 will be provided to the Contractor within 1 working day of the Project Engineer receiving the corresponding Production QC results indicated in Table 7. The remainder of the QA results indicated in Table 8 will be provided to the Contractor within 3 working days of their availability.

.4 Sampling and QA testing is described in Table 8 Quality Assurance Testing Requirements:

Table 8 - Quality Assurance Testing Requirements

Acceptance Testing	Minimum Frequency
HMA Analysis (including Binder Content, Aggregate Gradation, Marshall Density, MTD, Void Properties, Marshall Stability and Flow), see Note 1	For each mix type, 1 test for each 3,500 sq. m. of placement, or 3 tests per Lot, which ever is greater
HMA Gradation Fracture Face Count	For each mix type, 1 test per Lot
TSR	For each mix type, 1 test per Lot, see Note 2
Compaction Testing (Cores) and Thickness Determination	For each mix type, 1 test for each 2,000 sq. m. of placement, or 3 tests per Lot, whichever is greater
HMA Mix Temperature	No minimum frequency

Note 1: HMA air voids are to be determined by comparison to the MTD and by calculation utilizing the HMA mix design data. If the MTD air voids differ by more than +/- 0.5% of the calculated air voids undertake an analysis to determine the cause of the increased variation and report such to the Project Engineer. Utilizing the asphalt binder content and the combined aggregate Effective Specific Gravity (Gse) from the mix design calculate the MTD. If the calculated MTD differs from the as tested sample MTD by more than +/- 0.015 undertake an analysis to determine the cause of the increased variation and report such to the Project Engineer. The asphalt binder content is to be reported to the nearest 0.01%.

Note 2: TSR samples are to be collected for each Lot but testing for the TSR value is to be done on the even numbered Lots (2, 4, 6, etc.) initially. If an initial result indicates a non-compliant TSR then the odd numbered Lot samples on either side of it will be tested.

.5 Quality Assurance Sampling Procedures:

.1 Loose HMA samples will be acquired from the Work site in accordance with Table 9. Auger samples may be used if agreed to in writing by both the Project Engineer and the Contractor.

.2 Loose HMA mix sample timing will be by stratified random sampling, with each sample representing a similar placement or production quantity as indicated in Table 8.

.3 Locations for HMA compaction and thickness will be selected using stratified random sampling procedures, as indicated in Table 9. The Lot will be divided into segments meeting or exceeding the frequency in Table 8 and of approximately equal area.

.4 Areas within 3.0 m of transverse joints or 300 mm of a HMA mat edge or longitudinal joint are excluded from QA sampling and testing for HMA compaction and thickness.

.6 Appeal of Quality Assurance Testing Results

.1 General:

.1 The Contractor may appeal Asphalt Binder Content, Compaction Standard, Gradation, TSR, and HMA Compaction and Thickness for any Lot subject to a payment adjustment or rejection only once. A notice of appeal must be in writing and submitted to the Project Engineer within 3 working days of receipt of notice from the Project Engineer that the Lot is subject to a payment adjustment or rejection.

.2 No appeal of individual QA test results within a Lot will be permitted.

.3 Appeals will only be considered if cause can be shown, to the satisfaction of the Project Engineer, and the requirements of Tables 6 and 7 have been satisfied.

.4 QC tests initiated after the Contractor's receipt of the QA test results from the Lot being appealed will not be considered when evaluating cause for appeal.

.5 At the Project Engineer's written discretion, QC testing during production for the subject project will only be considered when evaluating cause for appeal.

.6 The Contractor will have the option for the appeal testing to be performed by the materials testing laboratory undertaking the project QA testing or by an independent materials testing laboratory jointly selected by the Contractor, Project Engineer and Engineer.

.7 For all appeals, all QA test results from the appealed Lot will be discarded. A new Lot mean will be determined using the same number of tests as was used to determine the original appealed Lot mean.

.8 The new Lot mean will be used for acceptance, payment adjustments, and will be binding on Project Engineer, Engineer and the Contractor.

.9 If the new Lot mean shows that any payment adjustment or rejection still applies to the appealed Lot, the costs of the appeal sampling and testing, as well as other ancillary costs such as traffic accommodation for field coring and engineering reporting costs, will be borne by the Contractor. If the new Lot mean shows that a payment adjustment or rejection no longer applies, the sampling and appeal testing costs will be the responsibility of the Project Engineer.

.2 Asphalt Binder Content Appeal:

.1 The Project Engineer will develop a stratified random sampling plan with the same number of segments as the original number of samples for the appealed Lot. Sufficient core samples (150 mm diameter) will be acquired from each segment to enable asphalt binder content determinations.

.2 For all cored specimens, a diamond saw is to be used to separate the layer to be tested from other pavement layers and to remove all tack or fog coat. The core specimens will also be trimmed to remove cut coarse aggregate as indicated in ATT-12, Part II. Cored specimens taken over crack filler will be discarded and the immediate area re-sampled.

.3 The same test method must be used for the asphalt binder content appeal testing as was used in the original QA testing. If the Contractor chooses the option of selecting an independent laboratory and if the original asphalt binder contents were determined with an ignition oven, then the Contractor must provide sufficient virgin aggregates, RAP (if used), asphalt binder, and anti-stripping agent (where applicable) so that the independent laboratory will be able to determine the ignition oven correction factor.

.3 Compaction Standard Appeals:

.1 The materials testing laboratory conducting the project QA sampling and testing will retain companion samples of sufficient size for the determination of the HMA mix MTD compaction standard.

.2 The same number of compaction standard samples will be tested as the original number of compaction standard samples for the appealed Lot.

.4 Gradation Appeals:

.1 The Project Engineer will develop a stratified random sampling plan with the same number of segments as the original number of samples for the appealed Lot. Sufficient core samples (150 mm diameter) will be acquired from each segment to enable gradation determinations.

.2 The core specimens will also be trimmed to remove cut coarse aggregate as indicated in ATT-12, Part II.

.5 Tensile Strength Ratio Appeals:

.1 The materials testing laboratory conducting the project QA sampling and testing will retain companion samples of sufficient size for the determination of the HMA mix TSR.

.2 The same number of TSR samples will be tested as the original number of TSR for the appealed Lot.

.6 HMA Compaction and Thickness Appeals:

.1 Any attempt to improve HMA compaction on the appealed Lot after the Project Engineer has obtained QA samples will void the appeal and the original QA results will apply.

.2 The Project Engineer will develop a stratified random sampling plan with the same number of segments as the original number of samples for the appealed Lot. Sufficient core samples will be acquired from each segment to enable compaction and thickness determinations.

.7 Methods for Quality Control, Quality Assurance, and Appeal Testing:

.1 Unless otherwise specified, material characteristics will be determined utilizing the current edition of the test method specified in Table 9 Quality Control, Quality Assurance, and Appeal Test Methods:

Table 9 - Quality Control, Quality Assurance, and Appeal Test Methods

Test Description	Test Method
Stratified Random Test Locations	ASTM D3665
Sampling HMA mixes	ASTM D979
HMA Moisture Content	ATT-15
Asphalt Binder Content, see Note 1	ATT-12, Part I or II or 74, Part I
Fractured Face Count	ASTM D5821
Gradation Analysis Aggregates, see Note 2	ATT-26
MTD	ASTM D2041
TSR	AASHTO T283
Marshall Specimens	ASTM D6926
HMA Bulk Specific Gravity	ASTM D2726
Marshall Stability and Flow	ASTM D6927
Retained Stability	TLT 306
Film Thickness	TLT 311
Field Coring	ASTM D5361
Lift Thickness	ASTM D3954
Ignition Oven Correction Factor	ATT-74, Part II
Gradation Analysis RAP	ATT-53

Note 1: Minimum sample size, regardless of mix type, must be at least 2,000 g.
Note 2: In all test methods, metric sieves in accordance with sieve sizes to CAN/CGSB 8-GP-2M rather than ASTM E11.

.2 In the case of a discrepancy between this specification and the test method indicated in Table 9, this specification will govern.

15.2.7 Acceptance

.1 General:

.1 The Contractor must provide Work conforming to the quality and tolerance requirements of this specification. Where no tolerances are specified, the standard of workmanship must be in accordance with accepted industry standards, as indicated in the current edition of “Construction of Hot Mix Asphalt Pavement” Asphalt Institute Manual Series No. 22 and “Hot Mix Asphalt Materials, Mixture Design and Construction” TB-1 as published by the National Asphalt Pavement Association (NAPA).

.2 Acceptance of any Lot at full payment will occur if there are no obvious defects, as determined in writing by the Engineer, and the Lot mean results for asphalt binder content, gradation, TSR, HMA compaction, and HMA thickness meet or exceed the specified requirements.

.3 Payment adjustments will only be applied on the basis of QA testing in accordance with Table 8.

.4 Failure to satisfy the Production QC requirements indicated in Section 15.2.6.3 will result in the HMA supplied during such period to be subject to rejection, at the Project Engineer's written discretion.

.5 HMA mix supplied during periods in which 3 consecutive Production QC results indicate that not all required HMA properties are within the specified tolerance limits may be subject to rejection, at the written discretion of the Project Engineer.

.6 HMA not meeting the plant discharge or on-site temperature requirements specified herein will be subject to rejection, at the Project Engineer's written discretion.

.2 Asphalt Binder Content:

.1 For full payment, the Lot Mean Asphalt Binder Content must be within +/- 0.30% of the approved JMF value, as specified in Section 16

.2 Payment adjustment for asphalt binder content is as indicated in Table 10 Asphalt Binder Content Payment Adjustment:

Table 10 - Asphalt Binder Content Payment Adjustment

Lot Asphalt Binder Content Deviation from JMF Value	Payment Adjustment Factor
+/- 0.30 or less	1.00
+/- 0.31 to +/- 0.50	As per Chart A
Greater than +/- 0.50	Reject, see Note 1

Note 1: Subject to removal and replacement, at the written discretion of the Engineer.

.3 HMA Compaction:

.1 HMA compaction will be determined as the ratio (in percent) of the Lot mean field core density divided by the Lot mean MTD. For full payment, the Lot Mean HMA compaction must be equal to or greater than 94% of the Lot mean MTD.

.2 Payment adjustment for HMA compaction is as indicated in Table 11 HMA Compaction Payment Adjustment:

Table 11 - HMA Compaction Payment Adjustment

Lot HMA Compaction	Payment Adjustment Factor
Greater than 94.0	1.00
91.0 to 94.0	As per Chart B
Less than 91.0	Reject, see Note 1

Note 1: Subject to removal and replacement, at the written discretion of the Engineer.

.4 Thickness (New Construction and Top Lift Only):

.1 For full payment, the Lot mean HMA thickness must be equal to, or greater than, the specified HMA thickness.

.2 The Lot Mean Thickness for any Lot will be determined on the basis of the QA cores described in Table 8.

.3 Payment adjustment for HMA thickness is as indicated in Table 12 HMA Thickness Payment Adjustment:

Table 12 - HMA Thickness Payment Adjustment

Lot Thickness Deficiency (x% of Specified Thickness)	**Payment Adjustment Factor**, see Note 1	
	Total Thickness (Single or Multiple Lifts), see Note 2	**Top Lift Thickness (Multiple Lifts)**
Compliant or Greater	1.00	1.00
5.0 or less	0.90	0.95
5.1 to 18.9	1.04 - 0.0286x	1.11 - 0.0321x
19.0 or more Deficient	Reject, see Note 3	Reject, see Note 3

Note 1: If both the total thickness and top lift thickness are deficient only a single Thickness Payment Adjustment Factor will be applied, whichever Payment Adjustment Factor is the lower value.

Note 2: Total thickness can be bottom lift for new construction until the final lift of HMA is placed prior to the Final Acceptance Certificate (FAC) inspection.

Note 3: Subject to removal and replacement at the expense of the Contractor, at the written discretion of the Engineer.

.4 If any individual QA core result indicates that the HMA thickness deficiency is 19.0% or greater, additional cores will be obtained to identify the extent of the deficient pavement thickness area. The Contractor will pay for all additional coring costs. Additional cores will be taken 5.0 m from the individual QA core, longitudinally in the same HMA mat, until the deficient HMA thickness is less than 19.0%. The so determined deficient HMA thickness area will be subject to removal and replacement, at the written discretion of the Engineer. Notwithstanding the Engineer's requirement for removal and replacement the originally determined Lot HMA thickness payment adjustment will be applied.

.5 Smoothness:

.1 The completed HMA surface must be true to the dimensional and tolerance requirements of the specifications and drawings. Unless detailed otherwise in the contract documents the finished HMA surface must be within 5 mm of the design elevation but not uniformly high or low. When checked with a 3.0 m straight edge placed in any direction for both profile and cross-slope irregularities in the finished HMA surface most not exceed the following:

.1 HMA base lifts - 10 mm.

.2 HMA surface lifts - 5 mm.

.2 When irregularities, in excess of the above tolerances are found, the HMA surface must be corrected by methods satisfactory to the **Engineer**. Correction of defects must be carried out until there are no deviations anywhere greater than the allowable tolerances.

.6 Segregation:

.1 The finished HMA surface must have a uniform texture and be free of segregated areas. Segregation is defined as an area of the HMA surface where the texture differs visually from the texture of the surrounding area. Segregation severity is subjective and the Engineer will have the final determination of the segregation severity.

.2 The Contractor must perform daily inspections of the paving operations to identify any instances of segregation. If segregation is identified on a project, the Contractor must take immediate corrective action to prevent any further occurrences of segregation.

.3 Each Lot will be inspected by the Project Engineer after the Lot is placed. During the inspection the Project Engineer will identify and record any areas of slight, moderate, and severe segregation, as well as, any areas of centre-of-spreader streaks. The Project Engineer will evaluate all segregation to determine the repair requirements.

.4 The severity of segregation will be rated as follows and as indicated in the latest edition of AT's Segregation Rating Manual:

.1 Slight – The matrix of asphalt binder and fine aggregate is in place between the coarse aggregate particles, however there is more coarse aggregate in comparison to the surrounding acceptable HMA that results in small to medium sized surface voids.

.2 Moderate – Compared to the surrounding acceptable HMA, has significantly more coarse aggregate and exhibits a lack of asphalt binder and fine aggregate matrix that results in medium to large sized surface voids.

.3 Severe – Is an area of very stony or very high coarse aggregate mix with stone against stone contact, and very little or no surrounding asphalt binder and fine aggregate matrix that results in large to very large surface voids.

.4 Centre-of-Spreader Streak – Appears as a continuous or semi-continuous longitudinal "streak" consisting of a segregated area of severity varying from slight to severe and typically located in the middle of the spreader mat.

.5 In the case of a discrepancy between this specification and AT's Segregation Rating Manual this specification will govern.

.6 The Contractor, as directed by the Project Engineer, must repair all segregated areas and centre-of-spreader streaks. The following segregation repair methods are pre-approved:

.1 Slight – squeegee emulsified asphalt, to the requirements of Section 18, such that the surface voids are completely filled. Premixed commercial emulsion products may be used at the written discretion of the Engineer.

.2 Moderate – remove and replace or HMA overlay, for the full mat width. At the written discretion of the Engineer pre-mixed commercial slurry seal products that contain both mineral aggregates and mineral filler may be used

provided the moderate segregation is an isolated occurrence in the Lot. If, for any Lot, more than 3 moderate segregation areas or more than 0.05% of the area contains moderate segregation then, at the written discretion of the Engineer, use of a pre-mixed commercial slurry seal product will not be permitted.

.3 Severe – removal and replacement or HMA overlay for the full mat width.

.7 All repairs must be regular in shape and finished using good workmanship practices to provide an appearance suitable to the Project Engineer

.8 Any other methods of repair proposed by the Contractor will be subject to the written acceptance of the Project Engineer.

.9 Repairs will be carried out by the Contractor at the Contractor's expense.

.7 Gradation:

.1 The following requirements apply to HMA pavement material in all lifts except preliminary levelling.

.2 Price Adjustments for aggregate gradation variation will be based on the variation of the Lot Mean Gradation from the JMF tolerance, for each sieve size, as shown in Tables 13 and 14 and the corresponding adjustment points as shown in Table 15.

Table 13 - GRADATION TOLERANCES FOR THE LOT MEAN FROM THE JMF AND MAXIMUM RANGE BETWEEN INDIVIDUAL TEST RESULTS IN A LOT

CHARACTERISTICS	SIEVE SIZE (μm)					
	25 000, 20 000, 16 000,12 500,10 000, 5 000	2 500, 1 250	630	315	160	80
Tolerances for the Lot Mean from the JMF	+/- 5.0	+/- 3.0	+/- 2.0	+/- 2.0	+/- 1.5	+/- 1.5
Maximum Range between Individual	10.0	6.0	5.0	4.0	3.0	3.0
Test Results in a Lot						

Table 14 - MAXIMUM DEVIATION FOR THE LOT MEAN FROM THE GRADATION LIMITS SPECIFIED IN TABLE 2

CHARACTERISTIC	SIEVE SIZE (μm)		
	20 000, 16 000, 12 500, 10 000	5 000, 2 500, 1 250, 630, 315	160, 80
Maximum Deviation for the Lot Mean from Table 2 Gradation Limits	+/- 2.0	+/- 1.0	+/- 0.5

Table 15 - "A" AND "B" ADJUSTMENT POINTS FOR DEVIATION IN GRADATION

SIEVE SIZE μm	LOT MEAN
25 000, 20 000, 16 000, 12 500, 10 000	5 for each 1% Deviation
5 000, 2 500, 1 250	1 for each 1% Deviation
630, 315	2 for each 1% Deviation
160	0.2 for each 0.1% Deviation
80 Deviation < 1.0% 80 Deviation > 1.0%	1.0 for each 0.1% Deviation 0.2 for each additional 0.1% Deviation

.3 When the lot Mean Gradation is outside the JMF tolerance, the penalty assessment will be $0.04 per tonne for each Mean Adjustment Point, up to the limits shown in Table 2. When the Lot Mean Gradation is outside the limits of Table 2, the penalty assessment will be $0.40 per tonne for each Mean Adjustment Point outside those limits, regardless of the JMF tolerance. If the maximum deviation shown in Table 14 is exceeded the Lot is rejected.

.4 Lot mean Adjustment points will be calculated for each Lot. If the Lot Mean does not exceed the requirements in Table 14 a Lot Gradation Price Adjustment per tonne will be applied base on the following formula:

$$PAg = (A \times -0.04) + (B \times -0.40)$$

Where:

PAg = Unit Price Adjustment for Gradation.

A = Mean Adjustment Points assessed within the gradation limits specified in Table 2 but beyond the JMF tolerance requirements in Table 13.

B = Mean adjustment Points assessed outside the gradation limits specified in Table 2 regardless of the JMF tolerance.

.5 When the Lot Unit Price for HMA in the contract is in square metres a value of 2,320 kilograms per cubic metre will be used for the in-place density of the HMA, regardless of HMA mix type, in the conversion of tonnes of HMA to square metres of HMA.

.8 Payment adjustment for TSR is as indicated in Table 16 TSR Payment Adjustment:

Table 16 - TSR Payment Adjustment

Lot TSR Value	Payment Adjustment Factor
75.0 or Greater	1.00
73.5 to 74.9	0.99
72.0 to 73.4	0.97
70.5 to 71.9	0.95
69.0 to 70.4	0.92
67.5 to 68.9	0.89
66.0 to 67.4	0.85
64.5 to 65.9	0.81
63.0 to 64.4	0.76
61.5 to 62.9	0.71
60.0 to 61.4	0.65
Less than 59.9	Reject, see Note 1

Note 1: Subject to removal and replacement at the expense of the Contractor, at the written discretion of the Engineer.

15.3 EXECUTION

.1 Continuity of Production:

.1 During the time period that Work is in progress on any project for which this specification is in effect, and at the Project Engineer's written discretion, the HMA mixing plant may be limited to producing only the HMA mix type required for that project.

.2 HMA Production:

.1 Preparation of Aggregates:

.1 Aggregates and RAP (if used) must be loaded into separate cold feed bins and be loaded in such a manner that prevents the mixing of the separate aggregate or RAP materials.

.2 To ensure uniformity, aggregates may have to be pre-dried, before they are feed into the HMA mixing plant.

.3 Heating of the aggregates in the HMA mixing plant must be at as low a temperature as is consistent with proper drying, mixing, and lay down and in no case to exceed 25°C over the recommended mixing temperature for the asphalt binder being used.

.2 HMA Plant and Mixing:

.1 HMA mixing plants must be operated in accordance with the manufacturer's recommendations, the specifications and must be calibrated prior to the commencement of HMA production. The Contractor must provide the Project Engineer with a certificate of calibration that indicates that the HMA mixing plant has been calibrated to produce a uniform mixture in accordance with the JMF for each mix type.

.2 When the HMA contains RAP the HMA mixing plant must be capable of

thoroughly separating and heating the RAP particles and blend the RAP with the virgin aggregates and asphalt binder. The mixing plant must contain specialized mixing equipment that will prevent the RAP from coming into direct contact with the burner flame to minimize emissions and oxidation of the asphalt binder in the RAP.

.3 The aggregates, RAP (if used), and anti-stripping agent (where applicable) and asphalt binder must be mixed in a manner to produce a consistent, homogeneous mixture in which all particles are uniformly coated with asphalt binder at the point of HMA mixing plant discharge.

.4 HMA mixing plants must be operated in accordance with the "Code of Practice for Asphalt Paving Plants" made under the *Environmental Protection and Enhancement Act*.

.3 Preparation for Paving:

.1 The Contractor must provide the Project Engineer a minimum of 12 hours notice of the intention to commence HMA paving over any previously approved prime coated or tack coated surface.

.2 The HMA must be laid upon a dry, firm surface, true to grade and cross-section, and mechanically swept to be free from all loose or deleterious material. No HMA will be placed when the surface, as determined by the Project Engineer, is wet or when other conditions prevent proper spreading, finishing, or compaction.

.3 If undercutting, and subsequent backfill with HMA is done, the backfill operation must be performed sufficiently far ahead of the paving operation to allow the HMA to be compacted and then sufficient time to cool down in order to support equipment.

.4 HMA Placing - Ambient Air Temperature:

.1 No HMA will be dispatched to the field unless the ambient air temperature, as issued by Environment and Climate Change Canada for the nearest reported location to the job site, is rising and meets the following minimum requirements:

.1 HMA thickness equal or less than 50 mm, 7°C.

.2 HMA thickness greater than 50 mm, 2°C.

.2 No surface lift HMA will be placed regardless of ambient air temperature until the road surface, as determined by the Project Engineer, is 5°C or higher.

.5 HMA Placing – Lift Thickness:

.1 Spread the HMA mix uniformly in 1 or more lifts, or as directed by the Project Engineer, to depths sufficient to obtain the design lift thickness. The minimum and maximum thickness of the HMA mix prior to compaction, unless specifically waived by the Engineer in writing, must not exceed the following:

.1 Mix type B1 – 80 mm minimum, 120 mm maximum.

.2 Mix type S1 – 45 mm minimum, 80 mm maximum.

.3 Mix type S2 – 40 mm minimum, 80 mm maximum.

.4 Mix type M1 – 30 mm minimum, 60 mm maximum.

.6 Hours of Operation:

.1 No loads of HMA will be dispatched from the HMA mixing plant after sunset or during hours of darkness unless loads can be placed and compacted in accordance with these specifications, and suitable artificial illumination is provided, all subject to the written acceptance of the Project Engineer.

.7 Transportation of HMA:

.1 HMA haul trucks must be equipped with tarpaulins of sufficient weights and size to cover the entire open area of the truck box. Regardless of weather conditions, tarpaulins must be used.

.2 Vehicles used for the transportation of HMA from the plant to the site of the Work must have tight metal boxes previously cleaned of all foreign matter. Just before loading the inside surface of the truck box may be lightly lubricated with a release agent consisting of a non-petroleum based solution that has been approved in writing by the Project Engineer. Drain all excess release agent from the truck box prior to HMA loading.

.3 The speed and weight of hauling trucks must be regulated so that, in the opinion of the Project Engineer, no damage will occur to any portion of the Work underway. Any damage to the tack coat, prime coat, or the existing surface caused by the Contractor's equipment must be repaired at the Contractor's expense.

.4 Any load of HMA with a temperature less than 25°C below the recommended mixing temperature indicated in the JMF, will be considered reject, at the written discretion of the Project Engineer.

.5 Deliver HMA mix to the spreader at a uniform rate and in an amount within the capacity of the spreader and compaction equipment.

.8 HMA Spreaders and Rollers:

.1 The HMA spreading machine must be self-propelled and capable of placing a uniform layer of HMA to the depth and grades as shown on the plans or as indicated by the Project Engineer. The spreader must be operated in accordance with the manufacturer's recommended procedures and the specifications.

.2 The screed must include a tamping bar or vibratory strike-off device for use when required. The screed must strike-off the mix to the depth and cross-section specified and produce a finished surface of uniform texture with no open or segregated areas.

.3 Control of the screed must be by automatic sensing devices. Longitudinal control must be accomplished by a sensor, which follows a string-line, ski, or other reference. The grade sensor must be moveable and mounts provided so that grade control can be established on either side of the spreader. A slope control sensor must also be provided to maintain the proper transverse slope of the screed. Use of manual screed controls is subject to the written acceptance by the Project Engineer.

.4 Self-propelled rollers of sufficient number, type, and weight in order to obtain the required degree of compaction and smoothness of the HMA. The rollers must be operated in accordance with the manufacturer's recommended procedures and the specifications.

.5 Keep the tires and steel drums of the rollers slightly moistened with wetting and scraping devices to prevent pick up or adhesion of HMA mix to the tires or drums. Moisten with water or a non-petroleum based release agent, approved in writing by the Project Engineer, but do not over-moisten. Petroleum derivatives are not permitted for use as a cleaning or wetting agent. Pneumatic-tired rollers must be equipped with full coverage wind skirts.

.9 Hand Tools:

.1 Only lutes or rakes must be used during the spreading and finishing operation and when the HMA is worked by hand.

.2 Tamping irons may be used to consolidate the HMA along structures inaccessible to the rollers. Mechanical compaction equipment, satisfactory to the Project Engineer, may be used instead of tamping irons.

.3 For purposes of checking the finished surface, Contractors must provide and carry on each spreading machine a 3.0 m straight edge and slope measuring level.

.4 Use a non-petroleum based release agent, approved in writing by the Project Engineer, to clean the hand tools. Petroleum derivatives are not permitted for hand tool cleaning.

.10 Pre-levelling for HMA:

.1 The Project Engineer will designate, in writing, uneven surface areas or areas having 20 mm or greater depressions that require pre-levelling with HMA mix.

.2 Pre-levelling HMA mix is to be placed must be accomplished by the use of a grader, spreader, hand, or by a combination of these methods, as directed in writing by the Project Engineer.

.3 After placement, the HMA used for pre-levelling must be compacted with a combination of rollers that provide uniform and consistent compaction.

.11 Paving Operations:

.1 The HMA must be placed to the design thickness as shown on the contract drawings. On new construction where an established reference is lacking, a string-line, ski, or other reference will be required. Adjacent mats on the same lift are to be controlled by use of the grade sensor. No relaxation of the above procedure will be permitted without written acceptance of the Project Engineer.

.2 When using spreaders in echelon the second spreader must follow the uncompacted edge of the HMA mix placed by the first spreader. The spreaders must be operated, as close together as is practical but in no case are they to be more than 30 m apart.

.3 The spreader must be operated in such a manner as to distribute the HMA to proper cross-section, width and thickness without causing segregation of the HMA. The forward motion of the spreader must be controlled so that no irregularities in the pavement surface are caused by excessive speed. The rate of placement of the HMA must be uniform and must be coordinated with the production rate of the HMA plant without intermittent operation of the spreader.

.4 Any failure of the spreader or operation to produce a smooth, uniformly mat, free from irregularities, segregation or poor workmanship, must be corrected immediately to the satisfaction of the Project Engineer.

.5 Excess HMA mix is to be wasted. Do not pick up any HMA mix that has been placed through the spreader and put it back into the spreader hopper or in front of the augers. Placing of any excess spreader laid HMA mix back into the spreader hopper or in front of the augers will be assessed a $100 penalty per occurrence, as documented by photographs and in writing by the Project Engineer. The Project Engineer will notify the Contractor in writing of the assessment of these penalties as soon as they occur.

.12 Areas Inaccessible to the Spreading Machine:

.1 Areas that are inaccessible to the spreading machine may be paved by other methods, as approved by the Engineer in writing.

.2 In small areas or where the use of mechanical equipment is not practical, the HMA may be spread and finished by hand. The HMA must be dumped on the area and immediately thereafter distributed into place by shovels and spread with lutes or rakes in a loose uniform layer of uniform density and correct depth. Material must be handled so as to avoid segregation.

.13 Surface Irregularities and Obvious Defects:

.1 The finished surface must be free of visible signs of poor workmanship such as, but not limited to:

- segregation and non-uniform surface texture.
- areas of excess or insufficient asphalt binder.
- improper matching of longitudinal or transverse joints.
- dimpling, cracking, checking, shoving, tearing, ripples.
- screed marks, roller marks, roller pick-outs, tire marks.
- sampling locations not properly reinstated.
- localized low spots or bird baths.

.2 The Contractor must correct irregularities and defects that develop before completion of compaction by loosening the surface of the HMA and removing or adding material, as required.

.3 Areas showing checking or hairline cracking must be repaired by methods approved in writing by the Engineer.

.14 Compaction:

.1 The Contractor must supply sufficient compaction equipment to:

.1 Provide a compaction rate that will equal or exceed the placing rate of the spreader.

.2 Ensure the specified compaction is attained before the temperature of the HMA mat surface falls below 50°C, as determined by an infrared thermometer.

.15 Longitudinal and Transverse Joints:

.1 Longitudinal and transverse joints must be made in a manner consistent with industry standards, as indicated in the current edition of "Construction of Hot Mix Asphalt Pavement" Asphalt Institute Manual Series No. 22 and "Hot Mix Asphalt Materials, Mixture Design and Construction" TB-1 as published by the National Asphalt Pavement Association (NAPA). Coarse aggregate removed from the HMA mix during joint preparation must be wasted and not be broadcast back on to the mat.

.2 Paving joints must not be placed in the same vertical plane. Longitudinal joints must be offset at least 150 mm and transverse joints must be offset at least 2.0 m.

.3 Longitudinal joints must be uniformly aligned to the travel lanes and must not be located within the wheel paths of the travel lane. If permitted in writing by the Engineer the longitudinal joint may be located between the wheel paths at the centre of the travel lane.

.4 Edges where additional HMA mix is to be placed must be vertically formed to true line. A lute or rake must be used immediately behind the spreader when required to obtain a true line and vertical edge.

.5 The exposed edges of all cold HMA joints must be cleaned and painted with a layer of emulsified asphalt tack coat.

.6 At the end of each day's paving of the surface course and upper lift of the base course mix, the uncompleted paving mats must be provided with vertical transverse joints.

.7 All joints between old and new pavements or between successive days production must be of a vertical butt type, well bonded, sealed and finished to provide a continuous, smooth profile across the joint.

.16 Utility Appurtenances:

.1 Pavement incorporating utility appurtenances, including water valves, gas valves, manholes and other surface utility fixtures must be constructed in a manner satisfactory to the Project Engineer.

.2 A tack coat must be provided to the vertical surface of utility appurtenances prior to paving.

.3 The paved surface adjacent to utility appurtenances must have a tight uniform surface and must be free of segregation.

.4 All catch basins, manholes, water valves, and other roadway fixtures must be brought to the proper elevation before final lift paving. Provide temporary protection where necessary until completion of paving. If catch basins, manholes, water valves, and other roadway fixtures are not raised to their proper elevation and are required to be raised subsequent to final lift paving a $500.00 penalty per occurrence, as documented in writing by the Engineer, will be assessed to the Contractor.

.17 Opening to Traffic:

.1 Prior to any application of traffic, HMA paving mats must be sufficiently cool to resist any deformation or surface scuffing by turning vehicle tires.

.2 Means of cooling (e.g. application of water) the completed HMA pavements prior to opening to traffic may be required, at the Project Engineer's written discretion.

.3 Traffic may be prohibited from travelling on newly paved surfaces, for any length of time deemed necessary by the Project Engineer.

2. MEASUREMENT AND PAYMENT

.1 HMA supplied will be measured in square metres or tonnes of material placed, as detailed in the contract.

.2 The Unit Price for HMA will be full compensation for all materials, labour, tools, equipment and incidentals necessary to complete the Work in accordance with these specifications.

.3 Material must be scaled and recorded by the Contractor on duplicate weight slips. Weight slips must be supplied at the time of delivery and a copy supplied to the Project Engineer.

.4 The weight scale must be inspected and certified by an Authorized Service Provider recognized by Measurement Canada, an agency of Innovation, Science and Economic Development Canada, at the Contractors' expense prior to the start of the supply of HMA and as often thereafter, as the Project Engineer may direct in writing.

.5 The Unit Price applicable to each Lot quantity of HMA will be calculated as follows:

$$\textbf{LOT UNIT PRICE} = (\textbf{CONTRACT UNIT PRICE} + PAg) \times PA_{AC} \times PA_{COM} \times PA_{T} \times PA_{TSR}$$

Where: PAg = Unit Price Adjustment for Gradation.
PA_{AC} = Asphalt Binder Content Paymemt Adjustment.
PA_{COM} = Compaction Payment Adjustment.
PA_{T} = Thickness Payment Adjustment.
PA_{TSR} = TSR Payment Adjustment.

CHART A
ASPHALT BINDER CONTENT
PAYMENT ADJUSTMENT FACTOR

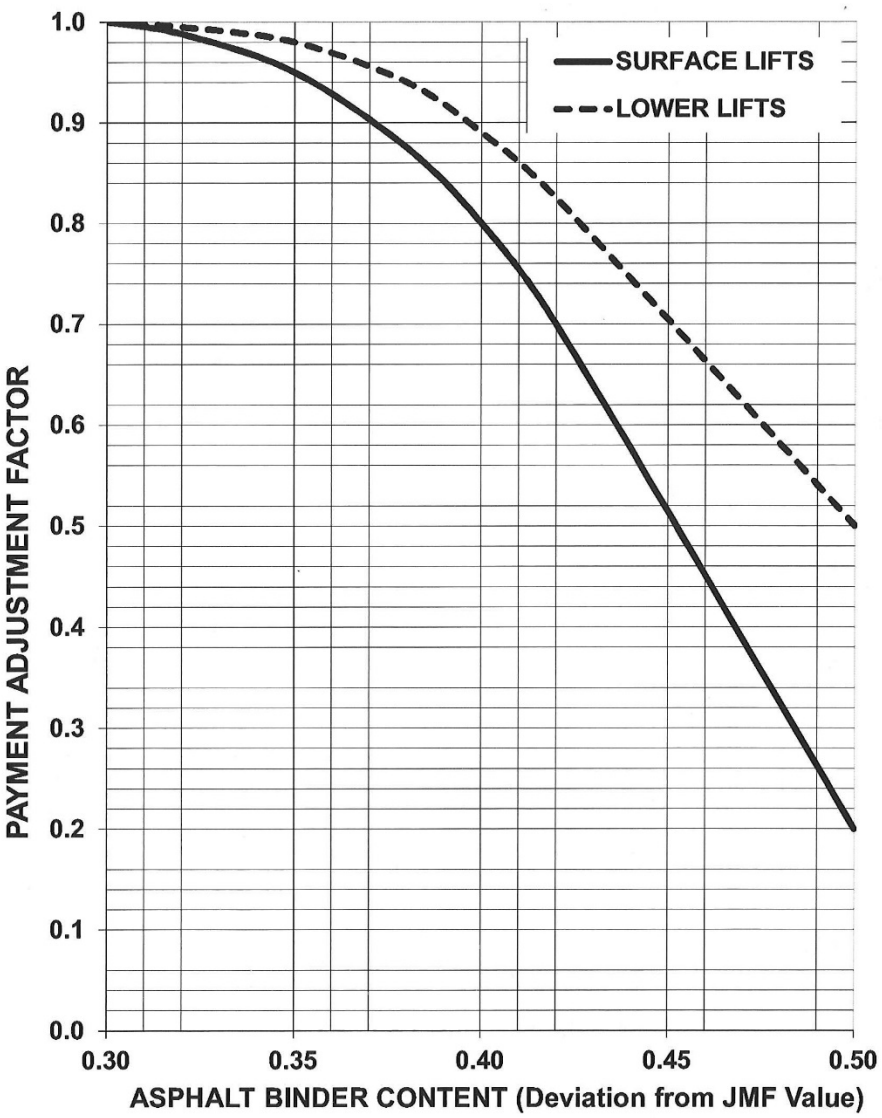
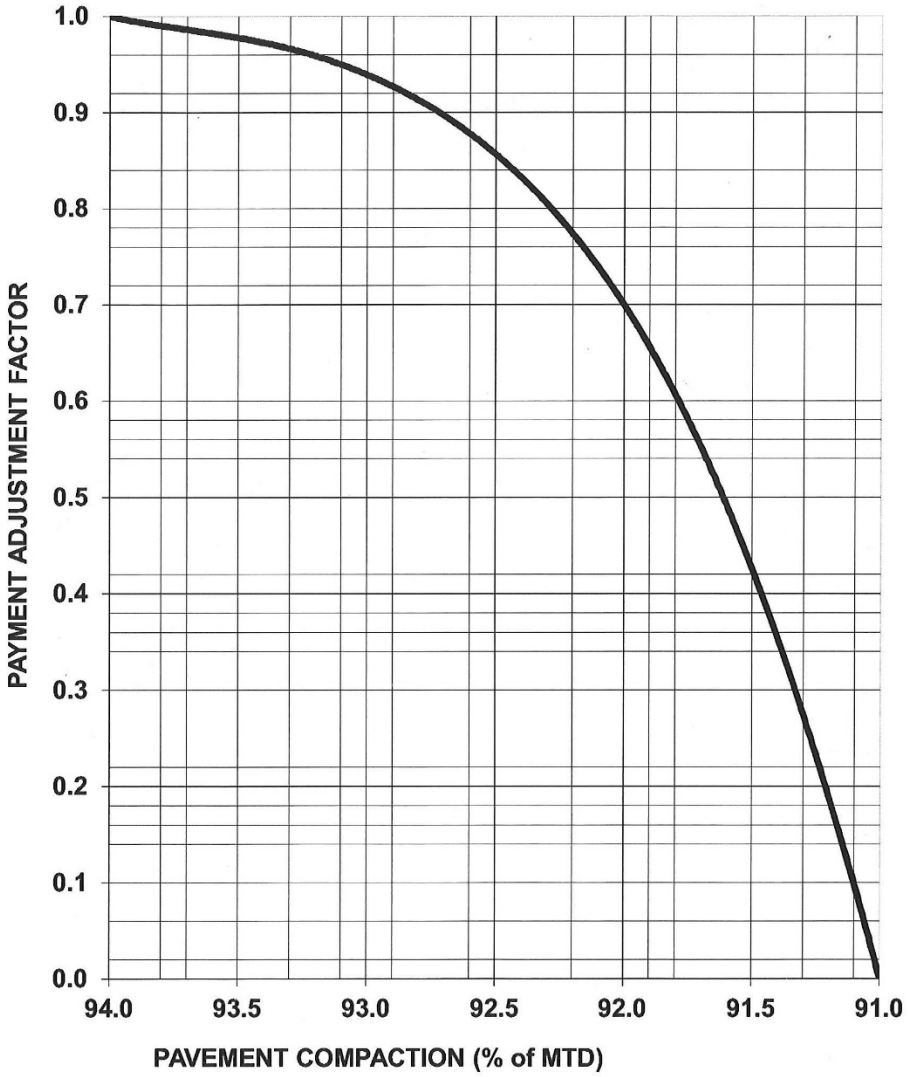


CHART B
COMPACTION
PAYMENT ADJUSTMENT FACTOR



END OF SECTION

16 ASPHALT BINDER

16.1 GENERAL

16.1.1 Description

This section specifies the requirements for asphalt binder to be used in producing Hot Mix Asphalt (HMA) concrete paving mixtures.

The Work consists of supplying asphalt binder including ordering, scheduling, delivery, storage facilities, handling, storing, sampling, testing, and other related items.

When a penetration-viscosity grade asphalt binder is designated for use in the contract, this specification will apply rather than Section 17 Performance Graded Asphalt Binder.

16.1.2 Related Sections

Performance Graded Asphalt Binder – Section 17.

Hot Mix Asphalt Concrete – Section 15.

Hot Mix Asphalt Concrete Trails – Section 19.

16.1.3 Definitions

Acceptance is the process undertaken by the Engineer in which the available Quality Control and Quality Assurance test data is reviewed and the Work is inspected by Project Engineer to ensure that it meets the requirements of the specifications. Recommendation for acceptance may be provided by Project Engineer.

Asphalt binder is a dark brown to black cement like residuum in which the predominating constituent is bitumen obtained from the distillation, with or without additional processing, of a suitable petroleum crude oil. Reference to asphalt binder within this specification includes virgin asphalt binder and asphalt binder / liquid anti- stripping agent combinations, as the case may be.

Contractor is the Party that enters into an agreement to provide the required materials and to perform the Work on the project at a predetermined price or rate.

Engineer as referred to in this specification, shall be the County or their designated representative.

Project Engineer shall be the County or their designated representative or shall mean the licensed professional Engineer retained by the Developer.

Quality Assurance (QA) is the planned and systematic activities, on the part of a purchaser or owner, implemented in a quality system so that the quality requirements for a material, product or service are verified or confirmed.

Quality Control (QC) is the operational techniques and activities, on the part of a material, product or service provider, used to achieve and maintain the material, product or service to the required quality.

16.2 PRODUCTS

16.2.1 Asphalt Binder

The Contractor must supply the types and grades of asphalt binder as specified in the contract.

The asphalt binder must meet the requirements of this specification and the requirements of Alberta Transportation's latest edition of Standard Specification for Highway Construction, Section 5.7 Supply of Asphalt.

All asphalt binders must be prepared from the refining of petroleum crude oil in a straight run refining process with no air blowing or the addition of chemical agents. Asphalt binders must be uniform in character, must be free from impurities, and must not foam when heated to 175°C.

Re-refined Engine Oil Bottoms (REOB), also known as Vacuum Tower Asphalt Extenders (VTAE) must not be added, in any proportion, to the asphalt binder. The Project Engineer may perform period chemical analysis to determine if REOB/VTAE has been used.

The Contractor may be required to use more than one type or grade of asphalt binder for a particular purpose on a project. The Engineer must approve in writing any change in asphalt binder type or grade prior to the change being made by the Contractor.

Liquid anti-stripping agents, listed in the most current edition of the Alberta Transportation Products List, may be added to the asphalt binder at a rate not to exceed 0.5% by weight of virgin asphalt binder. The asphalt binder/ liquid anti-stripping agent combination must meet the asphalt binder requirements of this specification.

Liquid anti-stripping addition rates greater than 0.5% by weight of virgin asphalt binder will only be allowed if the Contractor completes laboratory testing to confirm that the treated virgin asphalt binder meets the requirements of this specification and receives written approval from the Engineer.

The Engineer may consider the use of a liquid anti-stripping agent that is not in the most current Alberta Transportation Products List at the written request of the Contractor. The Contractor must provide sufficient time and all the supporting documentation on the use and long-term performance of the proposed anti-stripping agent required by the Engineer to make a written determination on its use.

The Contractor may use hydrated lime at an additive rate as determined by the HMA mix design but the additive rate must be at least 1.4% by weight of dry aggregate, in place of a liquid anti-stripping agent. The hydrated lime must meet the requirements of AASHTO M303, Lime for Asphalt Mixtures. The Contractor must include the details of the proposed procedures for uniformly incorporating the hydrated lime into the asphalt mix as part of the HMA mix design submission.

16.2.2 Materials Certification

At least 3 weeks prior to commencing Work on the project submit written and signed certification, from the asphalt binder manufacturer, that the asphalt binder complies with these specifications. This certification must include but is not limited to:

1. Name of the asphalt binder manufacturer.
2. Source(s) of the base asphalt binder(s).
3. Type and source(s) of additives.
4. Current laboratory test results for the asphalt binder.
5. A certification statement that the asphalt binder is a straight run, non-air blown/oxidized, non-chemically modified asphalt binder and, if the asphalt binder is modified, it has only been modified with Styrene Butadiene (SB) or Styrene Butadiene Styrene (SBS) type copolymers.

At least 10 working days prior to commencing HMA production submit a current temperature-viscosity chart for each required asphalt binder showing the Kinematic Viscosity in mm2 per second (centistoke) over a temperature range of at least 105°C to 175°C that indicates the recommended mixing and

compaction temperatures for the asphalt binder. This submission is to be included as part of the HMA mix design submission.

16.2.3 Sampling and Testing

All asphalt binder may be subject to inspection, sampling, and testing by the Project Engineer.

Upon written request by the Project Engineer, submit the manufacturer's most recent test data indicating that the asphalt binder meets requirements of this specification and Alberta Transportation's August 2013, Edition 15, Standard Specification for Highway Construction, Section 5.7 Supply of Asphalt.

The Contractor must obtain representative, uncontaminated samples of each type and grade of the asphalt binder delivered for use on the project for QA testing. Samples must be obtained once from every 1,500 tonnes of asphalt binder delivered to the asphalt binder storage facility. At least 1 sample of each type of asphalt binder must be obtained for each project, regardless of project size, unless directed otherwise, in writing by the Engineer.

The QA samples must be appropriately labelled in order to identify the Contractor, asphalt binder supplier, date and time sampled, type and grade of asphalt binder, type and amount of any liquid anti-stripping agent, and the weigh bill number of the load sampled.

The Contractor must supply a weight scale that must be inspected and certified by an Authorized Service Provider recognized by Measurement Canada, an agency of Innovation, Science and Economic Development Canada, at the Contractors' expense prior to the start of the supply of asphalt binder and as often thereafter, as the Project Engineer may direct in writing.

16.2.4 Quality Control

The Contractor must have monitoring procedures in-place to provide daily "bulk" measurements of all materials used to produce HMA at the asphalt plant including; anti-stripping agents, hydrated lime, and any other additives, as applicable, to verify that usage quantities match targeted values. If requested in writing by the Project Engineer, the Contractor must provide the daily bulk quantity checks within 1 working day of the HMA being placed on the project.

16.2.5 Quality Assurance

The Contractor must deliver QA samples to the Project Engineer within 1 working day after they were obtained.

The Project Engineer may test random QA samples. If a tested sample indicates non- compliant asphalt binder the QA sample immediately prior and immediately after will also be tested.

Acceptance or rejection of the asphalt binder will be based on the test results.

16.3 EXECUTION

16.3.1 Delivery and Storage

Provide storage facilities capable of heating the asphalt binder under effective and positive control at all times. All asphalt binder storage facilities must be equipped with sampling valves maintained in good operating condition which are designed and locate to enable safe, representative sampling into the appropriate 1 or 2 litre containers of the asphalt binder. The Contractor must provide safe, convenient access, acceptable to the Project Engineer, for inspection and sampling of the asphalt binder, and must cooperate in the inspection and sampling process when requested to do so.

The Contractor must follow the manufacture's specified handling and storage requirements for each grade of asphalt binder.

The Contractor must prevent contamination of the asphalt binder, by asphalt binder of another type or grade, by solvent, or by any other material.

No asphalt binder type or grade must be diluted or mixed with a different type or grade, or with any other material, without the specific written approval of the Engineer.

Asphalt binder storage tanks must be emptied of one type or grade of asphalt binder, and cleaned as necessary to prevent detrimental contamination of the asphalt binder, before placing another type or grade of asphalt binder therein.

When a liquid anti-stripping agent is added by the asphalt binder supplier the type and percentage of liquid anti-stripping agent must be listed on each asphalt binder delivery weigh bill.

When a liquid anti-stripping agent is added at the HMA mixing plant the Contractor must provide documentation from the asphalt binder manufacturer that the proposed liquid anti-stripping agent is compatible with the asphalt crude source and asphalt binder grade contained in the mix design when added within the dosage range recommended by the additive supplier.

When liquid anti-stripping agent is added to the asphalt binder at the HMA mixing plant, the liquid anti-stripping agent must be introduced through a separate, calibrated pumping and metering system electronically interlocked with the operating controls of the mixing plant. The calibrated pumping and metering system must have a totalizing flow meter in order to monitor the amount of liquid anti-stripping agent being used on the project. The Contractor must have a procedure in-place enabling the safe sampling of treated asphalt binder including an in-line valve and sampling system.

If hydrated lime is used in place of a liquid anti-stripping agent the feed system must be calibrated to provide a consistent and accurate feed of dry hydrated lime into the mixing plant prior to the asphalt binder injection point. The hydrated lime feed system shall be synchronized to the rate of aggregate feed and must be electronically interlocked with the operating controls of the mixing plant.

The Contractor must provide, maintain and reclaim asphalt binder storage facilities.

Provide to the Project Engineer, upon written request, all freight and weight bills/bill of lading for asphalt binder, liquid anti-stripping agent, and hydrated lime shipments received.

16.3.2 Acceptance

Asphalt binder supplied and incorporated into the project will be considered for acceptance provided the required QA samples have been provided to the Project Engineer within the time frame specified and where the both the asphalt binder and the HMA in which the asphalt binder was used meet the requirements of the specifications.

If non-compliant asphalt binder is identified by the Engineer, the field placement of the HMA containing the non-compliant asphalt binder must be suspended until the Contractor, Project Engineer and Engineer can determine the impact of the non- compliance and what the necessary remedial actions to be taken by the Contractor will be. Remedial actions must be either acceptance at full payment, acceptance at a payment adjustment or rejection.

If the Contractor, Project Engineer and Engineer cannot agree on an acceptable payment adjustment for the HMA, which contains the non-compliant asphalt binder, the Contractor, Project Engineer and the Engineer will jointly hire an independent third party to determine the payment adjustment.

If, in the written opinion of the Engineer, any asphalt binder that fails to meet the required specifications is significant enough to result in the probable unsatisfactory performance of the HMA concrete in which

the asphalt binder was used, it will be rejected. The Contractor must remove and replace all the HMA concrete containing the failed asphalt binder. Removal and replacement of the rejected asphalt binder and HMA concrete must be at the Contractor's cost. If the Contractor disagrees and submits in writing to the Engineer within 3 working days of receipt of notice from the Engineer that the HMA concrete is rejected, the Contractor, Project Engineer and the Engineer will jointly hire an independent third party to determine if the non-compliant asphalt binder will result in the probable unsatisfactory performance of the HMA concrete and its subsequent rejection.

If the Contractor, Project Engineer and the Engineer cannot agree on an independent third party, the Contractor, Project Engineer and Engineer will each nominate an independent third party to a Panel and those parties will select an independent third party to act as the chair of the Panel. The Panel will then determine the payment adjustment or if the HMA concrete should be rejected.

All costs for any independent third party or the Panel will be split evenly between the Contractor and the Project Engineer.

If suspended, the paving program must only recommence upon written authorization of the Engineer.

16.4 MEASUREMENT AND PAYMENT

If the contract indicates a bid item for the supply of asphalt binder, measurement will be based on weigh bills provided by the manufacturer to the Contractor.

The Project Engineer may confirm delivery quantities by weighing the delivery vehicles before and after unloading.

If there is a discrepancy between the confirmed delivery weight and the manufacturer's weight bill, the confirmed delivery weight will be used.

When the contract contains a bid item for the supply of asphalt binder, payment for the accepted asphalt binder, utilized as per the project requirements, must be at the applicable unit price per tonne in the contract documents.

Where the contract does not contain a bid item for the supply of asphalt binder, accepted asphalt binder will not be paid for as a separate item. Payment for the asphalt binder is then considered to be included in the unit price bid for the contract item in which the asphalt binder was used.

All costs associated with the supply and incorporation of any anti-stripping agent regardless of whether the anti-stripping agent is incorporated by the asphalt supplier or the Contractor, must be included in the unit price bid for supply of asphalt binder (if there is one) or for the unit price bid for the contract item in which the asphalt binder and anti-stripping agent is to be used. No separate or additional payment will be made for the addition of an anti-stripping agent.

Payment will be the full compensation for supplying asphalt binder and anti-stripping agent, if required, to the project including ordering, scheduling, delivery, storage facilities, handling, storing, sampling, testing, and other related items.

END OF SECTION

17 PERFORMANCE GRADED ASPHALT BINDER

17.1 GENERAL

17.1.1 Description

This section specifies requirements for Performance Graded (PG) asphalt binder utilized in Hot Mix Asphalt (HMA) concrete paving mixtures.

The Work consists of supplying PG asphalt binder including ordering, scheduling, delivery, storage facilities, handling, storing, sampling, testing, and other related items.

When a PG asphalt binder is designated for use in the contract, this specification will apply rather than Section 16 Asphalt Binder.

17.1.2 Related Sections

Asphalt Binder – Section 16.

Hot Mix Asphalt Concrete – Section 15.

Hot Mix Asphalt Concrete Trails – Section 19.

17.1.3 Definitions

Acceptance is the process undertaken by the Engineer in which the available Quality Control and Quality Assurance test data is reviewed and the Work is inspected by Project Engineer to ensure that it meets the requirements of the specifications. Recommendation for acceptance may be provided by Project Engineer.

Asphalt binder is a dark brown to black cement like residuum in which the predominating constituent is bitumen obtained from the distillation, with or without additional processing, of a suitable petroleum crude oil. Reference to PG asphalt binder within this specification includes virgin PG asphalt binder and PG asphalt binder / liquid anti-stripping agent combinations, as the case may be.

Contractor is the Party that enters into an agreement to provide the required materials and to perform the Work on the project at a predetermined price or rate.

Engineer as referred to in this specification, shall be the County or their designated representative.

Performance Grading (PG) is an asphalt binder specification and grading system that was one of the outcomes of the Strategic Highway Research Program (SHRP) in the late 1980's and early 1990's. The PG asphalt binder specification is part of the Superior Performing Asphalt Pavement (SuperpaveTM) system for materials selection, testing, and mix design.

Project Engineer shall be the County or their designated representative or shall mean the licensed professional Engineer retained by the Developer.

Quality Assurance (QA) is the planned and systematic activities, on the part of a purchaser or owner, implemented in a quality system so that the quality requirements for a material, product or service are verified or confirmed.

Quality Control (QC) is the operational techniques and activities, on the part of a material, product or service provider, used to achieve and maintain the material, product or service to the required quality.

17.2 PRODUCTS

17.2.1 PG Asphalt Binder

The Contractor must supply the types and grades of PG asphalt binder as specified in the contract.

The PG asphalt binder must meet the requirements of this specification and the requirements of Alberta Transportation's current Standard Specification for Highway Construction, Section 5.7 Supply of Asphalt including all applicable Special Provisions and Specification Amendments.

All PG asphalt binders must be prepared from the refining of petroleum crude oil in a straight run refining process with no air blowing or the addition of chemical agents. PG asphalt binders must be uniform in character, must be free from impurities, and must not foam when heated to 175°C.

Re-refined Engine Oil Bottoms (REOB), also known as Vacuum Tower Asphalt Extenders (VTAE) must not be added, in any proportion, to the PG asphalt binder. The Project Engineer may perform period chemical analysis to determine if REOB/VTAE has been used.

The Contractor may be required to use more than one type or grade of PG asphalt binder for a particular purpose on a project. The Engineer must approve in writing any change in PG asphalt binder type or grade prior to the change being made by the Contractor.

Liquid anti-stripping agents, listed in the most current edition of the Alberta Transportation Products List, may be added to the PG asphalt binder at a rate not to exceed 0.5% by weight of virgin PG asphalt binder. The PG asphalt binder/ liquid anti- stripping agent combination must meet the PG asphalt binder requirements of this specification. Liquid anti-stripping addition rates greater than 0.5% by weight of virgin PG asphalt binder will only be allowed if the Contractor completes laboratory testing to confirm that the treated virgin PG asphalt binder meets the requirements of this specification and receives written approval from the Engineer.

The Engineer may consider the use of a liquid anti-stripping agent that is not in the most current Alberta Transportation Products List at the written request of the Contractor. The Contractor must provide sufficient time and all the supporting documentation on the use and long-term performance of the proposed anti-stripping agent required by the Engineer to make a written determination in writing on its use.

The Contractor may use hydrated lime at an additive rate as determined by the HMA mix design but the additive rate must be at least 1.4% by weight of dry aggregate in place of a liquid anti-stripping agent. The hydrated lime must meet the requirements of AASHTO M303 Lime for Asphalt Mixtures. The Contractor must include the details of the proposed procedures for uniformly incorporating the hydrated lime into the asphalt mix as part of the HMA mix design submission.

17.2.2 Materials Certification

At least 3 weeks prior to commencing Work on the project submit written and signed certification, from the PG asphalt binder manufacturer, that the PG asphalt binder complies with these specifications. This certification must include but is not limited to:

1. Name of the PG asphalt binder manufacturer.
2. Source(s) of the base asphalt binder(s).
3. Type and source(s) of additives.
4. Current laboratory test results for the PG asphalt binder.

5. A certification statement that the PG asphalt binder is a straight run, non-air blown/oxidized, non-chemically modified asphalt binder and, if the asphalt binder is modified, it has only been modified with Styrene Butadiene (SB) or Styrene Butadiene Styrene (SBS) type copolymers.

At least 10 working days prior to commencing HMA production submit a current temperature-viscosity chart for each required PG asphalt binder showing the Kinematic Viscosity in mm2 per second (centistoke) over a temperature range of at least 105°C to 175°C that indicates the recommended mixing and compaction temperatures for the PG asphalt binder. In lieu of the temperature-viscosity chart, the recommended mix and compaction temperature for the PG asphalt binder, as recommended by the PG asphalt binder manufacturer may be provided. This submission is to be included as part of the HMA mix design submission.

17.2.3 Sampling and Testing

All PG asphalt binder may be subject to inspection, sampling, and testing by the Project Engineer.

Upon written request by the Project Engineer submit manufacturer's most recent test data indicating that the PG asphalt binder meets requirements of this specification and Alberta Transportation's current Standard Specification for Highway Construction, Section 5.7 Supply of Asphalt including all applicable Special Provisions and Specification Amendments.

The Contractor must obtain representative, uncontaminated samples of each type and grade of the PG asphalt binder delivered for use on the project for QA testing.

Samples must be obtained once from every 1,500 tonnes of PG asphalt binder delivered to the PG asphalt binder storage facility. At least 1 sample of each type of PG asphalt binder must be obtained for each project, regardless of project size, unless directed otherwise, in writing by the Engineer.

The QA samples must be appropriately labelled in order to identify the Contractor, PG asphalt binder supplier, date and time sampled, type and grade of PG asphalt binder, type and amount of liquid anti-stripping agent, and the weigh bill number of the load.

The Contractor must supply a weight scale that must be inspected and certified by an Authorized Service Provider recognized by Measurement Canada, an agency of Innovation, Science and Economic Development Canada, at the Contractors' expense prior to the start of the supply of PG asphalt binder and as often thereafter, as the Project Engineer may direct in writing.

17.2.4 Quality Control

.1 The Contractor must have monitoring procedures in-place to provide daily "bulk" measurements of all materials used to produce HMA at the asphalt plant; including anti-stripping agents and any other additives, as applicable, to verify that usage quantities match targeted values. If requested in writing by the Project Engineer, the Contractor must provide the daily bulk quantity checks within 1 working day of the HMA being placed on the project.

17.2.5 Quality Assurance

The Contractor must deliver QA samples to the Project Engineer 1 working day after they were obtained.

The Project Engineer may test random QA samples. If a tested sample indicates non- compliant PG asphalt binder the QA sample immediately prior and immediately after will also be tested.

Acceptance or rejection of the PG asphalt binder will be based on the test results.

17.3 EXECUTION

17.3.1 Delivery and Storage

Provide storage facilities capable of heating the PG asphalt binder under effective and positive control at all times. All PG asphalt binder storage facilities must be equipped with sampling valves maintained in good operating condition which are designed and locate to enable safe, representative sampling into the appropriate 1 or 2 litre containers of the PG asphalt binder. The Contractor must provide safe, convenient access, acceptable to the Project Engineer, for inspection and sampling of the PG asphalt binder, and must cooperate in the inspection and sampling process when requested to do so.

The Contractor must follow the manufacturer's specified handling and storage requirements for each grade of PG asphalt binder.

The Contractor must prevent contamination of the PG asphalt binder, by asphalt binder or PG asphalt binder of another type or grade, by solvent, or by any other material.

No PG asphalt binder type or grade must be diluted or mixed with a different type or grade of asphalt binder, or with any other material, without the specific written approval of the Engineer.

PG asphalt binder storage tanks must be emptied of one type or grade of PG asphalt binder or asphalt binder, and cleaned as necessary to prevent detrimental contamination of the PG asphalt binder, before placing another type or grade of PG asphalt binder therein.

When the liquid anti-stripping agent is added by the PG asphalt binder supplier the type and percentage of liquid anti-stripping agent must be listed on each PG asphalt binder delivery weigh bill.

When the liquid anti-stripping agent is added at the HMA mixing plant the Contractor must provide documentation from the PG asphalt binder manufacturer that the proposed liquid anti-stripping agent is compatible with the asphalt crude source and

PG asphalt binder grade contained in the mix design when added within the dosage range recommended by the additive supplier.

When a liquid anti-stripping agent is added to the PG asphalt binder at the HMA mixing plant, the liquid anti-stripping agent must be introduced through a separate, calibrated pumping and metering system electronically interlocked with the operating controls of the mixing plant. The Contractor must have a procedure in-place enabling the safe sampling of treated PG asphalt binder including an in-line valve and sampling system.

If hydrated lime is used in place of a liquid anti-stripping agent the feed system must be calibrated to provide a consistent and accurate feed of dry hydrated lime into the mixing plant prior to the PG asphalt binder injection point. The hydrated lime feed system shall be synchronized to the rate of aggregate feed and must be electronically interlocked with the operating controls of the mixing plant.

The Contractor must provide, maintain and reclaim PG asphalt binder storage facilities.

Provide to the Project Engineer, upon written request, all freight and weight bills/bill of lading for PG asphalt binder, liquid anti-stripping agent, and hydrated lime shipments received.

17.3.2 Acceptance

PG asphalt binder supplied and incorporated into the project will be considered for acceptance provided the required QA samples have been provided to the Project Engineer within the time frame specified and where the both the PG asphalt binder and the HMA concrete in which the PG asphalt binder was used meet the requirements of the specifications.

If non-compliant PG asphalt binder is identified by the Engineer, the field placement of the HMA concrete containing the non-compliant PG asphalt binder must be suspended until the Contractor, Project Engineer and Engineer can determine the impact of the non-compliance and what the necessary remedial actions to be taken by the Contractor will be. Remedial actions must be either acceptance at full payment, acceptance at a payment adjustment or rejection.

If the Contractor, Project Engineer and Engineer cannot agree on an acceptable payment adjustment for the HMA concrete which contains the non-compliant PG asphalt binder the Contractor, Project Engineer and the Engineer will jointly hire an independent third party to determine the payment adjustment.

If, in the written opinion of the Engineer, any PG asphalt binder that fails to meet the required specifications is significant enough to result in the probable unsatisfactory performance of the HMA concrete in which the PG asphalt binder was used, it will be rejected. The Contractor must remove and replace all the HMA concrete containing the failed PG asphalt binder. Removal and replacement of the rejected PG asphalt binder and HMA concrete must be at the Contractor's cost. If the Contractor disagrees and submits in writing to the Engineer within 3 working days of receipt of notice from the Engineer that the HMA concrete is rejected, the Contractor, Project Engineer and the Engineer will jointly hire an independent third party to determine if the non-compliant PG asphalt binder will result in the probable unsatisfactory performance of the HMA concrete and its subsequent rejection.

If the Contractor, Project Engineer and the Engineer cannot agree on an independent third party, the Contractor, Project Engineer and Engineer will each nominate an independent third party to a Panel and those parties will select an independent third party to act as the chair of the Panel. The Panel will then determine the payment adjustment or if the HMA concrete should be rejected.

All costs for the independent third party or the Panel will be split evenly between the Contractor and the Project Engineer.

If suspended, the paving program must only recommence upon written authorization of the Engineer.

17.4 MEASUREMENT AND PAYMENT

If the contract indicates a bid item for the supply of PG asphalt binder, measurement will be based on weigh bills provided by the manufacturer to the Contractor.

Delivery quantities may be confirmed by weighing the delivery vehicles before and after unloading.

If there is a discrepancy between the confirmed delivery weight and the manufacturer's weight bill, the confirmed delivery weight will be used.

When the contract contains a bid item for the supply of PG asphalt binder, payment for the accepted PG asphalt binder, utilized as per the project requirements, must be at the applicable unit price per tonne in the contract documents.

Where the contract does not contain a bid item for the supply of PG asphalt binder, accepted PG asphalt binder will not be paid for as a separate item. Payment for the PG asphalt binder is then considered to be included in the unit price bid for the contract item in which the PG asphalt binder was used.

All costs associated with the supply and incorporation of any anti-stripping agent regardless of whether the anti-stripping agent is incorporated by the PG asphalt supplier or the Contractor, must be included in the unit price bid for supply of PG asphalt binder (if there is one) or for the unit price bid for the contract item in which the PG asphalt binder and anti-stripping agent is to be used. No separate or additional payment will be made for the addition of an anti-stripping agent.

Payment will be the full compensation for supplying PG asphalt binder and anti- stripping agent, if required, to the project including ordering, scheduling, delivery, storage facilities, handling, storing, sampling, testing, and other related items.

END OF SECTION

18 PRIME, TACK AND FOG COATS

18.1 GENERAL

18.1.1 Description

This section specifies the requirements for low-viscosity bituminous materials (emulsified asphalt) to be used in prime coats, tack coats, and fog coats, as well as associated materials.

The Work consists of supplying emulsified asphalt including ordering, scheduling, delivery, storage facilities, handling, storing, sampling, testing, placement of the emulsified asphalt on the required locations or as directed in writing by the Project Engineer, and other related items.

18.1.2 Related Sections

Hot Mix Asphalt Concrete – Section 15.

Hot Mix Asphalt Concrete Trails – Section 19.

18.1.3 Definitions

Acceptance is the process undertaken by the Engineer in which the available Quality Control and Quality Assurance test data is reviewed and the Work is inspected by Project Engineer to ensure that it meets the requirements of the specifications. Recommendation for acceptance may be provided by Project Engineer.

Contractor is the Party that enters into an agreement to provide the required materials and to perform the Work on the project at a predetermined price or rate.

Emulsified asphalt is a suspension of minute globules of asphalt binder in water that contains a small amount of emulsifying agent.

Engineer as referred to in this specification, shall be the County or their designated representative.

Fog coat is an application of emulsified asphalt to seal small cracks and surface voids in existing Hot Mix Asphalt (HMA) concrete to inhibit ravelling and/or the ingress of moisture. A fog coat will only be required if, in the written opinion of the Engineer, the HMA concrete is open in texture/segregated and/or contains small surface cracks.

Prime coat is an application of emulsified asphalt which is designed to penetrate, bond, and stabilize a previously prepared granular base course or an existing absorbent surface, preparatory to placing bituminous surfacing materials or HMA concrete and is intended to promote bonding between the 2 differing materials.

Project Engineer shall be the County or their designated representative or shall mean the licensed professional Engineer retained by the Developer.

Quality Assurance (QA) is the planned and systematic activities, on the part of a purchaser or owner, implemented in a quality system so that the quality requirements for a material, product or service are verified or confirmed.

Quality Control (QC) is the operational techniques and activities, on the part of a material, product or service provider, used to achieve and maintain the material, product or service to the required quality.

Sand blotter is the application of clean granular material used to absorb excess emulsified asphalt, which has failed to penetrate into the granular base course or ponded on other surfaces.

Tack coat is an application of emulsified asphalt to a previously constructed paved surface of any type or age in preparation for placing a new layer of HMA concrete and is intended to provide a thorough bond between the old and new materials.

18.2 PRODUCTS

All emulsified asphalts must be homogeneous and uniform in character throughout and meet the requirements indicated in the current edition of Alberta Transportation's Standard Specification for Highway Construction, Section 5.7 Supply of Asphalt, Table ASPH-7 Specifications for Anionic Emulsified Asphalts.

18.2.1 Prime Coat

The emulsified asphalt must be a Slow Setting (SS) type SS-1 diluted at a maximum of 1 part potable water added to 1 part SS-1 up to September 30. After September 30 the Contractor may use an undiluted Medium Setting (MS) type MS-1 or a Rapid Setting (RS) type RS-1.

18.2.2 Tack Coat

The emulsified asphalt type must be a SS-1 diluted at a maximum of 1 part potable water added to 1 part SS-1 September 30. After September 30 the Contractor may use an undiluted Rapid Setting (RS) type RS-1.

18.2.3 Fog Coat

The emulsified asphalt type may be a SS-1 or a MS-1 depending on the surface material to be sealed.

18.2.4 Sand Blotter

The materials for sand cover used to blot excessive emulsified asphalt must consist of clean granular aggregate material, all of which must pass a 5 000 μm sieve, be free from organic matter or other deleterious materials, and approved in writing for use by the Project Engineer.

18.2.5 Materials Certification

At least 3 weeks prior to commencing Work on the project submit written and signed certification, from the emulsified asphalt supplier, that the emulsified asphalt complies with these specifications. This certification must include but is not limited to:

1. Name of the emulsified asphalt supplier.
2. Source(s) of the base asphalt binder(s).
3. Current laboratory test results for the emulsified asphalt.

18.2.6 Sampling and Testing

All emulsified asphalt may be subject to inspection, sampling, and testing by the Project Engineer.

Upon written request by the Project Engineer submit supplier's most recent test data indicating that the emulsified asphalt meets requirements of this specification and the current addition of Alberta Transportation's Standard Specification for Highway Construction, Section 5.7 Supply of Asphalt, Table ASPH-7 Specifications for Anionic Emulsified Asphalts.

The Contractor must obtain representative, uncontaminated samples of each type of the emulsified asphalt delivered for use on the project for QA testing. Samples must be obtained once from every 500 tonnes of each type of emulsified asphalt delivered for use on the project. At least 1 sample of each type

of emulsified asphalt must be obtained for each project, regardless of project size, unless directed otherwise, in writing by the Project Engineer.

The QA samples must be appropriately labelled in order to identify the Contractor, emulsified asphalt supplier, project, date and time sampled, type of emulsified asphalt, and the weigh bill number of the load sampled.

18.2.7 Quality Control

The Contractor must have monitoring procedures in-place to provide daily "bulk" measurements of emulsified asphalt and potable water, as applicable, to verify that the maximum dilution rates indicated in 18.2.1 and 18.2.2 are not exceeded. If requested in writing by the Project Engineer, the Contractor must provide the daily bulk quantity checks within 1 working day of the HMA being placed on the project.

18.2.8 Quality Assurance

The Contractor must deliver the QA samples to the Project Engineer within 1 working day after they were obtained.

The Project Engineer may test random QA samples. If a tested sample indicates non- compliant emulsified asphalt the QA sample immediately prior and immediately after will also be tested.

Acceptance or rejection of the emulsified asphalt will be based on the test results.

18.3 EXECUTION

18.3.1 Delivery and Storage

All emulsified asphalt storage facilities must be equipped with sampling valves maintained in good operating condition which are designed and located to enable representative sampling into the appropriate 1 or 2 litre containers of the emulsified asphalt. The Contractor must provide safe, convenient access, acceptable to the Project Engineer, for inspection and sampling of the emulsified asphalt, and must cooperate in the inspection and sampling process when requested to do so.

The Contractor must follow the supplier's specified handling and storage requirements for each type of emulsified asphalt. All asphalt emulsions must be protected from freezing.

The Contractor must prevent contamination of the emulsified asphalt, by emulsified asphalt of another type, by solvent, or by any other material.

No emulsified asphalt type must be diluted or mixed with a different type, or with any other material, without the specific written approval of the Project Engineer.

Emulsified asphalt storage tanks must be emptied of one type of emulsified asphalt, and cleaned as necessary to prevent detrimental contamination of the emulsified asphalt, before placing another type of emulsified asphalt therein.

Provide to the Project Engineer, upon written request, all freight and weight bills/bill of lading for emulsified asphalt binder received.

18.3.2 Equipment

Pressure Distributor:

Designed, equipped, maintained, and operated so that the emulsified asphalt materials can be heated to a uniform temperature and can be applied uniformly on variable widths of surface up to 5 metres. The

application rate must be readily determined and controlled at rates from 0.2 to 5.0 litres/square metre (L/m2) and with an allowable variation from any specified rate not exceeding 0.1 L/m2.

Capable of distributing emulsified asphalt material from a spray bar in a pressurized, uniform spray without atomization at the temperature required. The spray patterns made by the nozzles must result in overlap so that 3 nozzles cover any given area (except the 2 nozzles at the very end of the spray bar) to avoid streaking. Nozzles must be of the same manufacture, size, type, and must be set in the spray bar so that all nozzle slots make the same angle with the longitudinal axis of the spray bar.

Capable of maintaining the spray bar, at a constant height for uniform application of the emulsified asphalt, as material is withdrawn from the reservoir tank.

Equipped with a meter registering lineal metres per minute visibly located to enable the operator to maintain constant speed required for application at specified rates.

Has a positive displacement pump equipped with flow meter registering litres per minute passing through the nozzles and visible to the operator of the distributor. The pump must operate by a hydraulic motor powered by the truck power unit or by a separate independent power unit.

Equipped with an easily read, accurate, and sensitive device, which registers the temperature of the emulsified asphalt in the reservoir tank.

Equipped with accurate volume measuring device or calibrated tank.

Equipped with heating attachments and circulation or agitation capability.

Has a pressurized hand wand that can be used to treat areas not readily accessible by the spray bar.

Has a positive shut-off valve to prevent dripping from the spray bar or hand wand.

Application:

Before application of the emulsified asphalt all loose, dirty or objectionable material must be removed from the surface by power brooming or by other methods acceptable to the Project Engineer. Obtain Project Engineer 's written approval of existing surface before applying any emulsified asphalt.

Temperature of the emulsified asphalt is to be between 20°C and 60°C in the reservoir tank prior to application.

Upon the prepared and approved surface, the emulsified asphalt must be applied uniformly without streaking at a rate of: from 0.50 to 3.00 L/m2 for prime coats; from 0.20 to 0.90 L/m2 for tack coats; from 0.20 to 0.60 L/m2 for fog coats; or as directed in writing by the Project Engineer.

The emulsified asphalt must be uniformly applied and without streaking or ponding.

Joints and seams must not be excessively overlapped. Correct all areas that have not received sufficient coverage or have been damaged by traffic with the additional application of emulsified asphalt, to the written satisfaction of the Project Engineer.

Immediately correct all areas of ponding or excessive emulsified asphalt by an application of a sand blotter, removal by squeegeeing or scraping, rolling with a pneumatic tired roller or other means, to the written satisfaction of the Project Engineer. If the emulsified asphalt has set remove excess material by cold milling or other means, to the written satisfaction of the Project Engineer.

Where traffic is to be maintained treat no more than 1/2 of the roadway surface at a time with emulsified asphalt.

Cover all contact surfaces of curbs, gutters, headers, manholes, water valves, and like appurtenances with a uniform coat of the same emulsified asphalt material.

Do not apply emulsified asphalt when rain is forecast within 2 hours, the weather is foggy, excessively windy or when the air temperature is less than 5°C, unless otherwise permitted in writing by the Project Engineer.

All areas and structures adjacent to the roadway must be completely protected from the emulsified asphalt application operation including any accidental spillage of emulsified asphalt. Any unnecessary spraying or splashing by emulsified asphalt of areas adjacent to the roadway Work that will be visible when placement of the HMA concrete is complete must be cleaned to the written approval of the Project Engineer. All costs related to cleaning these areas will be borne solely by the Contractor.

Traffic must not be permitted to travel on the prime coat until at least 6 hours after application or until it has completely cured. The Contractor must maintain the prime coat surface until the HMA concrete has been place on it. Maintenance must include spreading any additional sand blotter and patching any breaks in the prime coat surface with additional emulsified asphalt.

Preferably, the emulsified asphalt prime coat should be entirely absorbed by the granular base course and therefore require no sand cover. However, if the emulsified asphalt has not been completely absorbed 6 hours after application, just sufficient sand blotter must be spread over the surface to blot up the excess emulsified asphalt and prevent it from being picked up by any traffic.

Traffic must not be permitted to travel on the tack coat or fog coat until they are completely cured. The Contractor must use flagmen, if required, and signage to control traffic until the tack coat or fog coat has completely cured.

Acceptance

The Contractor must provide emulsified asphalt, prime coats, tack coats, and fog coats conforming to the requirements of this specification and to workmanship in accordance with industry standards.

If non-compliant emulsified asphalt is identified by the Contractor or the Engineer, use of the non-compliant emulsified asphalt must be suspended until the Contractor, Project Engineer and Engineer can meet to determine the impact of the non- compliance and what the necessary remedial actions to be taken by the Contractor will be. Remedial actions must be either acceptance at full payment, acceptance at a payment adjustment or rejection.

If the Contractor, Project Engineer and Engineer cannot agree on an acceptable payment adjustment for the HMA concrete affected by the non-compliant emulsified asphalt the Contractor, Project Engineer and the Engineer will jointly hire an independent third party to determine the payment adjustment.

If, in the written opinion of the Engineer, any emulsified asphalt that fails to meet the required specifications is significant enough to result in the probable unsatisfactory performance of the HMA concrete affected by the non-compliant emulsified asphalt, it will be rejected. The Contractor must remove and replace all the HMA concrete placed on the failed emulsified asphalt. Removal and replacement of the rejected HMA concrete must be at the Contractor's cost. If the Contractor disagrees and submits in writing to the Engineer within 3 working days of receipt of notice from the Engineer that the HMA concrete is rejected, the Contractor, Project Engineer and the Engineer will jointly hire an independent third party to determine if the non-compliant emulsified asphalt will result in the probable unsatisfactory performance of the HMA concrete and its subsequent rejection.

If the Contractor, Project Engineer and the Engineer cannot agree on an independent third party, the Contractor and Engineer will each nominate an independent third party to a Panel and those two parties will select an independent third party to act as the chair of the Panel. The Panel will then determine the payment adjustment or if the HMA concrete should be rejected.

All costs for the independent third party or the Panel will be split evenly between the Contractor and the Project Engineer.

If suspended, the paving program must only recommence upon written authorization of the Engineer.

Acceptance in writing by the Engineer will only occur if there are no obvious defects just prior to the placement of HMA concrete in the case of prime coats and tack coats and upon complete curing in the case of fog coats. In addition, the required QA samples have been provided to the Engineer within the time frame specified.

18.4 MEASUREMENT AND PAYMENT

Where the contract does not contain a separate bid item for emulsified asphalt, all costs associated with the supply, application, and maintenance of emulsified asphalt must be included in the unit price per tonne of granular base in the case of prime coats and in the unit price per tonne of HMA concrete in the case of tack coats and fog coats and no separate or additional payment will be made.

Where the contract contains a separate bid item for the supply, application, and maintenance of emulsified asphalt measurement will be made by the square metre of treated area regardless of the number of applications of emulsified asphalt.

The supply and application of blotting sand, where required, will be considered incidental to the Work, and no separate or additional payment will be made.

END OF SECTION

19 HOT MIX ASPHALT CONCRETE TRAILS

19.1 GENERAL

19.1.1 DESCRIPTION

This section specifies requirements for Hot Mix Asphalt (HMA) Concrete Trails (multiuse sidewalk) construction under a Quality Assurance Specification framework.

The Work includes site preparation, site excavation, sub-grade preparation, supply of granular materials, granular materials placement, HMA supply, HMA placement, and clean-up, all to the requirements of this specification.

This section includes the material requirements, material certification, quality control testing, quality assurance testing, product acceptance and rejection, reporting, and measurement and payment as required by the project.

This section makes reference to other Construction Specifications. In the case of a discrepancy between this section and other referenced Sections, this section will govern.

19.1.2 Related Sections

.1 Sub-grade Preparation – Section 4.

.2 Granular Base and Sub-base – Sections 13 & 14.

.3 Prime, Tack, and Fog Coats – Section 18.

.4 Asphalt Binder – Section 16.

.5 Performance Graded Asphalt Binder – Section 17.

.6 Hot Mix Asphalt Concrete – Section 15.

19.1.3 1.3 Definitions

Acceptance is the process undertaken by the Engineer in which the available Quality Control and Quality Assurance test data is reviewed and the Work is inspected by Project Engineer to ensure that it meets the requirements of the specifications. Recommendation for acceptance may be provided by Project Engineer.

Contractor is the Party that enters into an agreement to provide the required materials and to perform the Work on the project at a predetermined price or rate.

Common Fill is all inorganic mineral deposits that are free from organic topsoil or loam, roots, rocks larger than 50 mm, and building debris. Excavation material is suitable if it conforms to the above and is approved in writing by the Engineer.

Common Material are all inorganic mineral deposits, other than Rock, and includes partially cemented materials that can be ripped and excavated by a hydraulic excavator.

Engineer as referred to in this specification, shall be the County representative or representative designated by the County.

On-site Topsoil is the naturally occurring organic soil or loam material found in-place on the site surface.

Project Engineer shall be the County or designated representative or shall mean the licensed professional Engineer retained by the Developer.

Quality Assurance (QA) is the planned and systematic activities, on the part of a purchaser or owner or designate, implemented in a quality system so that the quality requirements for a material, product and/or service are verified or confirmed.

Quality Assurance Specification is a specification whereby the methods of construction are not completely defined and require Contractor QC and Project Engineer QA and Acceptance of the Work. The Contractor is responsible for QC and the Project Engineer will monitor the Contractor's control of the process that produces the Work. The Project Engineer will undertake QA and Inspection to accept the Work.

Quality Control (QC) is the operational techniques and activities, on the part of a material, product or service provider, used to achieve and maintain the material, product or service to the required quality.

Rock is all firmly cemented or solid mineral material that cannot, without drilling and blasting, be removed by a hydraulic excavator equipped with a straight cutting edge bucket with a minimum of 4 equally spaced high penetration teeth, and 0.5 cubic metres in capacity.

Sub-soil is the layer of soil directly below the surface topsoil layer that contains the lower portion of the root zone, lacks the organic matter and humus content of topsoil, and is typically lighter in colour than the topsoil layer.

Topsoil is natural, friable surface soil of organic character suitable for agricultural purposes that is free of objectionable quantities of sub-soil, roots, stones, and other deleterious substances, is normally referred to as the plough layer in agriculture soils, and is typically darker in colour than the sub-soil layer.

19.2 PRODUCTS

19.2.1 Materials

Sub-grade to the requirements of Section 4 Sub-grade Preparation Materials but Fill Material will mean Common Fill and approved native material will mean Common Material.

Imported topsoil must be a homogeneous mixture of organic soil, loam, and compost that is easily friable, neither heavy clay nor of very light sandy nature, consisting of approximately 45% sand, 35% silt, 20% clay, with a pH value ranging from 6.5 to 7.5, and a minimum organic content of 6% that is approved for use by the Project Engineer in writing.

Sub-base and Base gravel to the requirements of Sections 13 & 14 Granular Base & Sub-base Preparation.

HMA concrete to the requirements of Section 15 Hot Mix Asphalt Concrete, and mix type S2.

19.2.2 Sampling and Testing

The Project Engineer must have access to all production processes and materials used for the Work to monitor material quality as often as deemed necessary. Such inspection and testing will not in any way relieve the Contractor of the responsibility for meeting the requirements of the specifications.

19.2.3 Quality Control

The Contractor will be totally responsible for production of materials and construction that meet all specified requirements.

QC is the responsibility of the Contractor throughout every stage of the Work from utility locates to the final accepted product. Tests performed by the Project Engineer will not be considered as QC tests.

All QC materials testing must be conducted by qualified agencies and personnel. The Contractor will bear the cost of all QC testing and consulting services.

QC sampling and testing frequencies are indicated within the individually referenced Sections.

19.2.4 Quality Assurance

Within this specification, certain requirements, limits and tolerances are specified regarding supplied materials and workmanship. Compliance with these requirements will be determined from QA testing and Acceptance inspections undertaken by the Project Engineer, as described in this section. All QA materials testing must be conducted by qualified agencies and personnel.

QA testing is the responsibility of the Project Engineer and the Project Engineer will hire an independent materials testing laboratory to perform the required QA testing. The materials testing laboratory undertaking the QA testing must be independent of the materials testing laboratory undertaking QC testing for the Contractor.

Initial QA testing will be undertaken free of cost to the Contractor. Unless otherwise indicated in the individually referenced Sections the QA results will be provided to the Contractor within 1 working day of the QA test being completed.

QA tests to determine field compaction of the sub-grade preparation will be performed at a minimum frequency of 1 compaction test per 400 square metres.

QA tests to determine field compaction the sub-base gravel and base gravel will be performed at a minimum frequency of 1 compaction test per 400 square metres. QA tests to determine the gradation and percent fracture will be performed at 1 test per 500 tonnes of material delivered to the site.

QA test for HMA will be performed at the frequencies indicated in Section 15 Hot Mix Asphalt Concrete.

19.3 ACCEPTANCE

19.3.1 General

Within this section, certain requirements, limits, and tolerances are specified regarding supplied materials and workmanship. Compliance with these requirements will be determined from QA testing and acceptance inspections undertaken by the Project Engineer .

The Contractor must provide Work conforming to the quality and tolerance requirements of the specifications. Where no tolerances are specified, the standard of workmanship must be in accordance with accepted industry standards.

When required in writing by the Project Engineer, the Contractor must provide and operate a loaded single axle test vehicle loaded to 8,165 kg on the rear axel to proof roll the sub-grade, sub-base gravel, or granular base for rutting, weaving, and soft spots. At the Project Engineer's written discretion the Contractor may provide an alternative loaded test vehicle. Where proof rolling indicates areas that are defective, the Contractor must remove and replace the material with suitable compacted material.

The Project Engineer will not accept materials or construction that do not meet the requirements of this section, unless indicated otherwise within other referenced Sections.

19.3.2 Inspection Procedures

The Contractor must provide safe, convenient access, acceptable to the Project Engineer, for sampling, testing, and inspection of the Work and must cooperate in the sampling, testing, and inspection process when requested to do so.

Where QA tests reveal Work not in accordance with the contract requirements, the Contractor must pay the costs for all additional QA tests or inspections, as the Project Engineer may require, to verify the acceptability of the corrected Work.

19.3.3 Inspection Stages

The Work will be inspected by the Project Engineer, upon notification by the Contractor, for the completion of the following stages of the Work:

.1 Clearing and grubbing.

.2 On-site topsoil excavation.

.3 Sub-grade preparation.

.4 Granular sub-base and granular base preparation.

.5 HMA placement.

The Project Engineer will undertake on going random inspections of the Work to monitor the progress of the Contractor and the quality and acceptability of the Work as it progresses. The frequency and timing of these inspections will be at the Project Engineer's sole discretion.

19.4 EXECUTION

19.4.1 General

The Contractor must locate all underground utilities prior to commencing Work on the project and obtain written approval of the Project Engineer and the appropriated utility departments and utilities companies, prior to commencing excavation.

Notify the Project Engineer and appropriate utility departments and utility companies 48 hours before starting excavations for utility line locates. Final excavation in the area of any utility line is to be done by hand or hydrovac, at the written discretion of the Project Engineer.

Protect active utility lines exposed by excavation from damage, as instructed by the utility departments or utility companies.

The Project Engineer will stake or flag the centreline or offset of the HMA concrete trail prior to commencement of construction, upon 2 working days notice from the Contractor. After initial location staking or flagging by the Project Engineer, the Contractor will be responsible for ensure the staking or flagging remains in place for as long as required for trail construction, as well as, protecting benchmarks and reference lines from damage. At the Contractor's cost, the Contractor must re-establish any staking or flagging, benchmarks, or reference lines disturbed or destroyed.

Supply and install adequate barriers, fences, warning and construction signs, to the written approval of the Project Engineer, to prevent injury to the public.

Maintain such barriers in good condition at all times during the Work.

Construct temporary detours as necessary to perform the Work and maintain temporary detours until construction is completed.

Location and drainage facilities for detours are subject to the written approval of the Project Engineer.

If authorized in writing by the Project Engineer to use existing roads for detours, the Contractor must maintain such roads for duration of the contract and make good any damage resulting from the Contractor's use of those roads.

The Contractor must protect all fences, buildings, sidewalks, curbs, paved areas, protected trees, shrubs, lawns, planted areas, and other features remaining as part of the final landscaping adjacent to the Work area from damage. The Contractor must repair, restore and make good, at the Contractor's cost, any and all damage to private and public property to the satisfaction of the property owner and the Project Engineer.

19.4.2 Trail Site Clearing and Grubbing

.1 Clear the trail site to a width of 1 m on both sides of the finished trail width, and to a height of 3 m. Trees at the trail edge must have all limbs facing the trail cut flush with a pole saw. Stripping and scaring of standing trees will not be permitted. All deadfall across the trail must be cut back to 600 mm outside the clearing width.

.2 Leaning and/or dead trees that in falling could reach the trail site must be felled away from the trail. The Project Engineer will flag all such trees.

.3 All trees presently growing on the site, which are to remain, must be protected to avoid any damage to them during construction operations. The Contractor must not excavate or use heavy equipment in proximity to trees that are to remain and must stay a minimum of 5 m away from the trunk or outside the drip line whichever is the larger value.

.4 The Contractor will be charged for any damage to trees that are to remain based on the value of the tree, as established by the International Society for Arboriculture Value Guide.

.5 Do not pull or rip out roots of trees that are to remain. If excavation through roots is required, excavate by hand and cut roots with a sharp axe.

.6 Stumps must be removed to a minimum depth of 600 mm below proposed finished grades.

19.4.3 Tree and Plant Protection

Protect tops, trunks, and roots of existing plants on site that are intended to remain.

Do not use heavy equipment within branch spread.

Remove interfering branches and roots, without injury to trunks, only when specifically directed in writing by the Project Engineer.

When existing grade around plants is lower than new finish grade perform re- grading by hand.

19.4.4 On-Site Topsoil Excavation

Remove all weed and vegetation growth from areas to be stripped of on-site topsoil.

Excavate on-site topsoil within the areas specified or as indicated in writing by the Project Engineer.

Do not permit on-site topsoil to be mixed with sub-soils.

Do not strip on-site topsoil under wet conditions.

Do not disturb on-site topsoil within branch spread of trees or shrubs that are to remain.

Stockpile on-site topsoil in locations approved in writing by the Project Engineer.

19.4.5 Common Material Excavation

All Common Material is to be excavated to the elevations and dimensions specified on the drawings. Make changes in grade gradual and blend sloped areas into level areas with a smooth transition.

Excavate all unsuitable material encountered from the construction area and stockpile on site in locations approved in writing by the Project Engineer.

If the Project Engineer deems that the equipment used for excavation is inadequate in size or over-sized for Work area, the Contractor will replace with suitable equipment, as directed in writing by the Project Engineer.

Rough grade to within 50 mm of the required sub-grade elevations but not uniformly high or low such that the exposed surface is clean cut.

Excavated Common Material must be used within the site for backfilling and embankment operations unless directed otherwise in writing by the Project Engineer.

Where Rock is encountered; any excavation Work for payment must be authorized by the Project Engineer in writing, prior to the start of excavation.

19.4.6 Sub-grade Preparation:

To the requirements of Section 4 Sub-grade Preparation.

19.4.7 Sub-Base Gravel Course Construction

To the requirements of Section 13 Granular Sub-Base Course.

19.4.8 Base Gravel Course Construction

To the requirements of Section 14 Granular Base Course.

19.4.9 Hot Mix Asphalt Concrete

To the requirements of Section 15 Hot Mix Asphalt Concrete and the following:

1. Notify the Project Engineer 72 hours prior to HMA paving.
2. Placed HMA when ambient temperature is above 7°C as issued by Environment and Climate Change Canada of the City of Medicine Hat. Monitor weather forecasts to determine optimum paving schedule.
3. Apply HMA in 1 full lift to achieve a total compacted thickness of 75 mm to the specified elevations and grades.
4. The elevation of the finished HMA surface is designed to be 50 mm higher than adjacent grades.
5. The rollers used to compact the HMA must include at least 1 pneumatic- tired roller.

19.5 MEASUREMENT AND PAYMENT

Where the Unit Price for an item indicated in the contract is stipulated to be by the square metre the area of the individual item will be determined in the field by the Project Engineer and it will be the top surface area determined from horizontal measurements with no allowance for uneven or sloping ground regardless of the item being measured.

Where the Unit Price for an item indicated in the contract is stipulated to be by the tonne the mass of the individual item must be scaled and recorded by the Contractor on duplicate weight slips. Weight slips must be supplied at the time of delivery and a copy supplied to the Project Engineer. The weight scale must be inspected and certified by Weights and Measures Inspection Services of the Federal Department

of Consumer and Corporate Affairs at the Contractor's expense prior to the supply of any materials and as often as the Project Engineer may direct in writing.

The Unit Price for items identified in the contract will be full compensation for all materials, labour, tools, equipment and incidentals necessary to complete the Work in accordance with these specifications.

Payment for underground utility location and excavation, supply and installation of adequate barriers, fences, warning and construction signs, construction of temporary detours, clearing and grubbing, tree and plant protection, and proof rolling the sub-grade, sub-base gravel and base gravel is considered incidental to the Work and no separate payments will be made.

On-site topsoil excavation will be paid by the square metre of area stripped regardless of the depth of topsoil.

Common Material excavation will be paid by the cubic metre.

Sub-grade preparation will be paid by the square metre regardless of the depth of sub-grade preparation.

Sub-base gravel and base gravel will be paid by the tonne for materials incorporated into the Work.

HMA will be paid for in accordance with Section 15 including any and all payment adjustments.

END OF SECTION

20 PAVEMENT MARKINGS

20.1 GENERAL

20.1.1 Samples

If requested by the County, submit the following material sample quantities at least 4 weeks prior to commencing work.

a) Two (2) 1 L samples of each type of paint.

b) One (1) 1 kg sample of glass beads.

c) Sampling to CGSB 1-GP-71.

Mark samples with name of project and its location, paint manufacturer's name and address, name of paint, CGSB specification number and formulation number and batch number.

20.2 PRODUCTS

20.2.1 Painted Markings

To CGSB 1_GP_74M, alkyd traffic paint.

Colour: to CGSB 1_GP_12C, yellow 505_308, white 513_301.

Thinner: to CAN/CGSB_1.5.

20.2.2 Permanent Markings

The use of other permanent marking materials that do not meet the following requirements will be subject to approval by the County. Acceptance during the warranty period will be based on the following:

a) not lift from the pavement,

b) exhibit no material loss within four (4) weeks of installation,

c) not deteriorated by contact with sodium, calcium chloride or traffic residue,

d) show no appreciable deformation or discoloration under exposure to traffic and road temperatures between –40ºC and 40ºC and,

e) maintain their original dimension and placement without chipping or cracking.

Cold Plastic Marking: two-component, cold-extruded and cold-curing, having a specific gravity of 1.9 minimum at 25°C.

Hot Thermoplastic Marking: hot-extruded, having a specific gravity of 2.0 minimum at 25°C, havin a softening point of 90°C minimum according to ASTM E28.

Both cold and hot plastic markings shall conform to the following:

a) Water Absorption: 0.5% maximum by mass retained water after 24 hour immersion, according to ASTM D570 Procedure A.

b) Impact Resistance: minimum 1.13 J at 25°C when material is cast into bar of 25 mm2 cross-section by 75 mm long, with 25 mm extending above vice jaws in a cantilever beam (Izod type) tester using the 2.82 J scale, according to ASTM D256 Method C.

c) Abrasion Resistance: maximum weight loss of 0.50 g when subjected to 200 revolutions on Taber abrader at 25°C using H-22 Calibrade wheels weighted to 500 g with sample

kept continuously wet with distilled water. Prepare test sample with representative material placed on 100 mm square plate, 3 ±0.1 mm thick.

d) Chemical Resistance: Test samples of 50 mm square, no degradation after exposure to:

1) 24 hours immersion in 5% NaCl.

2) 24 hours immersion in 5% CaCl.

3) 1 hour spot test with mineral oil.

e) No deterioration when in direct contact with asphalt cement in asphalt materials, or with sodium chloride, calcium chloride or other de-icing chemicals.

f) Non-toxic and not harmful to persons or property when in hardened state.

g) No discoloration from sunlight ultraviolet exposure and no bond failure for warranted life of material.

Glass Beads: minimum 80% true spherical shape; clear of cloudiness, dark inclusions, trapped air, or other defects; and conforming to the following:

a) Index of Refraction: 1.5 minimum when tested in liquid immersion at 25°C according to CGSB 1-GP-71 Method 49.1.

b) Gradation of glass beads for mixing with and for surface application on thermoplastic material, tested according to ASTM D1214:

Sieve Size (mm)	% Passing by Mass
850	90 – 100
300	15 – 50
180	0 – 10

Pre-marking Paint: as reviewed by the County.

Groove Filler: LRS 424 or approved equal.

20.2.3 Mix Formulation

Glass Sphere Content: minimum 20%, maximum 30% by mass of thermoplastic material.

White Colour: brilliant white, 70% minimum when measured with the Gardner Multi-Purpose Reflectometer 0, 45° daylight luminous directional reflectance, with a green filter.

Yellow Colour: conforming to CGSB Colour #505-308 or U.S. Federal Standard 595a, Colour Chip 33538, 45% minimum when measured with the Gardner Multi-Purpose Reflectometer 0, 45° daylight luminous directional reflectance, with a green filter. Colour tolerance to be within limits of U.S. Department of Transport Yellow Tolerance Chart PR#1 December 1972.

No formulation change unless approved by the County. Any significant change will be subject to field trials.

20.3 EXECUTION

20.3.1 Equipment Requirements

Paint applicator to be an approved pressure type distributor capable of applying paint in single, double and dashed lines. Applicator to be capable of applying marking components uniformly, at rates specified, and to dimensions as indicated, and to have positive shut-off.

Grooving machine subject to the County's approval.

20.3.2 Condition of Surfaces

Pavement surface to be dry, free from ponded water, frost, ice, dust, oil, grease and other foreign materials.

Remove conflicting markings.

20.3.3 Traffic Control

Conduct all traffic control to the requirements as specified.

20.3.4 Paint Application

Lay out pavement markings and review with the County.

Apply paint only when air temperature is above 10°C, wind speed is less than 60 km/h and no rain is forecast within next four (4) hours.

Apply traffic paint evenly at rate of 3.0 m^2/L.

Paint lines to be of uniform colour and density with sharp edges.

Thoroughly clean distributor tank before refilling with paint of different colour.

20.3.5 Cold Plastic Application

Mix components and apply cold plastic marking according to manufacturer's surface application procedure, to a thickness of 2 mm minimum and 3 mm maximum.

Apply when ambient temperature is between –10°C and 30°C.

Apply glass beads to surface of extruded material before it has set, at a rate of 140 to 250 g/m^2.

Let marking cure into a hardened state.

20.3.6 Hot Thermoplastic Application

Cut groove into pavement surface to designated width and depth. Remove grindings and haul to designated location. Sweep or airblast groove clean and dry.

Heat material and apply according to manufacturer's hot extrusion process.

Fill groove with hot molten material. Do not overfill more than 3.0 mm above pavement surface.

Apply glass beads to surface of extruded material while it is still molten at a rate of 140 to 250 g/m^2.

Trim surplus material to give clean straight edges.

Let marking cool to a hardened state.

20.3.7 Protection and Cleanup

Do not permit traffic over applied markings until they have adequately hardened.

Protect surrounding areas and structures from disfiguration and damage. Repair any damage as directed by the County.

On completion of work, clean up and leave site free of debris and waste matter.

20.3.8 Painted Marking:

Paint markings to be within plus or minus 12 mm of dimensions indicated.

Remove incorrect markings.

20.3.9 Cold Plastic Marking:

Measurement: The quality assurance laboratory will measure suspect markings with a surface micrometer. The average of five (5) measurements will represent 300 m of marking, or one job site, whichever is less.

Thickness Deficiencies: Where a significant number of deficiencies occur in the work, involving average thicknesses greater than 3.0 mm or less than 1.8 mm, the County may order removal and replacement, or application of additional material.

If surface dishing deeper than 0.5 mm occurs, the County may order removal and replacement.

The quality assurance laboratory will determine the width of suspect markings by the average of five (5) measurements representing 300 m of marking, or one job site, whichever is less.

20.3.10 Hot Thermoplastic Marking:

Measurement: The quality assurance laboratory will core suspect markings. The average thickness of 3 cores will represent 300 m of marking, or one job site, whichever is less.

Overfill Thickness: That portion of marking above pavement surface will receive no additional payment. If overfill exceeds 3.0 mm, the County may order removal and replacement of marking.

Groove Thickness Deficiencies: Where a significant number of deficiencies occur, involving average thicknesses less than 70% of that specified, the County may order removal and replacement.

If surface dishing deeper than 0.5 mm occurs, the County may order removal and replacement. Variations in asphalt surface profile may be taken into consideration.

The quality assurance laboratory will determine the groove width of suspect markings by average measurement of 3 cores representing 300 m of marking, or one job site, whichever is less.

20.3.11 Width Deficiencies:

Where a significant number of deficiencies occur greater than 10 mm in average widths of cold plastic, or in average groove widths of hot thermoplastic, the County may order removal and replacement.

20.3.12 Protection of Completed Work

Protect pavement markings until dry.

END OF SECTION

21 CURB, GUTTER & SIDEWALKS

21.1 GENERAL

Products, Concrete Materials, Execution and Methods of Concrete Construction shall be in accordance with CSA CAN3-A23.1or as modified in this section.

21.1.1 Work Included

The work described in this section pertains to the construction of concrete curbs, gutters, sidewalks, crossings and paving stones.

21.2 PRODUCTS

21.2.1 Portland Cement

Portland cement shall meet the requirements of CSA Standard Portland A5-M cement and shall be Type 10 normal, or type 50 sulfate resistant, as required by the County.

21.2.2 Aggregates

The fine and coarse aggregate used in the concrete mix shall conform to the following specifications:

a) Fine Aggregate: CSA CAN3-A23.1, Clause 5.3.

b) Coarse Aggregate: CSA CAN3-A23.1, Clause 5.4. Table 2 Group 1 (28-5)

Sieve Size (mm)	% Passing by Mass
40.000	100
28.000	95-100
14.000	30-65
5.000	1-10
2.500	0-5

21.2.3 Admixtures

All admixtures used to enhance the concrete shall conform to the following specifications:

a) Air Entrainment: ASTM C260

b) Chemical: ASTM C494

c) Calcium Chloride: ASTM C494

The use of calcium chloride shall only be used when approved by the County, but in no case will the amount added be greater than 2% of the cement weight. It shall not be used when the air temperature is above 4°C.

a) Fly ash shall not exceed 10% by weight of cement, and it shall conform to the requirements of CAN/CSA-A23.5. Only approved compatible superplasticizing admixtures and air entertaining agents shall be used with the fly ash. The County may require characteristic data for fly ash to prove conformance to the standards. After September 1st no portion of the specified cement content may be replaced with fly ash unless approved in writing.

21.2.4 Reinforcing Steel

Reinforcing bars shall be deformed bars in accordance with CSA Standard Specification G30.12-M1977.

Cold drawn wire or welded wire fabric for concrete reinforcement shall be 150x150 and conform to the requirements of CSA Standard Specification G30.3-1972.

21.2.5 Expansion Joint Filler

Joint filler shall conform to CGSB Standard Specification for polyurethane sealing compound #19-GP-15 or ASTM Standard Specification for SIKA FLEX 1A.

21.2.6 Membrane Curing Compound

Resin-base impervious curing compound shall conform to ASTM Standard Specification C309 Type 1D-Type B. The curing compound shall contain white fugitive dye.

21.2.7 Preformed Expansion Joint Filler

Preformed expansion joint filler shall conform to ASTM Standard Specification D-1752.

21.2.8 Concrete

Concrete mixes shall be designed by a qualified testing laboratory engaged by the Contractor. The mix design shall be submitted to the County for approval a minimum of 10 days prior to delivery of any concrete to the site. The specified compressive strength at 28 days shall be 30Mpa. The strength level of 30Mpa shall be considered to be achieved if averages of all sets of 3 consecutive strength tests equal or exceed the specified strength, and no individual strength test is less than 20Mpa.

The concrete shall contain not less than 315kg of Portland Cement per cubic metre of concrete produced.

The air content of the concrete shall be maintained between the limits of 6-8%.

The minimum slump permissible will be that which will allow the concrete to be placed efficiently and provide a homogeneous mass. The maximum allowable slump shall be 70mm +/- 10mm for all hand-poured concrete and 40mm +/-10mm for all machine-poured concrete.

21.2.9 Re-Tempering With Air

If, due to a low air entrainment percentage, as specified, the County feels it is necessary to add an approved air-entraining agent on site, placement of concrete shall stop to allow the concrete truck's drum to turn at mixing speed for a minimum of 3 minutes. Should the air content of the concrete not conform to specifications after re-tempering, then the concrete shall be rejected.

The County has the right to withdraw permission to add an air-entraining agent to the mix and reject the concrete if this practice is being abused.

21.2.10 Re-Tempering With Water

If, due to a low slump as specified, the County feels it is necessary to add water to the mix, it shall be injected into the drum under such pressure and direction of flow that it conforms to the specifications in ASTM C-94, Appendix XI. Placement of concrete shall stop at that point to allow the concrete truck's drum to turn at mixing speed for a minimum of 3 minutes. Should the slump of the concrete not conform to specifications, after re-tempering, then the concrete shall be rejected.

The County has the right to withdraw permission to add water to the mix and reject the concrete if this practice is being abused.

21.3 EXECUTION

21.3.1 Placing Concrete

Concrete shall not be placed until the subgrade, sub-base and base course materials have been completed, and approved by the County. The base shall be sufficiently moist to prevent absorption of water from the concrete, and free from mud or water pondage.

The concrete shall be placed within ninety (90) minutes of initial mixing at the plant, or before the drum on the concrete truck has turned 300 revolutions. Complete discharge of concrete shall not exceed two (2) hours. The concrete shall be transported by methods which will prevent segregation and deposited on the subgrade so that as little handling as possible is required.

Concrete shall be placed continuously until a complete section between expansion joints has been poured.

The concrete shall be thoroughly consolidated against and along the faces of the forms. Hand spreading shall be done with shovels, not with rakes, in order that the concrete will not be segregated. Precautions should be taken to prevent overworking of the concrete.

Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods which shall prevent the separation or loss of the ingredients. It shall be deposited in the forms as near as practicable to its final position to avoid re-handling.

The sequence of concrete placement shall be arranged so that concrete which has partially hardened shall not be subjected to injurious vibration.

The vertical free fall height of concrete shall not exceed 1.0m. For falls greater than 1.0m chutes or tremies shall be used.

During placement, concrete shall be sufficiently tamped or vibrated with suitable equipment to secure a close bond with the reinforcement, eliminate entrapped air voids and ensure a homogeneous structure with adequate consolidation.

The rate of delivery of mixed concrete shall be such that the interval between the placing of successive truck loads shall not exceed 30 minutes. If the time exceeds 30 minutes, then a construction joint shall be formed.

After the initial set of the concrete, neither the forms nor the concrete structure shall be jarred and no strain shall be placed on the ends of projecting reinforcement.

Construct all pararamps and crossings monolithically to the dimensions and at locations specified.

21.3.2 Joints

Curb, gutter and sidewalk contraction joints shall be constructed at 3.0m intervals and as detailed on the standard drawings, and shall not be less than 50mm deep. Contraction joint widths shall not be greater than 5mm.

Midway between each contraction joint on the sidewalk, a surface joint, 13mm deep, shall be constructed. These joints shall not extend into curb and gutter.

A surface joint shall be constructed longitudinally at the location shown on the standard drawings and shall continue through all driveways and lane crossings.

A construction joint shall be formed at the end of every pour. This joint shall be constructed in a “V” shape, as directed by the County, and using 10 M rebar 600mm long, spaced every 500mm.

10 M bars at 500mm on centre shall be dowelled and epoxied into the back of the existing curb prior to placing concrete.

21.3.3 Finishing

Sidewalk surfaces, either separate or monolithic with curb and gutter, shall be struck off and screeded to the slope, cross-section and elevation shown on the drawings or as directed by the County. The surface shall be consolidated and smoothed using a wood float. Light-steel trowelling shall be used followed by a uniform brush finish. Sidewalk shall be edged at all joints to prevent chipping of the concrete.

The exposed surfaces of concrete curbs and gutters, either separate or monolithic with sidewalks, shall be finished by means of a wood floating, light-steel trowelling and uniform brushing, and all edges shall be rounded to the required radius. No patching will be allowed.

Pararamps and crossings to lanes and private property shall be struck off and screeded to the required slope and cross-section. The finished surface shall be brushed as specified above.

All edges, including contraction or surface joints, shall be tooled for a width of 50mm and rounded to a radius of 6mm. The brush grooves shall be transverse on the sidewalk and longitudinal on the curb and gutter. The finished surface shall have no exposed aggregate or honeycomb.

If there is evidence of excess water on the concrete surface, finishing shall be delayed until the excess water has evaporated.

Surface grooves made by the broom shall not be more than 3 mm deep. Before brushing, all surplus water shall be removed from the brush.

21.3.4 Curing

Immediately after finishing, the concrete surface shall be protected by applying a membrane curing compound. After finishing and removal of forms if necessary, all exposed surfaces shall be wetted with water and then thoroughly sprayed with membrane curing compound. The membrane curing compound shall be applied in accordance with the manufacturer’s instructions with an approved pressurized spray.

The curing compound shall be applied in such a manner as to cover the entire surface thoroughly and completely with a uniform film at a rate which shall depend on the roughness of the surface of the concrete, but in no case at less than 0.25 litres per square metre of concrete surface.

21.3.5 Backfilling

Unless otherwise directed by the County, the Contractor shall backfill along the back of the curb edges, to the top of the concrete, within 3 to 7 days of the placing of the concrete. The backfill shall be

mechanically tamped in maximum lifts of 150mm, to a minimum of 95% Standard Proctor Density and to a distance of 300mm from the back of the walk or curb.

Where landscaping is to be carried out immediately after completion of the walks or curbs and gutters, the backfilling shall be left 100mm low to allow for the topsoil.

21.3.6 Forming

Forms shall be steel or wood of sufficient strength to resist the pressure of wet concrete, and the supply shall be sufficient to permit their remaining in place until hydration has occurred, or longer if the County considers it necessary. The Contractor shall remove all face forms to allow for a smooth brush finish. The use of bent, twisted, battered or worn-out forms will not be permitted. Forms will be checked for alignment and elevation by the County before concrete is poured, and shall be cleaned and oiled before each use.

Where required, reinforcement shall be secured in the location shown on the standard drawings and shall be free from mill scale, grease and rust prior to placing concrete. Forms shall be held securely by approved methods to prevent movement and bulging when the concrete is placed. Forms must be approved by the County before concrete is poured.

Curbs having a radius of less than 40m shall be constructed with flexible forms. A sufficient length of form (not less than 50 metres) shall be placed and checked before concrete is poured to ensure true line and grade. The forms shall be well staked, braced or otherwise held rigidly true to the established line and grade. The County may, at any time, reject the use of any forms considered unsatisfactory.

21.3.7 Mechanical Extruding Machines

Slip-form paving machines or concrete, extruding machines may be used for placing concrete provided they have received the approval of the County prior to commencement of the work and meet the following requirements:

a) The vibrators on the equipment shall be capable of producing a dense mass with a smooth surface, free of honeycombing.

b) The equipment shall include automatic grade and line controls which shall be used at all times.

Commence placement of concrete only after the subgrade has been prepared and approved by the County.

Any special grading or preparation of the base required by the Contractor to accommodate equipment shall be the responsibility of the Contractor, and shall restore the roadway and boulevards to their original condition within 3 to 7 days of the initial disturbance.

The extruded concrete shall be checked for alignment and elevation by the County while the concrete is being placed. All incorrectly placed or misaligned work shall be immediately removed while the concrete is still wet, and the work redone to the proper specifications using whatever means are required.

Whenever possible, the forming and placing of concrete by conventional hand pouring methods (as may be required at corners, crossings and catch basins) shall be carried out in conjunction with the extruding machine operation. Where this procedure is not practical, the “tie-ins” shall be completed within 3 days of construction of the adjacent extruded section, using 10 M rebar at all joints. All “tie-ins” shall be completed in 1 continuous pour.

21.3.8 Consolidation

The concrete shall be consolidated by means of an approved vibrating screed or, in the case of curb and gutter only, by means of a poker or pencil vibrator not exceeding 50mm in diameter.

Particular care shall be given to placing and tamping along the faces of the forms to ensure a dense, smooth surface.

Vibrations shall be of sufficient duration to thoroughly compact the concrete but not long enough to cause segregation. Vibrators shall not be used for moving concrete.

21.3.9 Inspection

All exposed concrete surfaces shall be checked by the Contractor with a 3m straight-edge, and any water pockets or deviations in line or grade exceeding a total of 6mm shall be corrected immediately.

Differences in elevation at any given point from that given by the design shall not exceed 13mm, and the maximum variation shall not be greater than 13mm.

Deviations in horizontal alignment at any given point from that given by the design shall not exceed 25mm, and the fluctuations in the horizontal alignment shall not be greater than 25mm.

Concrete not meeting the above criteria shall be replaced.

21.3.10 Field Tests

Testing shall be performed by a qualified CSA testing laboratory in accordance with the following:

a) Samples of concrete shall be obtained in accordance with CSA Test Method A23.2-1C for sampling plastic concrete.

b) Test cylinders shall be made and stored in accordance with CSA Test Method A23.2-3C. No less than 1 strength test shall be made from samples from each 150 cubic metres of concrete placed, and in no case shall there be less than 1 test from each day's pour. Each strength test shall consist of 3 test cylinders, 1 tested at 7 days and 2 at 28 days.

c) Air content determinations shall be made in accordance with CSA Test Method A23.2-7C, air content of plastic concrete by the volumetric method.

During construction start-up, every load or batch of concrete shall be tested until such time as satisfactory control of the air content has been established. Air content tests taken with the test cylinders will be sufficient once satisfactory control has been established. Whenever a test falls outside the specified limits, the testing frequency shall revert to 1 test per load or batch until satisfactory control is re-established. Any concrete that falls outside specified air control levels shall be rejected from use.

Slump tests made in accordance with CSA Test Method A23.2-5C, Slump of Concrete, shall be made in conjunction with each strength test.

21.3.11 Clean-up

As the work progresses, the Contractor shall clean up the site and all areas in which work has been done shall be left in a neat and presentable condition. All gutters and street drainage ditches that have been blocked as a result of the Contractor's operation shall be restored or repaired.

The Contractor shall dispose of all surplus excavated material, organic soil, rock, boulders and pieces of concrete and masonry at an approved location.

21.3.12 Protection

The Contractor shall be responsible for keeping all animals and pedestrians off the newly constructed sidewalks or curb until completely set. The Contractor shall also be responsible for keeping all vehicles off the work for a period of 3 days after the concrete has been finished.

21.3.13 Deficiency Penalty

Where there are variations from specified design strength, the following Deficiency penalty shall be assessed based on the 28-day, laboratory-cured cylinders.

a) When the concrete strength of any set exceeds 95% of design strength, no deficiency penalty will be administered.

b) When the concrete strength of any set is greater than 80% but less than 95% of design strength, the deficiency penalty will be administered as follows:

$$Q\left[P \times \frac{2\,(A - B)}{A}\right]$$

Where: P = unit price

A = specified strength

B = average 28 day cylinder strength

Q = quantity of deficient concrete

c) If the concrete strength of any set is less than 80% of design strength, the work represented by that set of cylinders will be rejected and replaced by the Contractor.

END OF SECTION

22 REGULATORY ROADWAY SIGNS

22.1 GENERAL

22.1.1 Design Requirements

Sign supports and appurtenances to be capable of withstanding summation of following loads:

a) Wind and ice loading specified to be consistent with anticipated loads in locality of installation. Refer to National Building Code of Canada and/or applicable provincial building code.

b) Dead load of signboards, sign supports and appurtenances.

c) Ice load on one face of signboards and around surface of all structural members and appurtenances.

Structural deflections and vibration in accordance with American Association of State Highway and Transportation Officials (AASHTO), “Specifications for the Design and Construction of Structural Supports for Highway Signs”.

22.1.2 Shop Drawings

Submit shop drawings for signage structures indicating product data and design.

22.2 PRODUCTS

22.2.1 Sign Supports

Steel posts: to CAN_G40.21, 3.1 m long, flanged “U” shaped in cross section, measuring 65 mm wide by 30 mm deep. Metal thickness: 4.5 mm. Hot dipped galvanized: to CAN/CSA_G164

Base plates for mounted signs: to ASTM B209M.

Fasteners: bolts, nuts, washers and other hardware for roadside signs to be cast aluminum alloy, or galvanized steel.

22.2.2 Signboards

Aluminum sheet shall be tension levelled, sign grade aluminum and conform to ASTM B209M, Alloys 6061-T6 or 5052-H38 pre-cut to required dimensions. Minimum thickness to be 1.6 mm for signboards up to 750 mm wide. Minimum thickness to be 2.0 mm for signboards 750 to 1200 mm wide.

Connecting straps and brackets to ASTM B209M.

Reflective sheeting shall meet or exceed the minimum requirements specified in ASTM-D4956 Performance Requirements Type III, High Intensity Retro Reflective Sheeting.

22.2.3 Fabrication

Signboards:

Aluminum blanks: Degrease, etch and bonderize with chemical conversion coating. Clean surfaces with xylene thinner. Dry. Aluminum signboards are to be painted before installation. Spray and bake face of signboards with two coats of enamel in accordance with CAN/CGSB_1.104.

Sign identification:

Apply sign number and date of installation with 25 mm high stencil painted black letters on lower left back face of each signboard.

22.3 EXECUTION

22.3.1 Installation

Sign Support:

a) Erect supports as indicated. Where separate concrete footings have been placed, erect posts with base plates resting on aluminum nuts and restrained with nuts and washers.

b) Coat underside of base plate with corrosion protective paint before installation.

c) Close open aluminum tubes and posts with aluminum cap.

d) Erect posts plumb and square to details as indicated.

e) Single channel steel posts are to be driven to required depth without damage to posts. If rock or concrete is encountered, auger hole to required depth and set post in sand.

f) In finished concrete or asphalt surfaces, backfill with concrete or grout. Protect from adverse conditions until cured.

g) Wooden post installations are to be excavated with an auger. Compact bottom of hole to provide firm foundation. Set post and backfill in 150 mm layers with excavated material. Compact each layer before placing each subsequent layer.

h) Permissible tolerance is ±12 mm departure from vertical.

Signboard:

a) Fasten signboards to supporting posts and brackets as indicated.

b) Use strapping with crimped or bolted connections where signs fastened to utility poles.

22.3.2 Protection

Place temporary covering on signboards where required. Covering to be capable of withstanding rain, snow and wind and be non-injurious to signboard. Replace deteriorated covering and remove covers as reviewed by the County.

22.3.3 Correcting Defects

Correct defects, identified by the County, in consistency of reflectivity, colour or illumination.

END OF SECTION

23 ASPHALTIC CONCRETE PAVEMENT MILLING

23.1 GENERAL

This section specifies requirements for milling or grinding existing asphalt pavement to lines, grades, and typical cross sections indicated on plans or as established by the County.

23.1.1 Protection

Protect existing pavement, utility appurtenances, traffic detector loops, home runs, light units, and structures from damages. In event of damage immediately replace or make repairs to approval of the County and at no additional cost to the Owner.

23.2 EXECUTION

23.2.1 Preparation

Inspect site and verify with the County areas designated for milling.

Arrange for temporary traffic control in areas where signal light traffic detector loops and home runs are to be removed.

23.2.2 Equipment

Use cold milling or grinding equipment capable of removing part of asphalt pavement surface to depths or grades indicated with a tolerance of +/- 10mm within areas designated.

Sweeping and collecting equipment capable of removing all residues from milling operations.

Apply water as necessary during milling operation to suppress dust.

23.2.3 Asphalt Removal

Mill asphalt pavement to grade and cross section dimensions indicated or as directed by the County.

Exercise care to avoid disturbance to pavement or other work designated to remain.

Keep drainage system clear of loose and waste materials.

Asphalt is to be removed to a uniform level including areas surrounding valves, manholes or other appurtenances.

Remove all residue materials resulting from milling operation.

Milling may be restricted on designated roads and streets with particular time frames throughout the week. The Contractor shall abide by these restrictions.

Surface to be left in a condition that can be reopened to traffic following removal of grindings.

23.2.4 Disposal of Materials

Removed pavement material is the property of the Owner and is to be stockpiled at a location designated by the County.

23.2.5 Finish Tolerances

Milled surfaces to be within +/- 10mm of specified grade but not uniformly high or low.

END OF SECTION

24 ASPHALT PAVEMENT CRACK ROUTING AND SEALING

24.1 GENERAL

The Work Consists of routing, cleaning and drying cracks in pavement surfaces, supplying crack sealant material and sealing the routed cracks with the sealant.

24.1.1 Material

Hot poured rubberised asphalt products generally accepted for this work are Husky 1G11, CRAFCO 522, KOCH 9030 or Beram 195LM.

The use of other materials will be subject to the approval of the County. In situations where the Contractor obtains approval to use a material not included in the above list, he shall provide the County with the following information 5 days prior to commencing the Work:

a) Name and mailing address of the crack sealant supplier and manufacturer

b) Name of crack sealant product to be supplied

c) Written confirmation from the manufacturer that the crack sealant to be supplied meets all specified requirements along with test results that demonstrate that the product meet all specified requirements.

The Contractor shall verify that the crack sealant delivered and used in the Work is the type and grade ordered.

24.1.2 Procedure

No Work shall be performed during rain or snow or when the pavement surface is wet.

The crack sealant shall not be applied when the pavement temperature is below 10 Celsius.

Unless otherwise directed by the County, all cracks between 2mm and 12mm in width shall be routed and sealed. All cracks shall be routed to a minimum width of 20mm and a depth of 10mm.

Prior to the application of crack sealant, the entire road surface shall be cleaned ensuring all loose material and moisture is removed from the routed cracks and surrounding areas.

Crack sealant shall be heated and applied in accordance with the manufacturer's recommendations. Routed cracks shall be filled with crack sealant such that upon cooling the sealant shall not be more than 3mm below the pavement surface.

Excessive crack sealant shall be removed from the pavement surface immediately following application. Traffic shall be kept off sealed cracks until the crack sealant has cured. At locations such as intersections where this is not practical, the Contractor shall prevent tracking by applying a blotting agent to the crack sealant. When a blotting agent is used, it shall not be applied until the sealant has cooled sufficiently to prevent inclusion of the blotting agent into the sealant.

When necessary, the Contractor shall supply one of the following blotting agents:

a) Screened sand with a maximum topsize of 2mm

b) Cement

c) Flash

The use of other blotting agents shall be subject to the approval of the County.

Fuel, asphalt and any other spills shall be cleaned up to the satisfaction of the County at the Contractor's expense.

24.1.3 Sampling and Testing

The Contractor shall supply material samples to the County for QA (Audit) testing purposes when requested.

24.1.4 Acceptance Criteria

Evaluation of the Work will be based on a visual inspection by the County. To be acceptable, the Work must conform to the following:

a) All routed cracks conform with the specified rout profile

b) The rout conforms to the path of the crack with no part of the crack outside or touching the edge of the rout cross section

c) All routed cracks have been sealed

d) At least 95% of the cracks treated have been filled with an adequate amount of crack sealant material.

Failure to comply with the acceptable criteria will result in the Contractor re-treating all failed cracks at his own expense.

END OF SECTION

25 ASPHALTIC PAVEMENT CRACK SEALING

25.1 GENERAL

The work consists of supplying crack sealant and sealing cracks in asphalt concrete pavement.

25.1.1 Materials

The type and grade of asphalt/emulsified asphalt material generally accepted for this work are Alberta Transportation designated EC101 or HC200.

The use of other materials will be subject to the approval of the County. In situations where the Contractor obtains approval to use a material not included in the "Recognized Products List", he shall provide the County with the following information 5 days prior to commencing the Work:

a) Name and mailing address of crack sealant supplier and manufacturer

b) Name of crack sealant product to be supplied

c) Written confirmation from the manufacturer that the crack sealant to be supplied meets all specified requirements along with test results that demonstrate that the product meets all specified requirements.

The Contractor shall verify that all crack sealant delivered and used in the Work is the type and grade ordered.

25.1.2 Procedure

No Work shall be performed during rain or snow or when the pavement surface or cracks are wet.

Crack sealant shall not be applied when the atmospheric temperature at the work site is below 10 degrees Celsius.

All cracks within the entire width of the pavement surface, which are between 5mm and 25mm in width, shall be sealed.

Prior to the application of crack sealant, the Contractor shall ensure that the road surface adjacent to the cracks is clean.

Hot Pour crack sealant shall be heated to the temperature specified by the manufacturer. Overheating will not be permitted.

Crack sealant shall be applied within the manufacturer's specified temperature range. Crack sealant shall be applied so that the crack is flush filled immediately following application and a thin overband of sealant extends approximately 25mm beyond the edges of the crack. Excess crack sealant shall be removed from the pavement surface immediately following application. Removal shall involve the use of a squeegee, starting from the centreline and proceeding to the shoulder.

Traffic shall be kept off sealed cracks until the crack sealant will not track under action of traffic. At locations such as intersections where this is not practical, the Contractor shall prevent tracking by applying a blotting agent to the crack sealant.

When necessary, the Contractor shall supply one of the following blotting agents:

a) Screened sand with a maximum topsize of 2mm

b) Cement

c) Flash

The use of other products shall be subject to the approval of the County.

Fuel, asphalt and other spills shall be cleaned up to the satisfactory of the County at the Contractor's expense.

25.1.3 Sampling And Testing

The Contractor shall supply material samples to the County for QA (Audit) testing purposes when requested.

25.1.4 Acceptance Criteria

Evaluation of the Work will be based on a visual inspection by the County. To be acceptable, all applicable cracks must be treated as specified herein and at least 95% of the treated cracks must contain an adequate quantity of crack sealant material.

Failure to comply with the acceptable criteria will result in the Contractor re-treating all failed cracks at his own expense.

EC101

Specification for Cold Pour Rubber Filled

Bituminous Emulsified Pavement Crack Sealant

Cold pour rubber filled bituminous emulsified pavement crack sealant shall conform to the requirements specified in the following table, for the grade designated by the County:

Asphalt Grade	EC-101		Test Method	
Requirements	Minimum	Maximum	Alberta Transportation	A.S.T.M
Uniformity	Pass		9.1	-
Viscosity @ 25^{0}C, Krebs units	70	90	9.2	D562
Solids Content by Evaporation, % by mass	59	-	9.3	D244
Ash Content, % by mass	-	2.0	9.4	-
Rate of Curing, %	-	-	9.5	-
24 hour	50	-	-	-
6 days	80	-	-	-
Low Temperature Flexibility	Pass		9.6	-
Elastic Recovery, %	40	-	9.7	-

HC200

Specifications for Hot Pour Bituminous Crack Sealant

Hot pour bituminous crack sealant shall conform to the requirements specified in the following table, for the grade designated by the County:

Asphalt Grade	HC200		A.S.T.M Test Method
Requirements	**Minimum**	**Maximum**	
Softening Point, ^{0}C	80	95	D36
Flash Point, C.O.C. , ^{0}C	230	-	D92
Penetration	-	-	D5
@ 0 ^{0}C, 200g, 60 sec.	30	-	-
@25 ^{0}C, 100g, 5 sec.	55	60	-
@46 ^{0}C, 50g, 5 sec.	-	150	-
Ductility @ 25 ^{0}C	45	-	D113
Solubility in Trichloroethylene, % by mass	98	-	D2042
Viscosity @ 177 ^{0}C, mm^2/s	-	1200	D2170

END OF SECTION

APPENDIX A
Abbreviations

APPENDIX A - Abbreviations

The following abbreviations may be used in this document:

BC - Beginning of curve

BOW - Back of walk

BVC - Beginning of vertical Curve

CCC - Co**n**struction Completion Certificate

EC - End of Curve

EVC - End of vertical Curve

FAC - Final Acceptance Certificate

FOW- Face of walk

ha - Hectare

ID - Inside diameter

Kg - Kilogram

lcd - Litres per capita per day

m^2 - meter squared

m^3 - meter cubed

OC - On centre

OD - Outside diameter

PVI - Point of vertical intersection

l/s - Litres per second

m/s - Metres per second

ACP - Asphaltic Concrete Pavement

ASBC - Asphalt Stabilized Base Course

SPD - Standard Proctor Density

CD - Compact Disc

DVD - Digital Video Disc

CCTV - Closed Circuit Television

PW - Public Works

Other abbreviations may be used or defined elsewhere in this document. Where undefined,

an abbreviation shall carry a meaning consistent with industry standards. Ascertaining the meaning of a word or abbreviation in context is the responsibility of the Developer.

APPENDIX B
Standard Drawings

SHEET LIST

NUMBER	TITLE
00	DETAIL LIST
5–100	VALVE BOX CONSTRUCTION DETAIL
5–101	VALVE BOX DETAIL SLIDING TYPE A AND SCREW TYPE B
5–102	MAIN VALVE CASING DETAIL
5–200	TYPICAL VALVE AND HYDRANT DETAIL
5–300	THRUST BLOCK DETAIL
5–301	VERTICAL BEND THRUST BLOCK DETAIL
5–500	FLUSHING POINT
5–600	HYDRANT ACCESS LOCATION OFF RURAL ROAD
5–700	TYPICAL CATCH BASIN BARREL AND HYDRANT
6–100	TYPICAL 5A PRE–CAST MANHOLE DETAIL
6–201	EXTERIOR DROP MANHOLE DETAIL
6–202	INTERIOR DROP MANHOLE DETAIL
6–300	PRE–BENCHED MANHOLE BASE
6–400	MANHOLE SAFETY PLATFORM
6–500	PIPE BEDDING DETAIL
6–600	TYPICAL TRENCH DETAIL
7–100	CATCH BASIN MANHOLE
7–101	CATCH BASIN TYPICAL–900mm
7–102	TYPICAL PERCHED MANHOLE FOR 600–1050mm DIAMETER PIPES
7–103	T–RISER MANHOLE FOR PIPES 1200mm AND LARGER
7–201	STORM CATCH BASIN ASSEMBLY 300mm SUMP
7–300	TRASH GRATE INLET
7–301	HAMLET CULVERT INSTALLATION
7–302	TYPICAL RIP–RAP FOR RURAL CULVERT SIZE 400–1200mm DIAMETER
7–400	CONCRETE DRAINAGE SWALE
8–100	SINGLE AND DOUBLE SERVICE LAYOUT
8–101	TYPICAL WATER SERVICE CONNECTION
8–102	TYPICAL SANITARY SERVICE CONNECTION
8–103	TYPICAL STANDARD RISER DETAIL
8–104	RESIDENTIAL SANITARY SEWER SERVICE RISER CONNECTION
8–200	WATER SERVICE CONNECTION MANUFACTURED HOME
8–201	SANITARY SERVICE CONNECTION MANUFACTURED HOME
9–100	LOCAL RESIDENTIAL (URBAN)
9–104	MINOR RESIDENTIAL COLLECTOR (URBAN)
9–105	LOCAL INDUSTRIAL (URBAN)
9–106	RURAL RESIDENTIAL – 30.0m R/W UTILITIES IN ROAD
9–107	RURAL INDUSTRIAL – 30.0m R/W UTILITIES BELOW DITCH
9–108	RV RESORT CROSS SECTION
9–109	TYPICAL TRAIL CROSS–SECTIONS
9–110	URBAN RESIDENTIAL CUL–DE–SAC CURB, GUTTER AND SIDEWALK

SHEET LIST

NUMBER	TITLE
9–112	RURAL RESIDENTIAL CUL–DE–SAC
9–113	LOCAL INDUSTRIAL/COMMERCIAL CUL–DE–SAC CURB AND GUTTER
9–201	400mm STANDARD CURB AND GUTTER
9–202	500mm ROLLED CURB AND GUTTER
9–203	STANDARD MONOLITHIC SIDEWALK
9–204	ROLLED MONOLITHIC SIDEWALK
9–205	SEPARATE SIDEWALK
9–300	RAMP DETAILS ON TANGENT
9–301	ACCESSIBILITY RAMP DETAILS AT BOTH CURB RETURNS
9–303	WHEEL CHAIR/BIKE RAMP LOCATIONS
9–400	INDUSTRIAL/COMMERCIAL CURB AND GUTTER CROSSING
9–401	LOW VOLUME LAND & DRIVEWAY CROSSING
9–402	ASPHALT SPEED BUMP
9–500	TYPICAL ROAD INTERSECTIONS
9–501	TYPICAL RESIDENTIAL APPROACHES
9–502	TYPICAL INDUSTRIAL APPROACHES
12–100	TYPICAL LOT GRADING

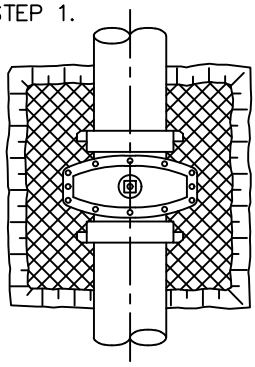
CYPRESS COUNTY

STANDARD DETAILS

DETAIL LIST

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
APR 2018	BRW	TDA	NTS	

STEP 1.



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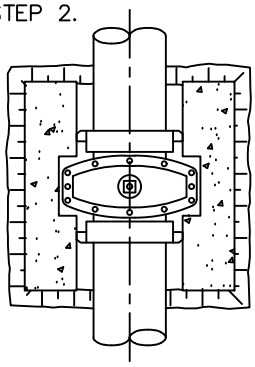

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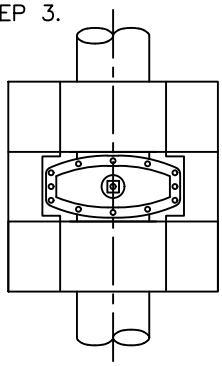

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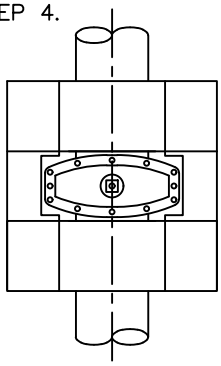

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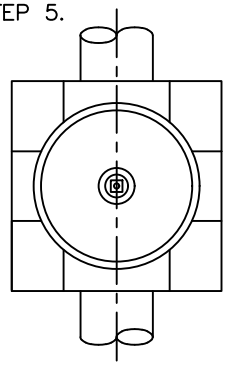

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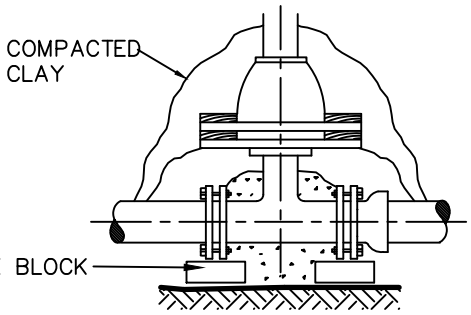


PROCEDURE:

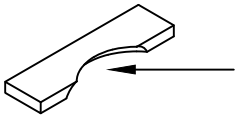
STEP 1. BUILD A 609 mm X 609 mm LEVEL FLAT BASE OF COMPACTED CLAY USING A FLAT TAMPER UP TO WITHIN 12 mm OF THE TOP OF THE TOP FLANGE.

STEP 2. CUT OR NOTCH OUT TWO OF THE 50X200X600 CONCRETE BLOCKS THE WIDTH OF VALVE FLANGE AND LAY ON BASE PARALLEL TO PIPE.

STEP 3. INSTALL TWO 50x200x600 CONCRETE BLOCKS TRANSVERSELY OR AT RIGHT ANGLES TO THE FIRST SET AND NO CLOSER TO THE FLANGE THAN THE CUTOUT SO THAT THEY DO NOT PROTRUDE OVER THE FLANGE.

STEP 4. ADD ALTERNATE LAYERS OF CONCRETE BLOCKS MAKING SURE EDGES ARE NO CLOSER TO VALVE THAN CUTOUT, CONTINUE UNTIL MINIMUM REQUIRED CLEARANCE (100 mm) FROM TOP OF VALVE BONNET TO VALVE NUT IS OBTAINED.

STEP 5. TWO PIECES OF CONCRETE BLOCKS ARE NOW CUT OUT TO OUTSIDE CIRCUMFERENCE OF BONNET AND UNDERCUT TO ACCOMMODATE BONNET THICKNESS.



STEP 6. APPROPRIATE LENGTHS OF BOTTOM AND TOP SECTION OF CASING ARE NOW INSTALLED AND BACKFILLED WITH COMPACTED CLAY TO ABOVE JOINT.

CYPRESS COUNTY

STANDARD DETAILS

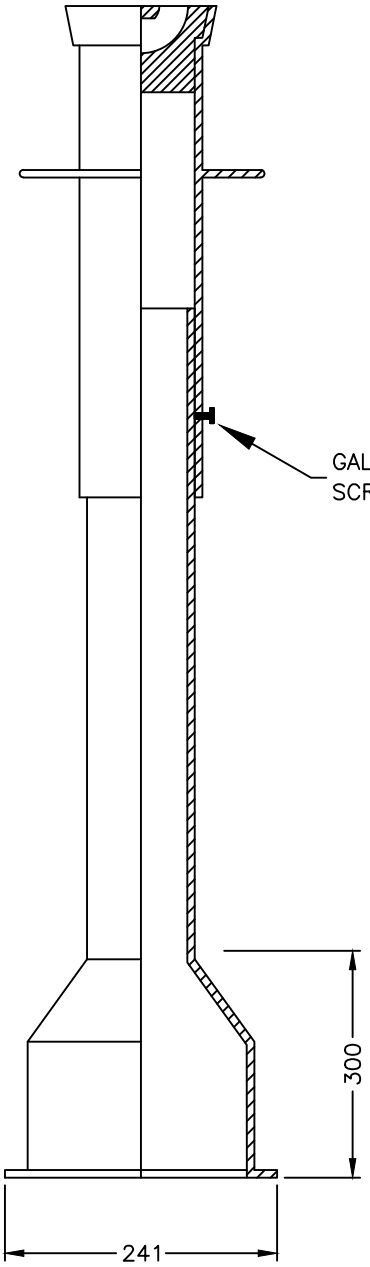
VALVE BOX CONSTRUCTION DETAIL

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
APR 2018	BRW	TDA	NTS	5–100

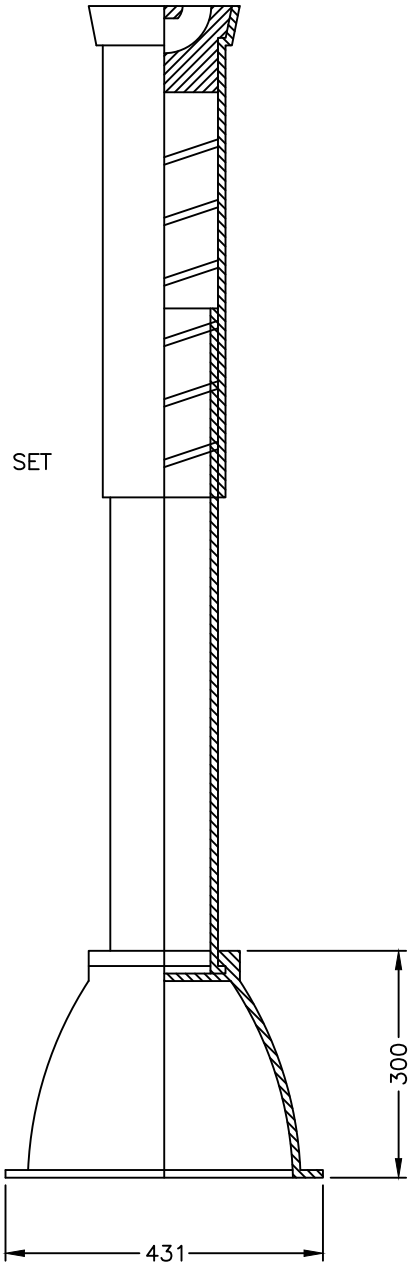
STANDARD VALVE PLUG

NOTES:

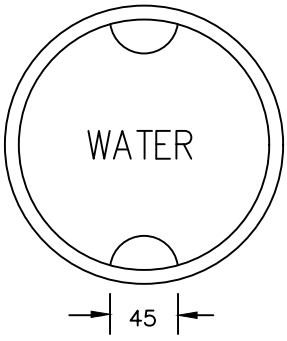
1. VALVE BOXES SHALL BE EXTERNALLY AND INTERNALLY COATED WITH ASPHALTIC OR EPOXY COATING.
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED.



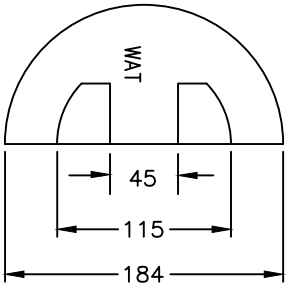
SLIDING TYPE A

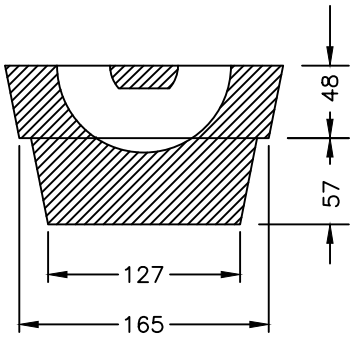


SCREW TYPE B



PLUG C/W CORED HANDHOLES AND MARKED 'WATER'



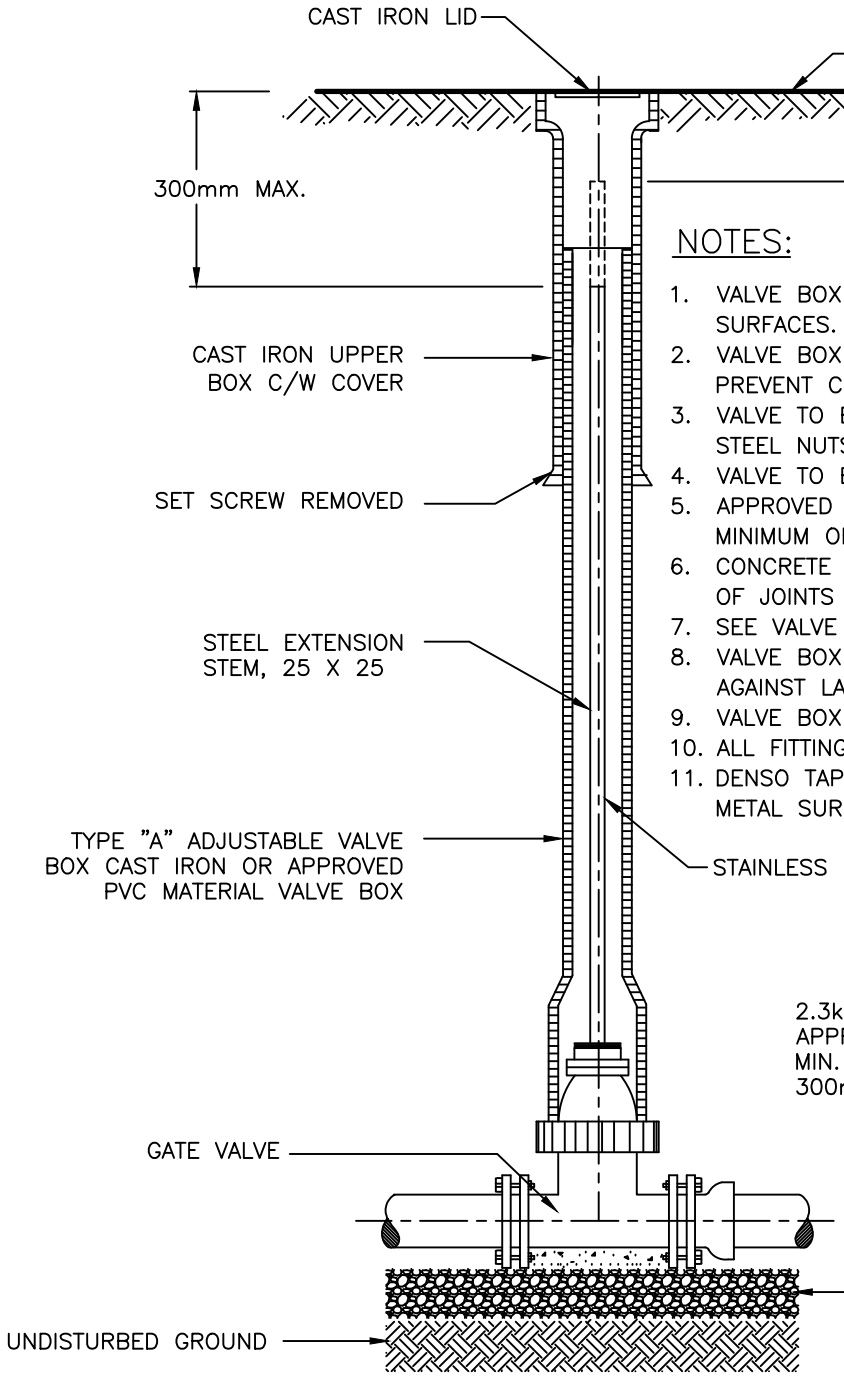


CYPRESS COUNTY

STANDARD DETAILS

VALVE BOX DETAIL SLIDING TYPE A AND SCREW TYPE B

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
APR 2018	BRW	TDA	NTS	5–101



NOTES:

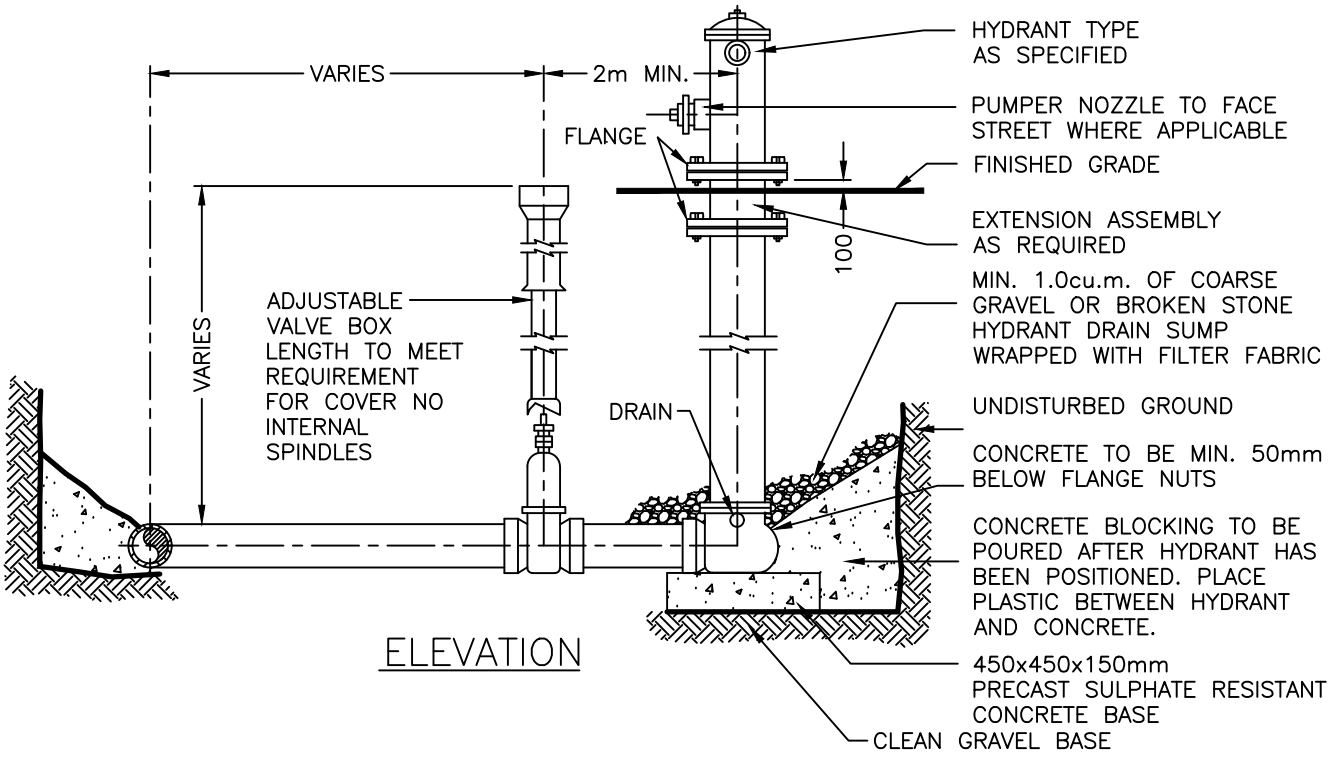
1. VALVE BOX TOPS TO BE SET FLUSH WITH SURFACES.
2. VALVE BOXES SHALL BE BITUMINOUS COATED TO PREVENT CORROSION.
3. VALVE TO BE EPOXY COATED WITH STAINLESS STEEL NUTS AND BOLTS.
4. VALVE TO BE RESILIENT SEATED WEDGE TYPE.
5. APPROVED BACKFILL TO BE COMPACTED TO A MINIMUM OF 98% SPD.
6. CONCRETE THRUST BLOCK TO BE POURED CLEAR OF JOINTS OR FLANGES.
7. SEE VALVE BOX CONSTRUCTION DETAIL.
8. VALVE BOX TO BE ADEQUATELY PROTECTED AGAINST LATERAL MOVEMENT.
9. VALVE BOX TO INCLUDE STONE GUARD.
10. ALL FITTINGS SHOULD BE STAINLESS STEEL.
11. DENSO TAPE TO BE USED ON ANY EXPOSED METAL SURFACE.

CYPRESS COUNTY

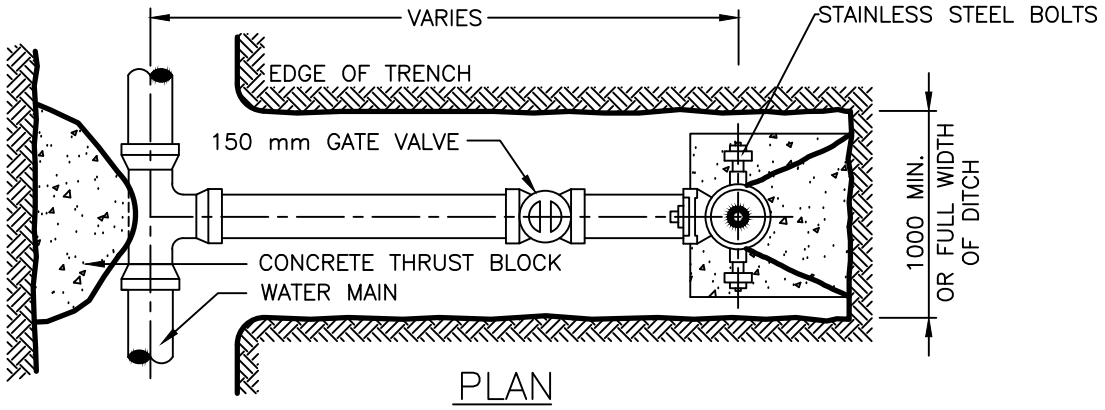
STANDARD DETAILS

MAIN VALVE CASING DETAIL

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
APR 2018	BRW	TDA	NTS	5–102



ELEVATION



PLAN

NOTES:

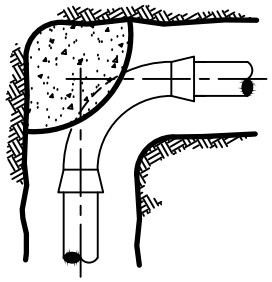
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
2. CONCRETE TO BE 25MPa @ 28 DAYS.
3. HYDRANTS SHALL BE COMPRESSION TYPE CONFORMING TO AWWA C502 COMPLETE WITH PLUGGED DRAINS, STAINLESS STEEL BOLTS AND ASPHALTIC COATED HYDRANT COMPONENTS.
4. PROVIDE CATHODIC PROTECTION AS SHOWN ON STD. DWG.
5. THRUST BLOCKS TO BE PLACED AGAINST UNDISTURBED GROUND HAVING A MINIMUM BEARING OF 7300kg/m^2
6. CONCRETE TO BE POURED CLEAR OF ALL FLANGES, JOINTS, AND HYDRANT DRAIN.
7. APPROVED BACKFILL TO BE COMPACTED TO A MINIMUM OF 98% SPD.
8. DO NOT ALLOW PONDING OR STANDING WATER AROUND HYDRANT.
9. PLACEMENT OF HYDRANT AND ORIENTATION OF PUMPER NOZZLE TO BE APPROVED.
10. HYDRANT TO BE DRAINING.
11. THREAD SIZES SHOULD CONFORM TO AMERICAN STANDARD THREAD SIZES.
12. DENSO TAPE TO BE USED ON EXPOSED METALIC SURFACES.

CYPRESS COUNTY

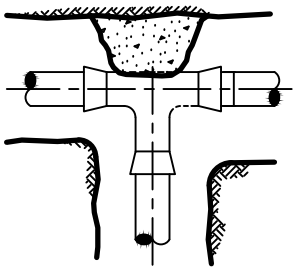
STANDARD DETAILS

TYPICAL VALVE AND HYDRANT DETAIL

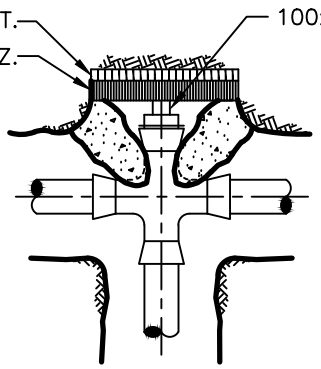
Date:	Drawn By:	Checked By:	Scale:	Drawing No.
APR 2018	BRW	TDA	NTS	5–200



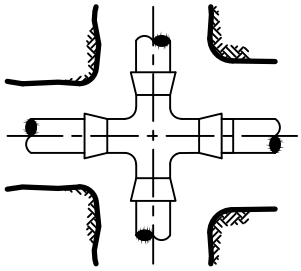
HORIZONTAL 90° BEND



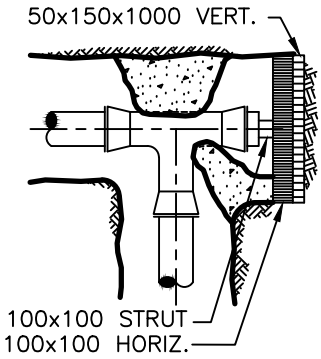
TEE



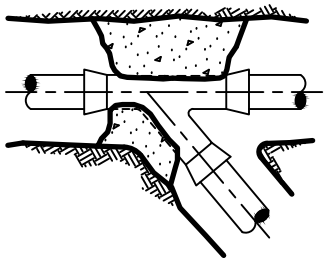
CROSS WITH PLUG



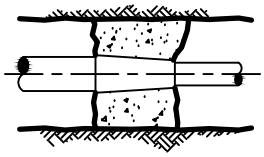
CROSS



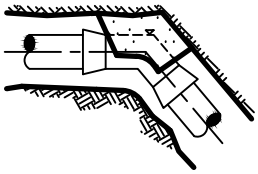
TEE WITH PLUG



WYE



REDUCER



HORIZONTAL BENDS

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES.
2. ALL FITTINGS TO BE WRAPPED IN 6MIL POLYETHYLENE PRIOR TO POURING CONCRETE.
3. ALL CONCRETE TO BE MIN. 28MPa @ 28 DAYS.
4. THE REQUIRED BEARING AREA SHALL BE DETERMINED BY THE CONTRACTOR TO SUIT SOIL CONDITIONS AND AS APPROVED BY THE COUNTY.
5. MECHANICAL RESTRANTS MAY BE USED BASED ON THE COUNTY AND DESIGN ENGINEER'S APPROVAL.

HORIZONTAL THRUST BLOCK BEARING SURFACE AREA						
MINIMUM CONCRETE AREA IN CONTACT WITH UNDISTURBED SOIL (sq. m)						
FITTING	SIZE OF MAIN (mm)					
	150	200	250	300	400	500
DEAD END MAIN & TEE	0.35	0.62	0.97	1.40	2.49	3.90
11 1/4 DEGREE BEND	0.07	0.12	0.20	0.28	0.50	0.78
22 1/2 DEGREE BEND	0.14	0.24	0.38	0.55	0.97	1.52
45 DEGREE BEND	0.27	0.48	0.75	1.07	1.91	2.98
90 DEGREE BEND	0.50	0.88	1.38	1.98	3.53	5.51
VALVE & REDUCER	0.35	0.62	0.97	1.40	2.49	3.90

NOTE:

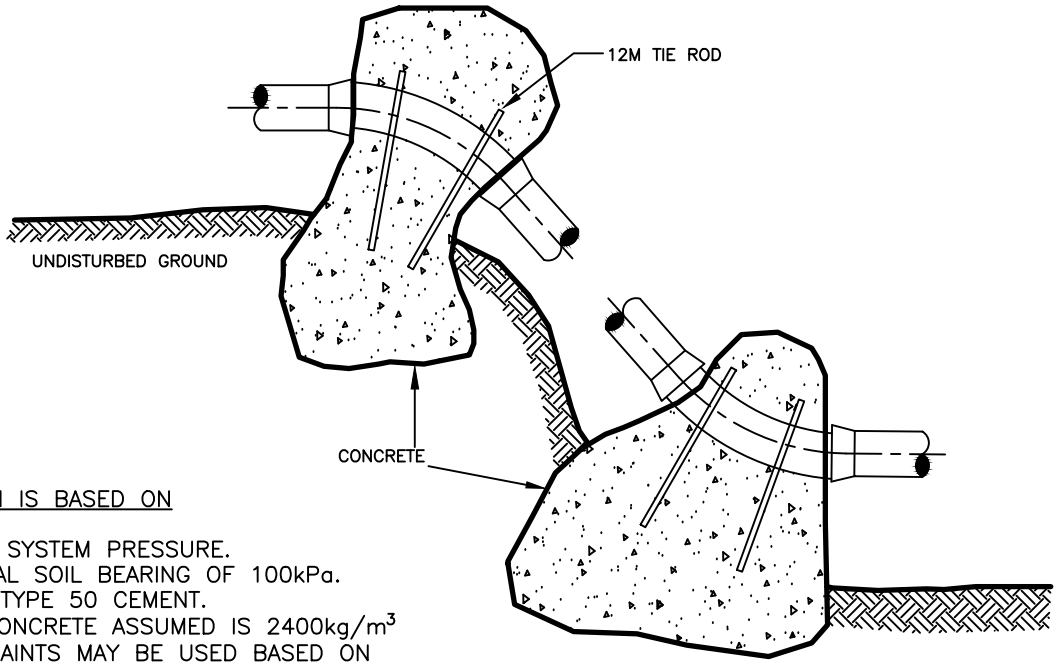
- BEARING AREA CALCULATED USING THE FOLLOWING:
  a. HYDRAULIC PRESSURE 1380kPa.
  b. SOIL BEARING CAPACITY 72kPa.
- CONCRETE STRENGTH TO BE 28MPa.
- CONCRETE TO BE CLEAR OF BELLS & PIPE.
- PLACE 6MIL POLYETHYLENE BETWEEN CONCRETE AND PIPE.
- SEE DWG. 5-500 FOR "CLASS B BEDDING DETAILS" FOR "d" DEPTH.

CYPRESS COUNTY

STANDARD DETAILS

THRUST BLOCK DETAIL

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
APR 2018	BRW	TDA	NTS	5-300



THRUST BLOCK DESIGN IS BASED ON

1. 1035kPa MAXIMUM SYSTEM PRESSURE.
2. A MINIMUM VERTICAL SOIL BEARING OF 100kPa.
3. CONCRETE 20MPa TYPE 50 CEMENT.
4. UNIT WEIGHT OF CONCRETE ASSUMED IS 2400kg/m^3
5. MECHANICAL RESTRAINTS MAY BE USED BASED ON THE COUNTY AND DESIGN ENGINEER'S APPROVAL.

UPWARD THRUST (GRAVITY) TABLE

FOR CALCULATION OF BASIC THRUST BEARING AREA (m^2)

PIPE SIZE / BEND	150	200	250	300	350	400	450
11.25°	0.16	0.28	0.45	0.64	0.87	1.14	1.44
22.50°	0.32	0.57	0.88	1.27	1.73	2.26	2.82
30°	0.42	0.75	1.17	1.69	2.3	3.00	3.80
45°	0.62	1.11	1.73	2.50	3.40	4.44	5.62

DOWNWARD THRUST TABLE

FOR CALCULATION OF BASIC THRUST BEARING AREA (m^2)

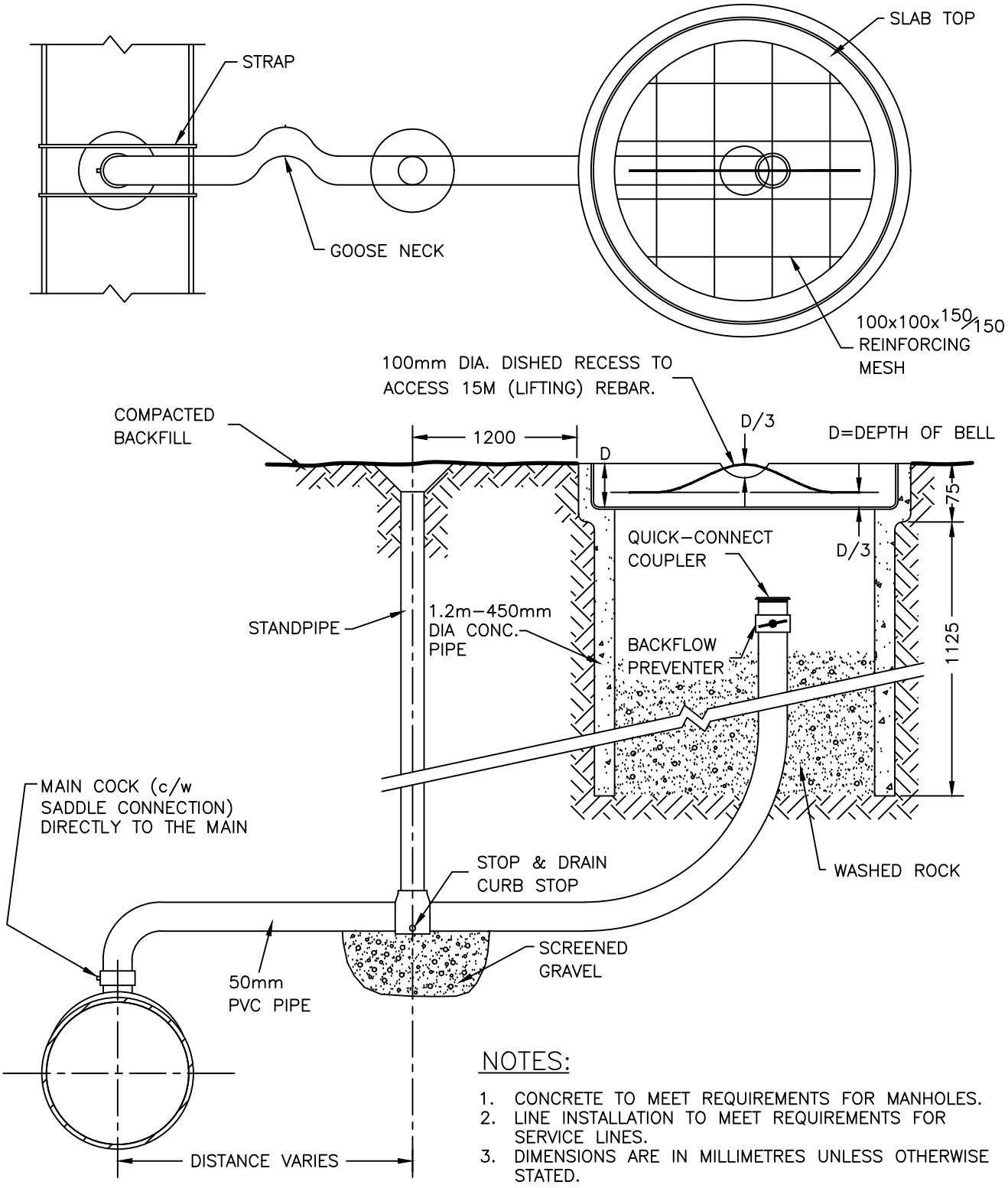
PIPE SIZE / BEND	150	200	250	300	350	400	450
11.25°	0.04	0.07	0.11	0.15	0.21	0.27	0.34
22.50°	0.08	0.13	0.21	0.30	0.41	0.53	0.67
30°	0.10	0.18	0.28	0.40	0.54	0.71	0.89
45°	0.15	0.26	0.41	0.59	0.80	1.05	1.32

CYPRESS COUNTY

STANDARD DETAILS

VERTICAL BEND THRUST BLOCK DETAIL

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
APR 2018	BRW	TDA	NTS	5–301



NOTES:

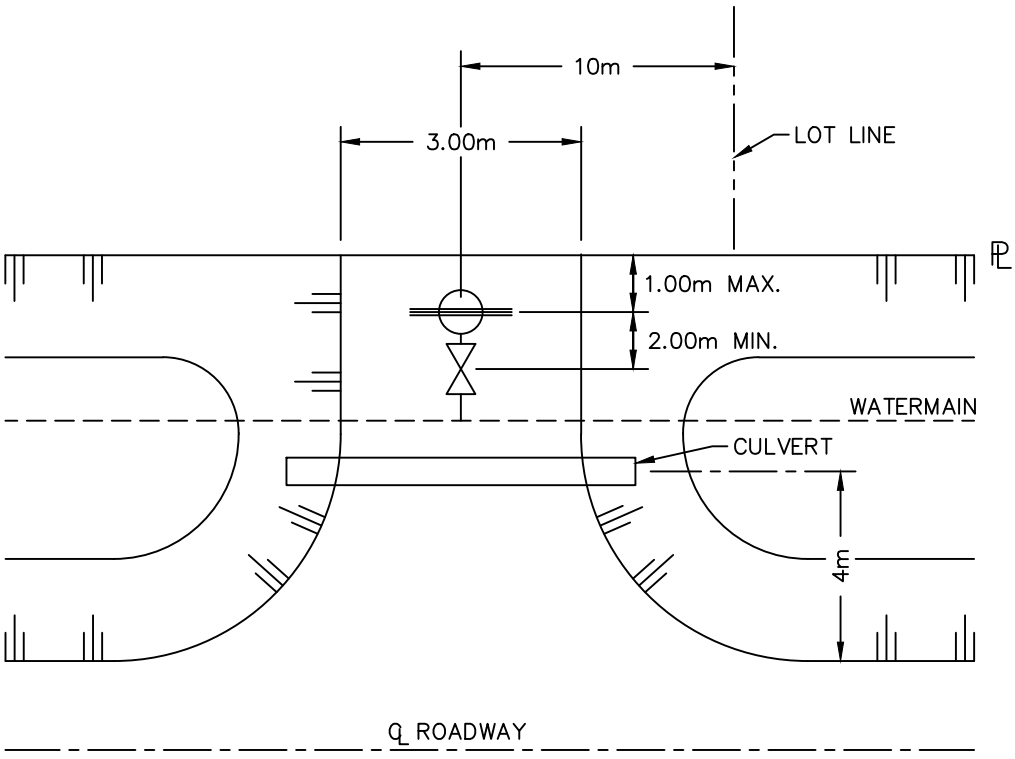
1. CONCRETE TO MEET REQUIREMENTS FOR MANHOLES.
2. LINE INSTALLATION TO MEET REQUIREMENTS FOR SERVICE LINES.
3. DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.

CYPRESS COUNTY

STANDARD DETAILS

FLUSHING POINT

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
APR 2018	BRW	TDA	NTS	5-500



NOTES:

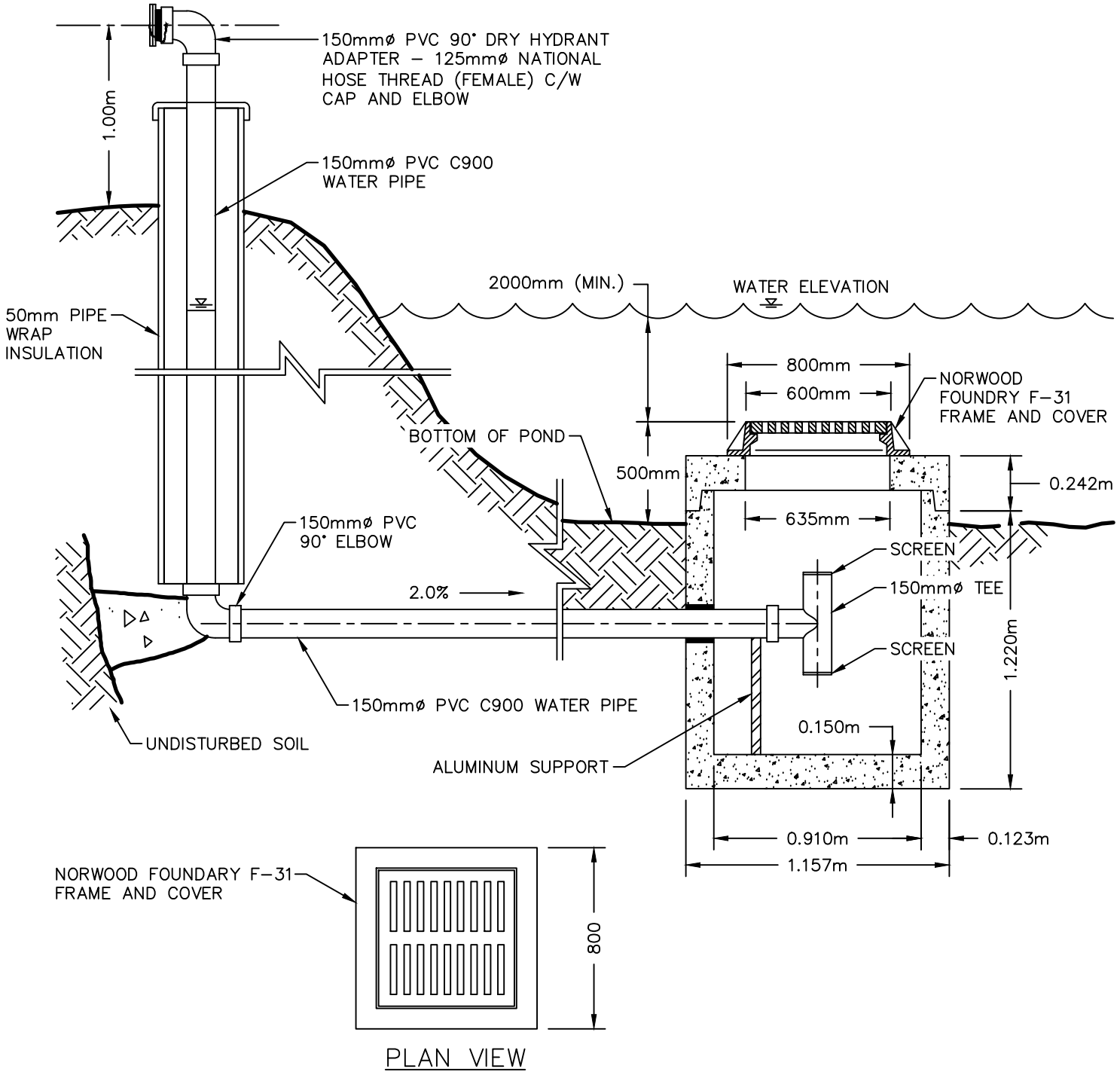
1. WHEN CULVERTS ARE REQUIRED THEY MUST BE C.S.P. CULVERTS AND BE THE MIN. DIAMETER OF 500mm.
2. CULVERTS MUST BE SET BACK A MINIMUM OF 4m FROM SHOULDER OF ROAD.

CYPRESS COUNTY

STANDARD DETAILS

HYDRANT ACCESS LOCATION OFF RURAL ROAD

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
APR 2018	BRW	TDA	NTS	5-600



PLAN VIEW

NOTE:

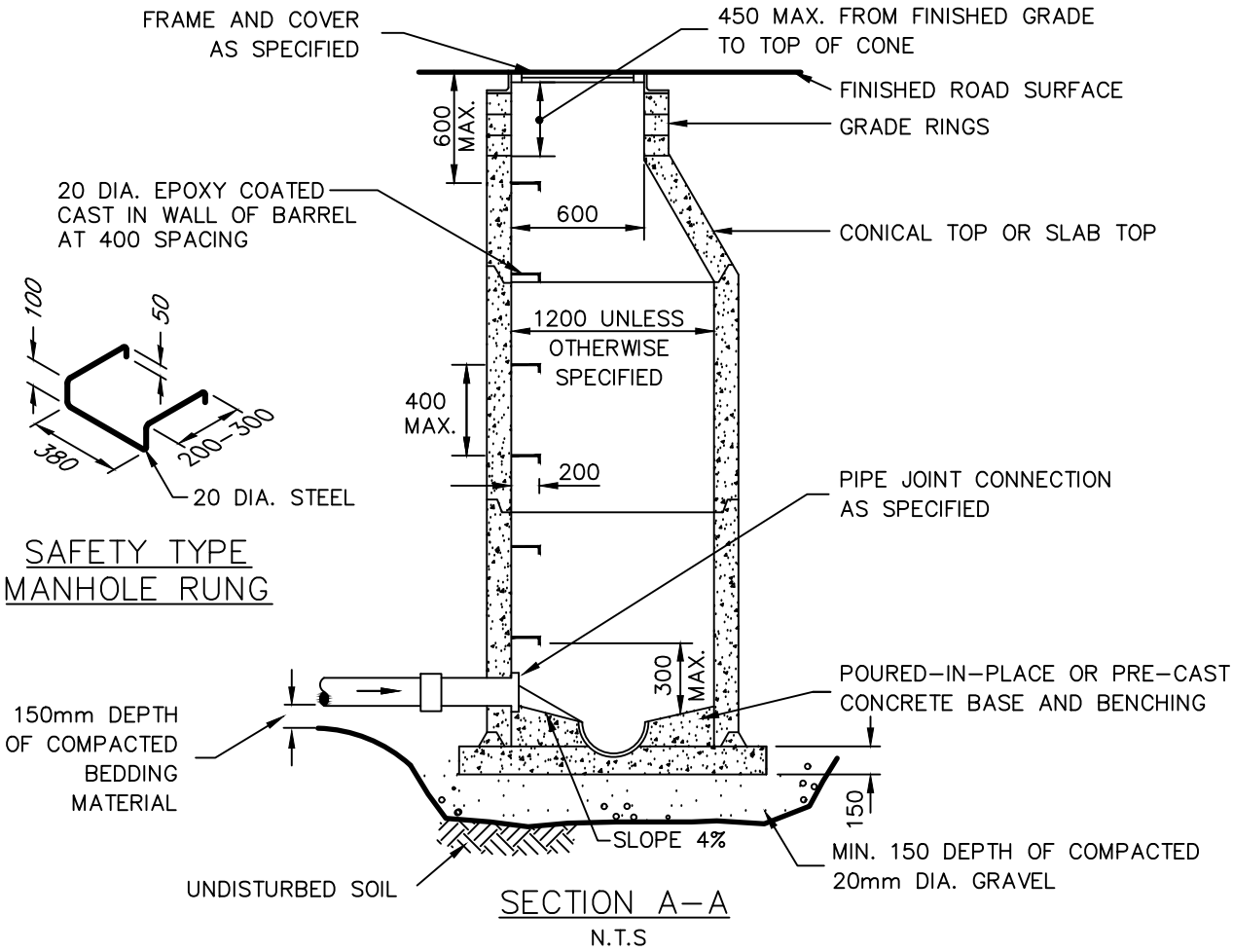
PLACE PVC SLOTTED DRAIN COVERS IN 150mmø TEE OR MANUFACTURE A SCREEN ASSEMBLY TO REDUCE PARTICLE SIZE ENTERING DRY HYDRANT.

CYPRESS COUNTY

STANDARD DETAILS

TYPICAL CATCH BASIN BARREL AND HYDRANT

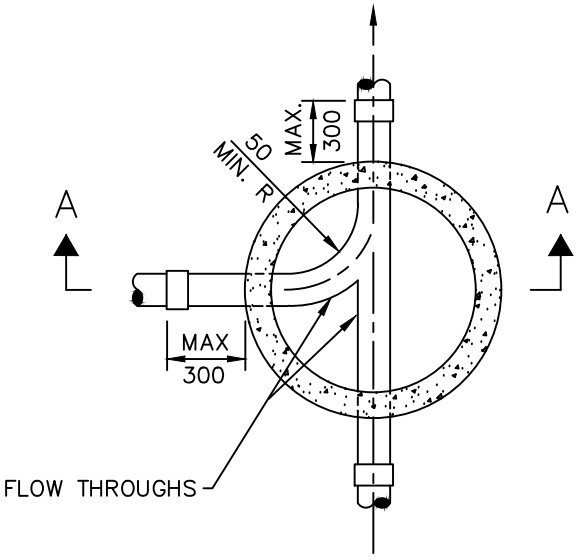
Date:	Drawn By:	Checked By:	Scale:	Drawing No.
APR 2018	BRW	TDA	NTS	5–700



SAFETY TYPE MANHOLE RUNG

SECTION A-A

N.T.S



PLAN

N.T.S

NOTES:

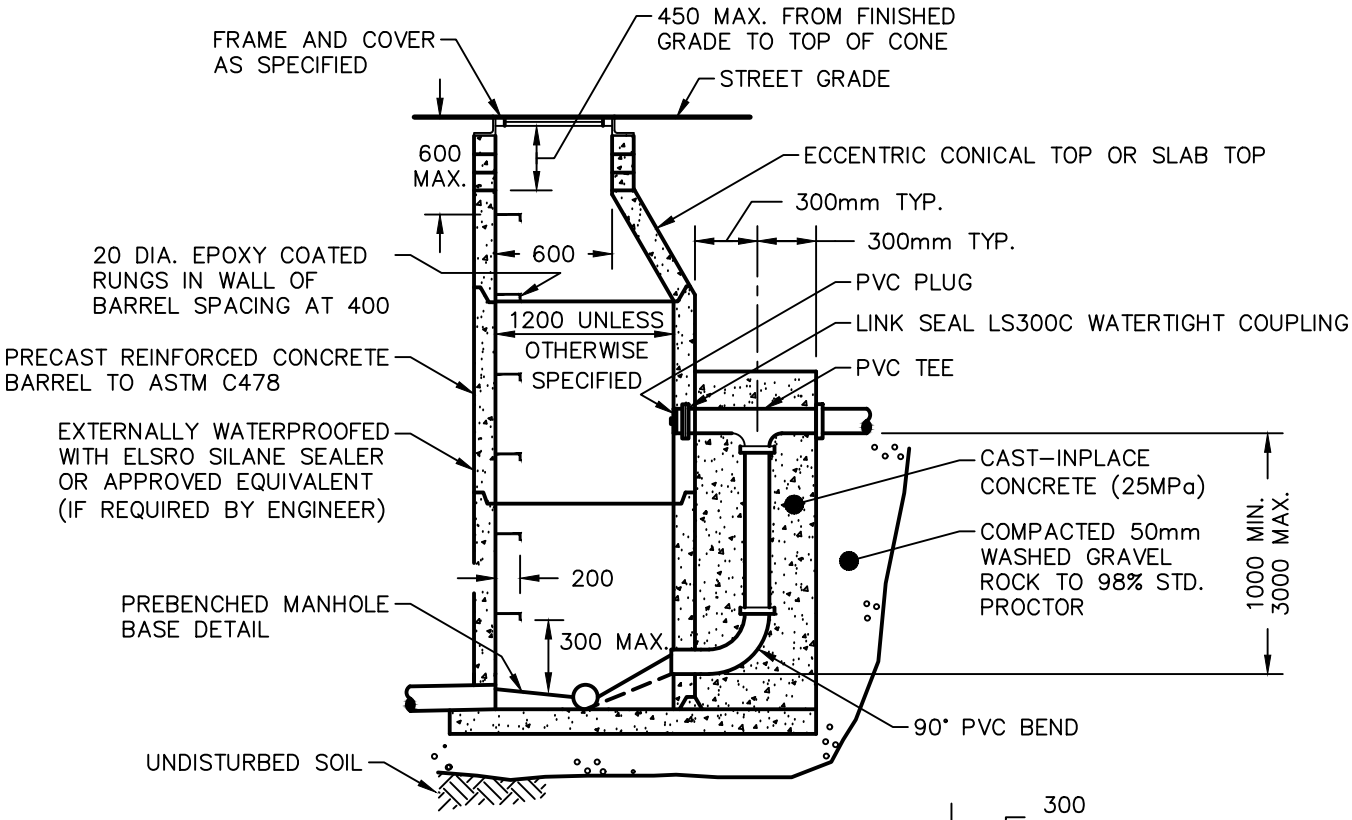
1. ALL PRE-CAST MANHOLES MUST CONFORM TO A.S.T.M. SPECIFICATIONS C478.
2. POURED-IN-PLACE CONCRETE SHALL HAVE 28 DAYS COMPRESSIVE STRENGTH OF AT LEAST 25MPa.
3. ALL JOINTS TO BE SET WITH RUBBER GASKET AND SET WITH NON-SHRINK GROUT, INSIDE AND OUT, FOR THE FULL CIRCUMFERENCE.
4. FORM FLOW TROUGH IN PARTIALLY SET CONCRETE AND TROWEL SMOOTH.
5. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.
6. BACKFILL AROUND MH. WITH SELECT NATIVE MATERIAL. COMPACT TO 98% S.P.D.
7. FLAT TOP SECTION TO BE USED FOR MANHOLES UP TO 1.8m BURY.
8. ALL JOINTS TO BE WATERTIGHT. METHODS TO BE CONSISTENT WITH SITE CONDITIONS.
9. FOR MANHOLES 5.0m IN DEPTH OR GREATER, A SAFETY PLATFORM SHALL BE INSTALLED.
10. MANHOLES TO MEET REQUIREMENTS OF MANHOLE DETAILS AND SPECIFICATIONS.
11. SAFETY STEPS TO BE PROVIDED, SPACED AT 400 MAX. FIRST STEP 600 MAX. BELOW FRAME, LAST STEP 300 MAX. ABOVE BASE.

CYPRESS COUNTY

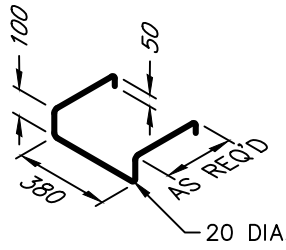
STANDARD DETAILS

TYPICAL 5A PRE-CAST MANHOLE DETAIL

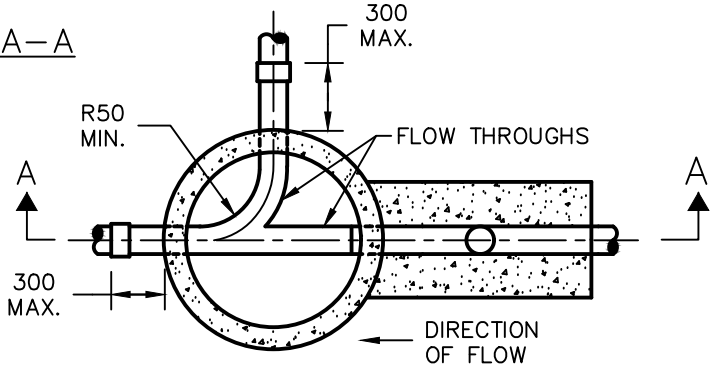
Date:	Drawn By:	Checked By:	Scale:	Drawing No.
APR 2018	BRW	TDA	NTS	6-100



SECTION A–A



SAFETY TYPE MANHOLE RUNG



PLAN

NOTES:

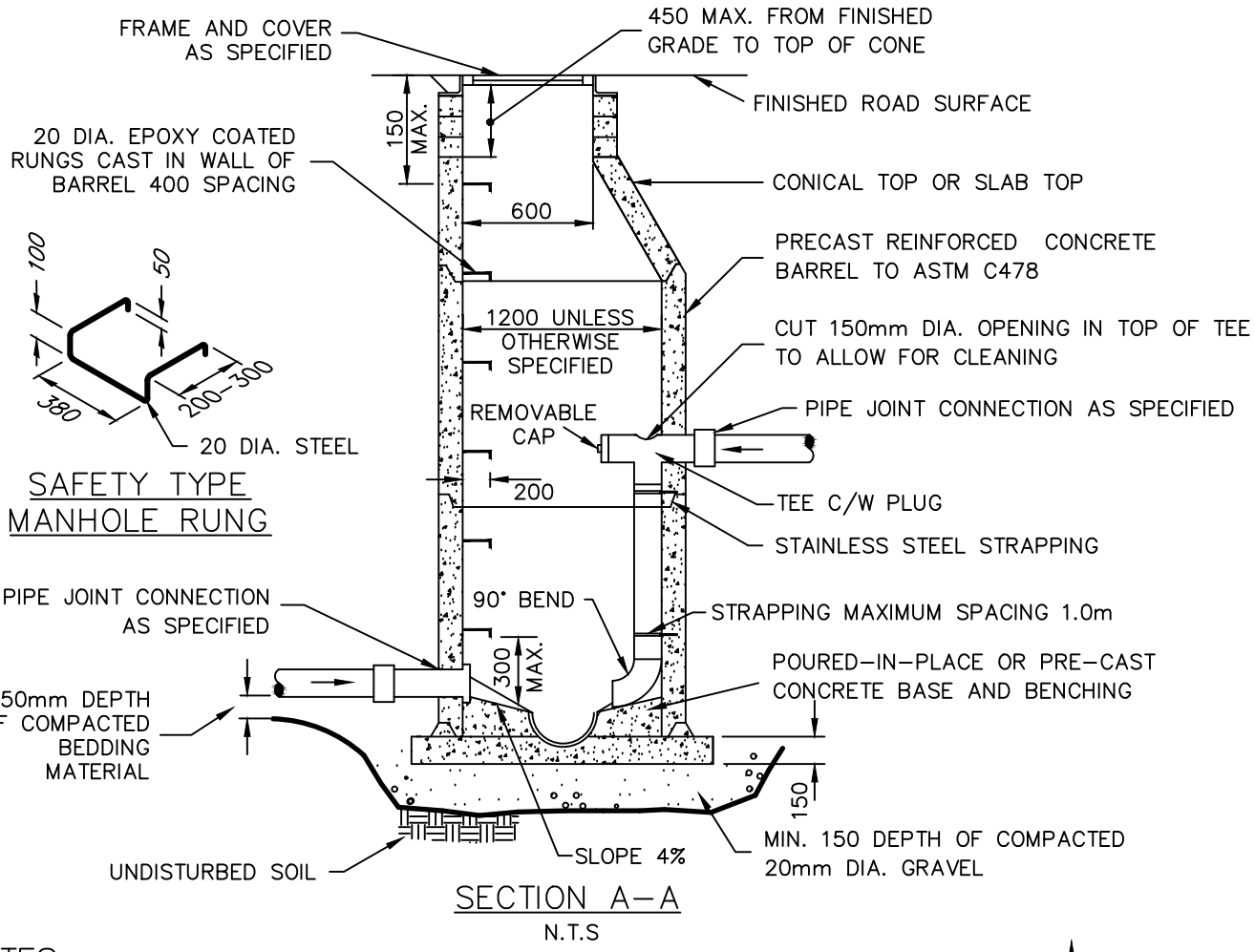
1. ALL PRE–CAST MANHOLES MUST CONFORM TO A.S.T.M. SPECIFICATIONS C478.
2. POURED–IN–PLACE CONCRETE SHALL HAVE A 28 DAY COMPRESSIVE STRENGTH OF AT LEAST 25MPa.
3. ALL JOINTS TO BE SET WITH RUBBER GASKET AND SET WITH NON–SHRINK GROUT, INSIDE AND OUT AROUND FULL CIRCUMFERENCE.
4. FORM FLOW TROUGH IN PARTIALLY SET CONCRETE AND TROWEL SMOOTH.
5. ALL DIMENSIONS IN MILLIMETRES.
6. BACKFILL AROUND MH. WITH SELECT NATIVE MATERIAL COMPACT TO 98% S.P.D.
7. FLAT TOP SECTION TO BE USED FOR MANHOLES UP TO 1.8m BURY.
8. ALL JOINTS TO BE WATERTIGHT. METHODS TO BE CONSISTENT WITH SITE CONDITIONS.
9. FOR MANHOLES 5.0m IN DEPTH OR GREATER, A SAFETY PLATFORM SHALL BE INSTALLED. SEE DETAIL B–110.
10. MANHOLES TO MEET REQUIREMENTS OF MANHOLE DETAILS AND SPECIFICATIONS.
11. SAFETY STEPS TO BE PROVIDED, SPACED AT 600 MAX. FIRST STEP 150 MAX. BELOW FRAME, LAST STEP 300 MAX. ABOVE BASE.
12. CHANNELING AND BENCHING TO BE FINISHED TO TROWEL SMOOTHNESS.
13. PVC ON EXTERIOR OF MANHOLE TO BE WRAPPED IN 6mm POLY PRIOR TO PLACEMENT OF CONCRETE.

CYPRESS COUNTY

STANDARD DETAILS

EXTERIOR DROP MANHOLE DETAIL

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
APR 2018	BRW	TDA	NTS	6–201



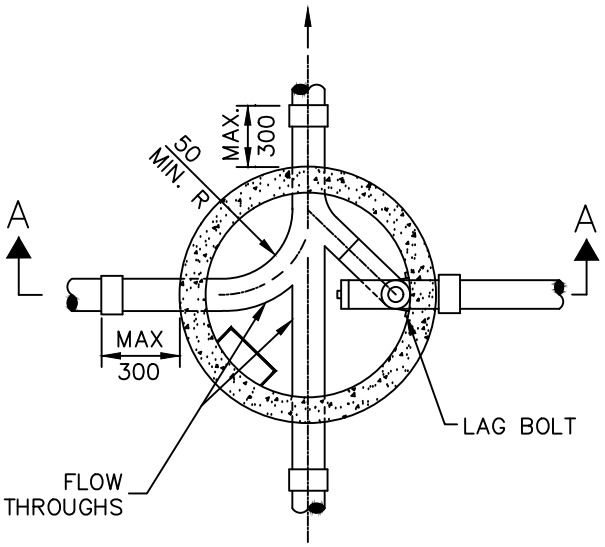
SAFETY TYPE MANHOLE RUNG

SECTION A–A

N.T.S

NOTES:

1. ALL PRE–CAST MANHOLES MUST CONFORM TO A.S.T.M. SPECIFICATIONS C478.
2. POURED–IN–PLACE CONCRETE SHALL HAVE 28 DAYS COMPRESSIVE STRENGTH OF AT LEAST 25MPa.
3. ALL JOINTS TO BE SET WITH RUBBER GASKET AND SET WITH NON–SHRINK GROUT, INSIDE AND OUT, FOR THE FULL CIRCUMFERENCE.
4. FORM FLOW THROUGH IN PARTIALLY SET CONCRETE AND TROWEL SMOOTH.
5. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.
6. BACKFILL AROUND MH. WITH SELECT NATIVE MATERIAL AND COMPACT TO 98% S.P.D.
7. FLAT TOP SECTION TO BE USED FOR MANHOLES UP TO 1.8m BURY.
8. ALL JOINTS TO BE WATERTIGHT. METHODS TO BE CONSISTENT WITH SITE CONDITIONS.
9. FOR MANHOLES 5.0m IN DEPTH AND GREATER, A SAFETY PLATFORM SHALL BE INSTALLED.
10. MANHOLES TO MEET REQUIREMENTS OF MANHOLE DETAILS AND SPECIFICATIONS.
11. STAINLESS STEEL LAG BOLTS AND STRAPPING ARE TO BE INSTALLED IMMEDIATELY BELOW THE TEE AND A CONTINUAL 1.0m VERTICAL SPACING TO THE BASE.
12. DIAMETER, SIZE, AND TYPE OF VERTICAL PIPE TO MATCH INLET PIPE.
13. SAFETY STEPS TO BE PROVIDED, SPACED AT 600 MAX. FIRST STEP 150 MAX. BELOW FRAME, LAST STEP 300 MAX. ABOVE BASE.



PLAN

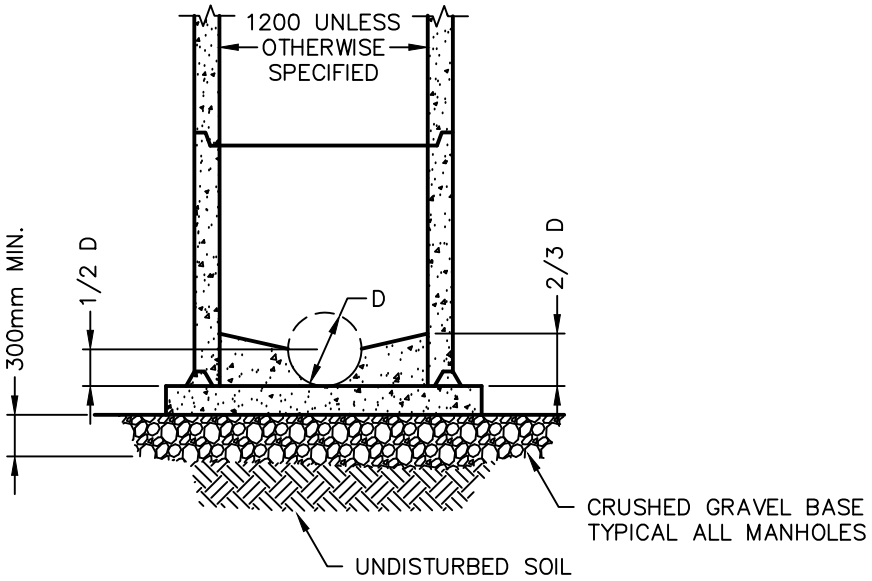
N.T.S

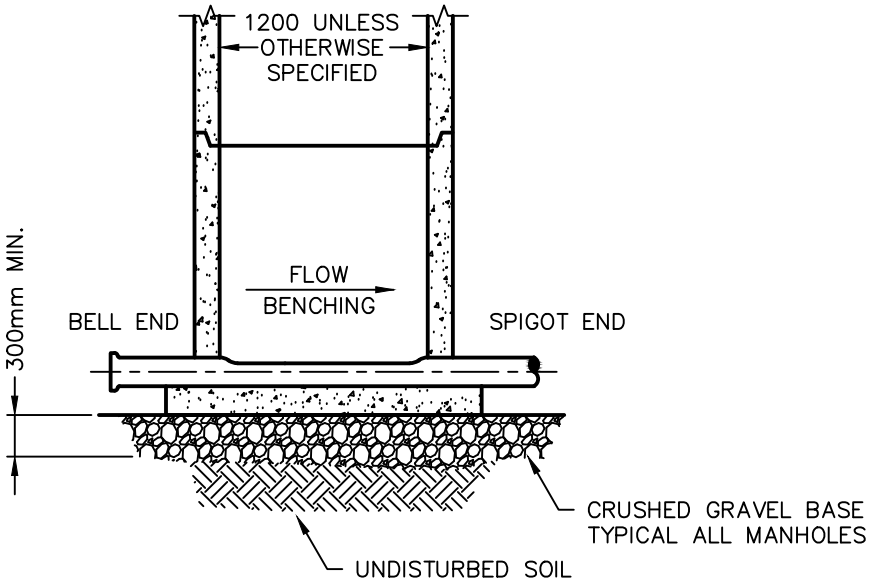
CYPRESS COUNTY

STANDARD DETAILS

INTERIOR DROP MANHOLE DETAIL

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
APR 2018	BRW	TDA	NTS	6–202





NOTES:

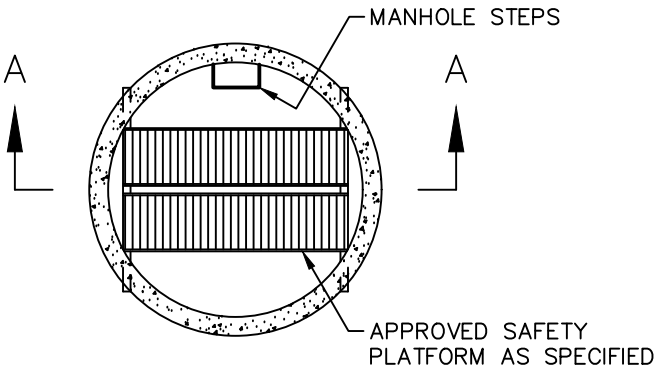
1. PRE-BENCHED MANHOLE BASES AS SUPPLIED BY CONCRETE MANUFACTURER.
2. SULPHATE RESISTANT CEMENT TO BE USED.

CYPRESS COUNTY

STANDARD DETAILS

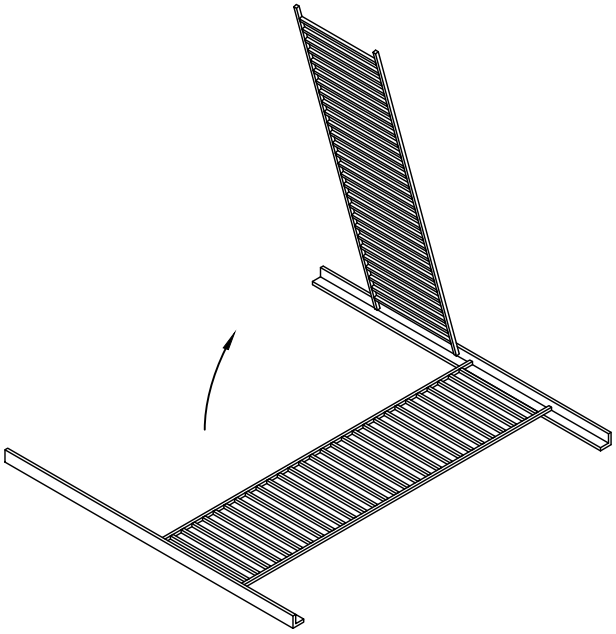
PRE-BENCHED MANHOLE BASE

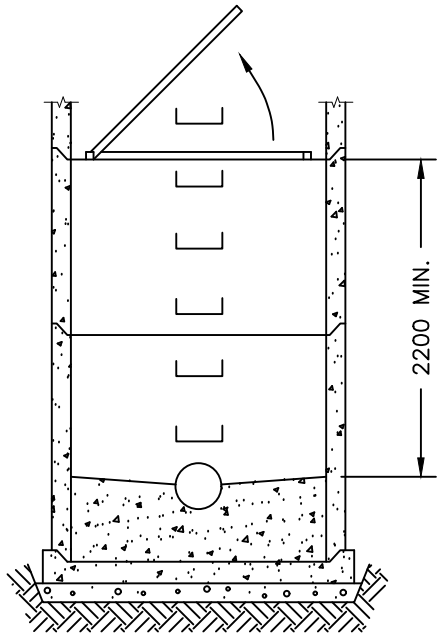
Date:	Drawn By:	Checked By:	Scale:	Drawing No.
APR 2018	BRW	TDA	NTS	6-300



PLAN VIEW

N.T.S





SECTION A–A

N.T.S

NOTES:

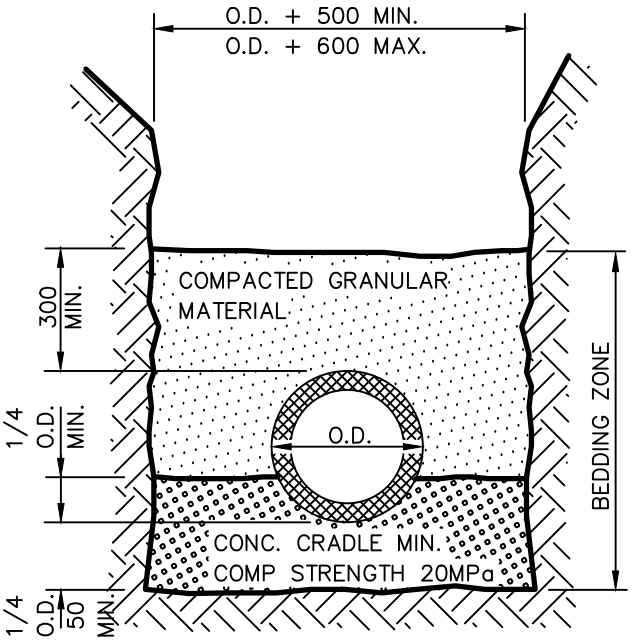
1. TO BE INSTALLED ON MANHOLES GREATER THAN 5.0m DEEP.
2. MAXIMUM SPACING BETWEEN PLATFORMS TO BE 5.0m.
3. ALUMINUM GRATES TO BE MSU MISSISSAUGA OR APPROVED EQUAL.
4. TO BE INSTALLED ACCORDING TO MANUFACTURER'S RECOMMENDATIONS.

CYPRESS COUNTY

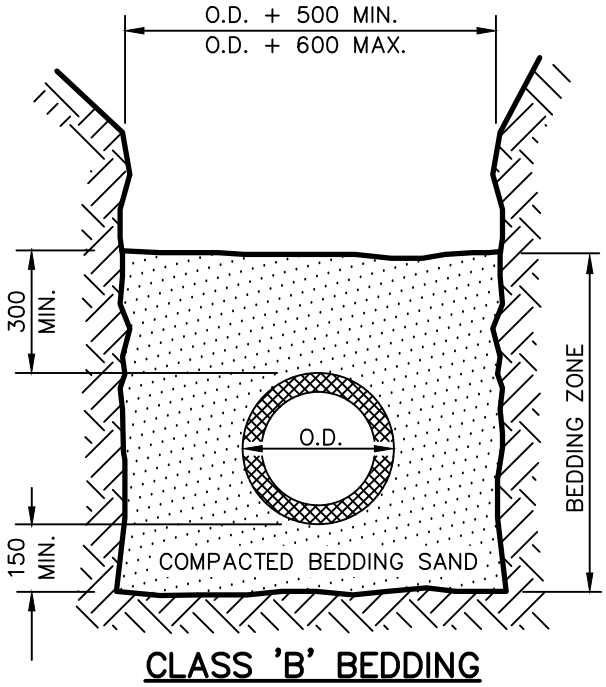
STANDARD DETAILS

MANHOLE SAFETY PLATFORM

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
APR 2018	BRW	TDA	NTS	6–400



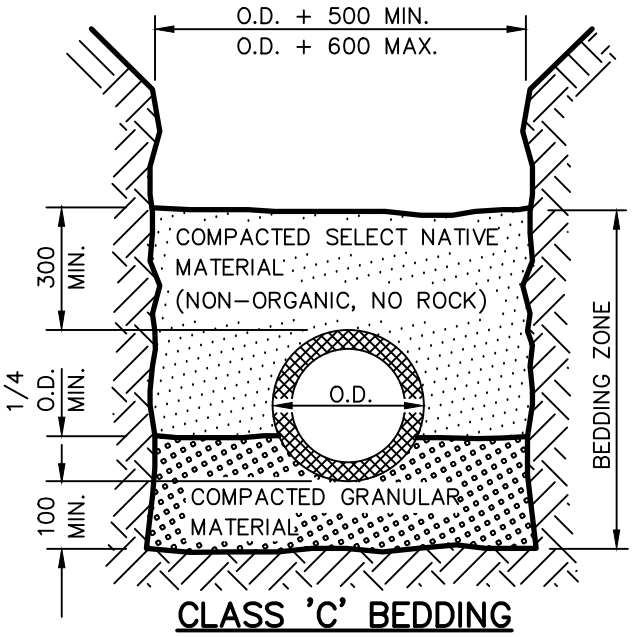
CLASS 'A' BEDDING



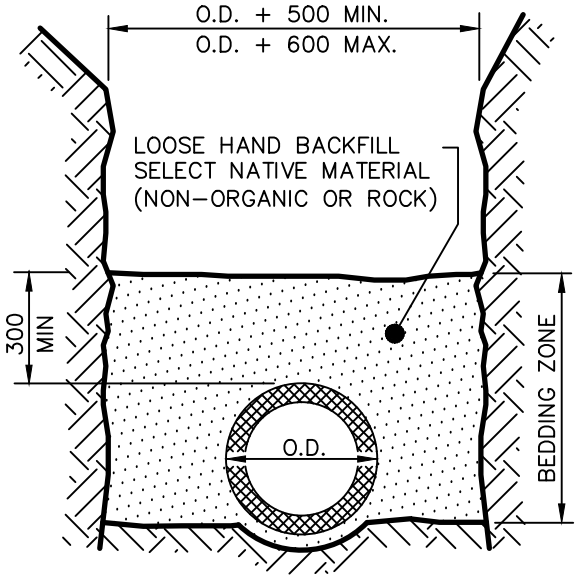
CLASS 'B' BEDDING

NOTES:

1. COMPACTION OF BEDDING ZONE SHALL BE AS PER SPECIFICATIONS. (MIN. 95% S.P.D.). TOP METRE MUST CONFORM TO SPECIFICATIONS (MIN 98% S.P.D.)
2. ALL DIMENSIONS ARE GIVEN IN MILLIMETRES UNLESS OTHERWISE STATED.
3. BACKFILL COMPACTION REQUIREMENTS WILL VARY. BACKFILL ABOVE PIPE ZONE TO BE APPROVED MATERIAL.
4. TRENCH SIDE SLOPES TO BE CONSISTENT WITH OCCUPATIONAL HEALTH AND SAFETY REQUIREMENTS.
5. SELECT NATIVE MATERIAL MUST BE APPROVED PRIOR TO USE.



CLASS 'C' BEDDING



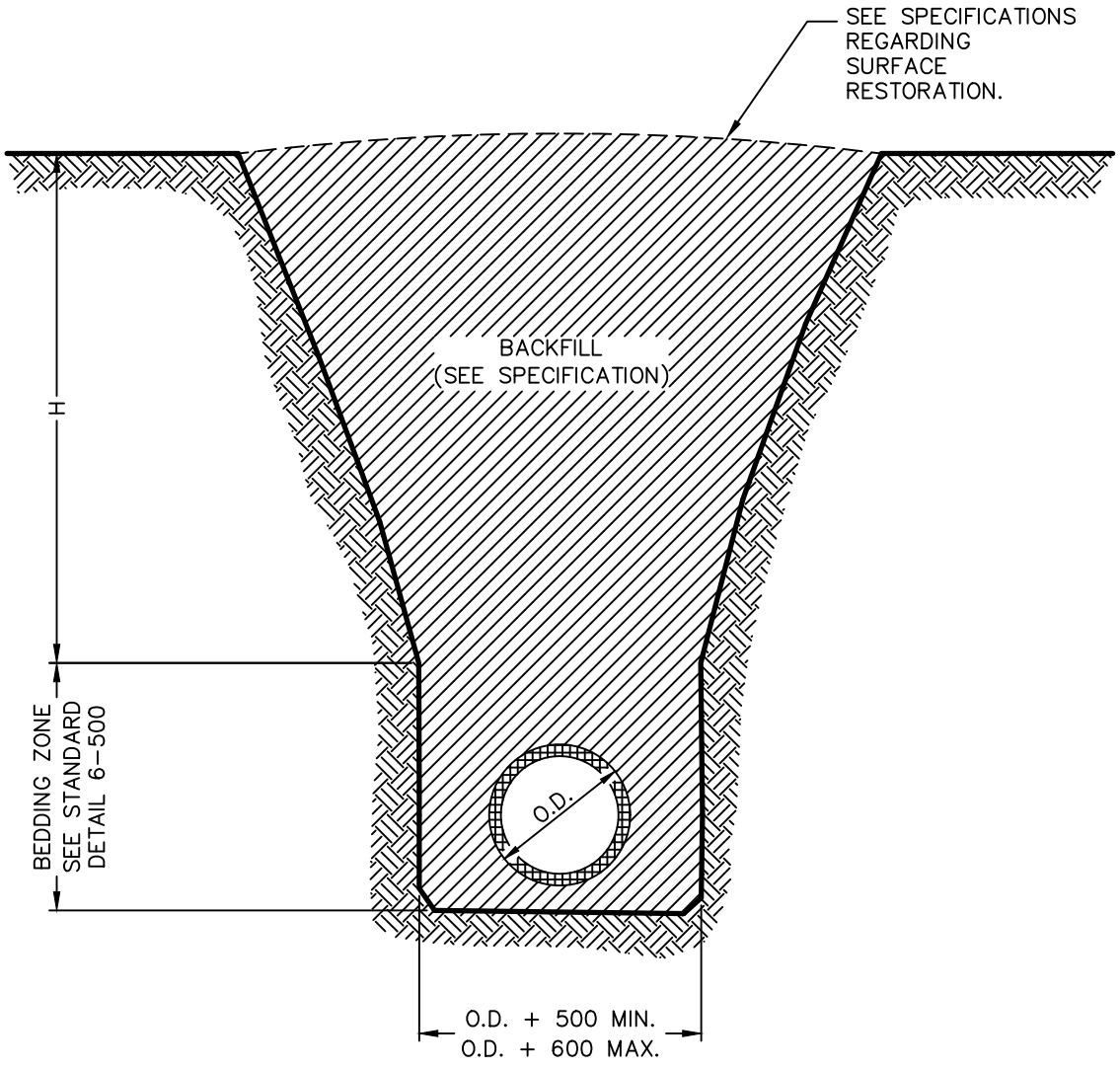
CLASS 'D' BEDDING

CYPRESS COUNTY

STANDARD DETAILS

PIPE BEDDING DETAIL

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
APR 2018	BRW	TDA	NTS	6-500



NOTES:

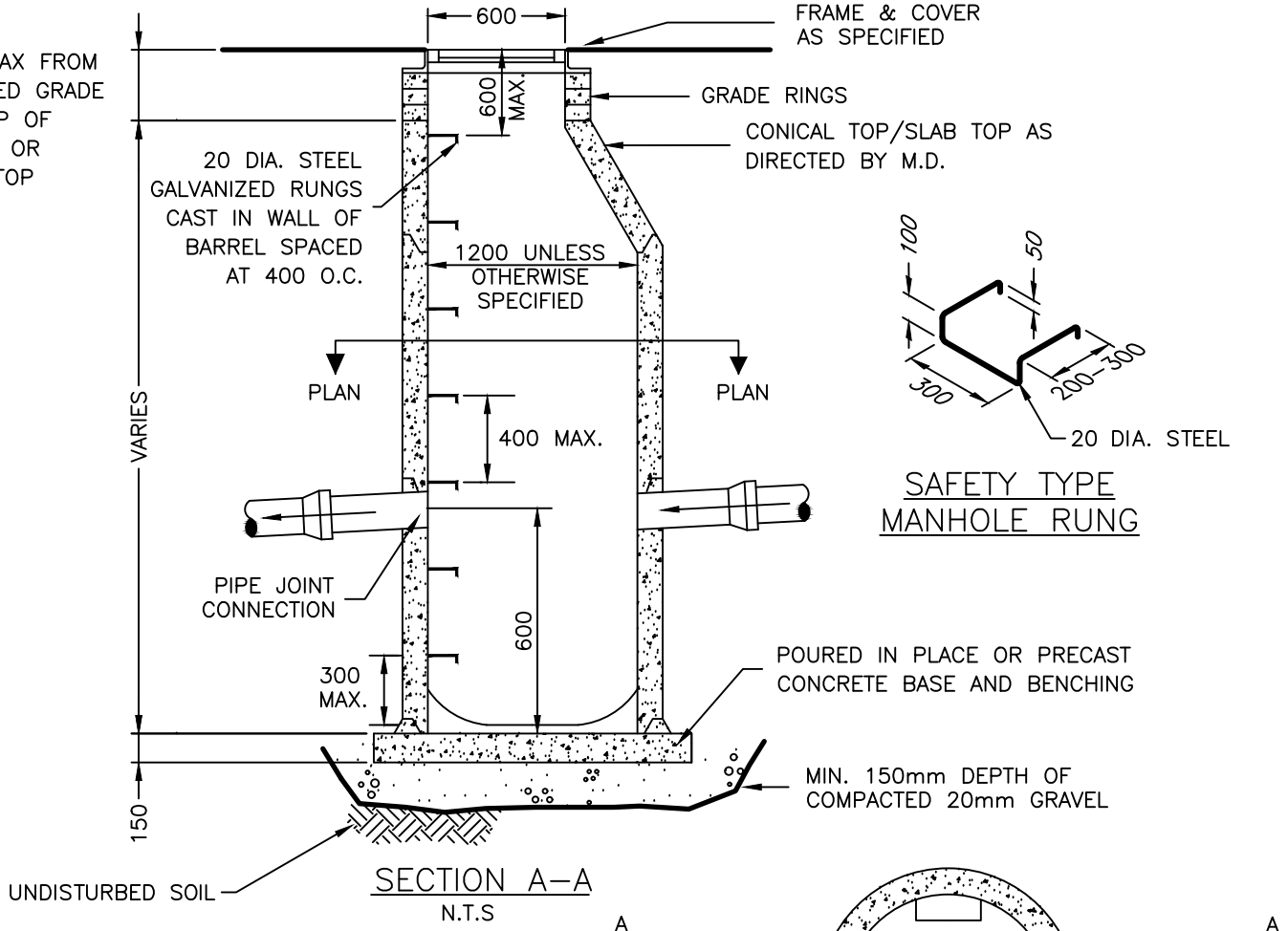
1. WHEN CUT BACK SLOPES ARE TO BE USED IN LIEU OF CAGES AND SHORING, THESE SLOPES ARE TO MEET REQUIREMENTS OF LOCAL CODES.
2. SEE SPECIFICATIONS FOR MINIMUM COVER ABOVE PIPE.
3. MIN. PIPE ZONE WIDTH IS SPECIFIED TO ALLOW PROPER PIPE ZONE COMPACTION.
4. O.D. = OUTSIDE PIPE DIAMETER.
5. WIDER TRENCH MAY BE REQUIRED AT THE DISCRETION OF THE ENGINEER.

CYPRESS COUNTY

STANDARD DETAILS

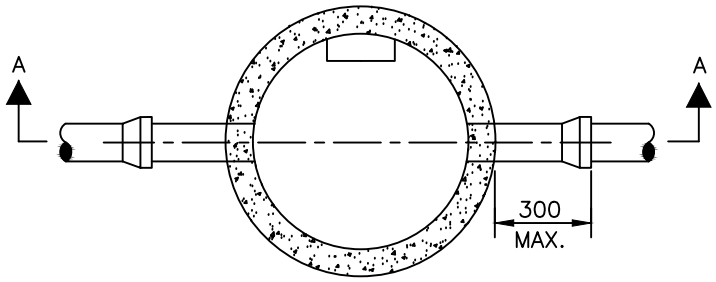
TYPICAL TRENCH DETAIL

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
MAY 2018	BRW	TDA	NTS	6-600



SECTION A–A
N.T.S

SAFETY TYPE MANHOLE RUNG



PLAN
N.T.S

NOTES:

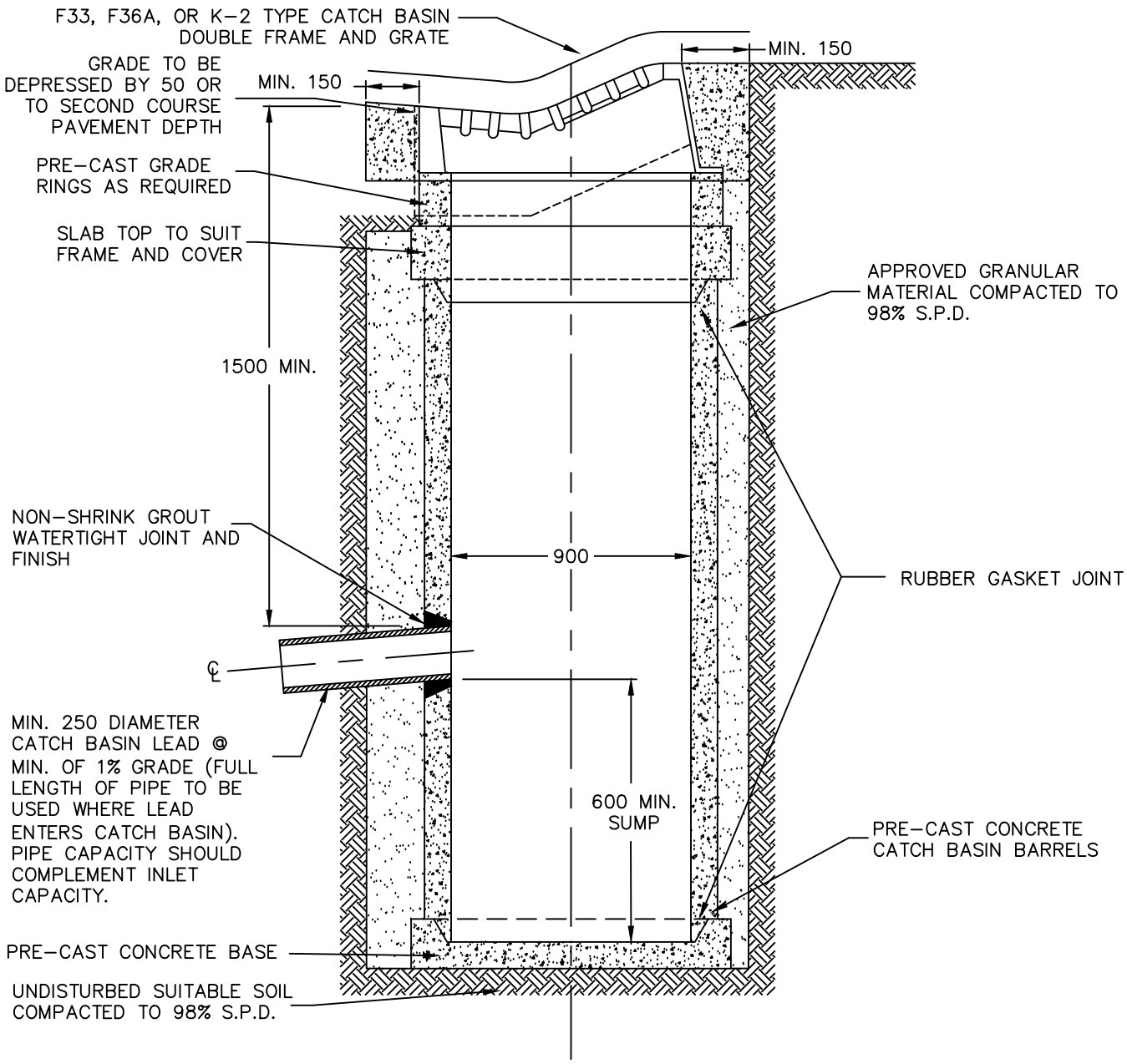
1. ALL PRE–CAST MANHOLES MUST CONFORM TO A.S.T.M. SPECIFICATIONS C478.
2. POURED–IN–PLACE CONCRETE SHALL HAVE A 28 DAYS COMPRESSIVE STRENGTH OF AT LEAST 25MPa.
3. ALL JOINTS TO BE SET WITH RUBBER GASKETS AND SET WITH NON–SHRINK GROUT, INSIDE AND OUT, FOR THE FULL CIRCUMFERENCE.
4. FORM FLOW TROUGH IN PARTIALLY SET CONCRETE AND TROWEL SMOOTH.
5. PIPES TO BE FLUSH WITH WALL.
6. MAX. DIST. FROM RIM TO TOP RUNG IS 800mm.
7. BACKFILL AROUND MH. WITH SELECT NATIVE MATERIAL AND COMPACT TO 98% S.P.D.
8. FLAT TOP SECTION TO BE USED FOR MANHOLES UP TO 1.8m BURY.
9. ALL JOINTS TO BE WATERTIGHT. METHODS TO BE CONSISTENT WITH SITE CONDITIONS.
10. FOR MANHOLES 5.0m IN DEPTH OR GREATER, A SAFETY PLATFORM SHALL BE INSTALLED.
11. MANHOLES TO MEET REQUIREMENTS OF MANHOLE DETAILS AND SPECIFICATIONS.
12. DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED.
13. CHANNELING AND BENCHING TO BE FINISHED TO TROWEL SMOOTHNESS.
14. SAFETY STEPS TO BE PROVIDED, SPACED AT 600 MAX. FIRST STEP 150 MAX. BELOW FRAME, LAST STEP 300 MAX. ABOVE BASE.

CYPRESS COUNTY

STANDARD DETAILS

CATCH BASIN MANHOLE

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
APR 2018	BRW	TDA	NTS	7–100



NOTES:

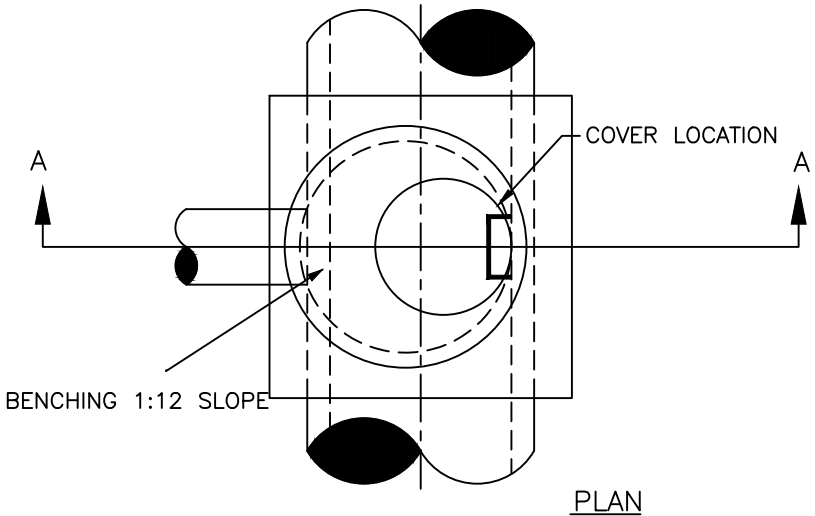
1. PRE-CAST CONCRETE COMPONENTS TO MEET CURRENT A.S.T.M. C478 STANDARDS.
2. CAST-IN-PLACE-CONCRETE TO BE 25MPa AT 28 DAYS.
3. ALL JOINTS TO BE WATERTIGHT; SET WITH RUBBER GASKET WITH NON-SHRINK GROUT INSIDE AND OUTSIDE FOR THE FULL CIRCUMFERENCE. THIS INCLUDES JOINTS BETWEEN GRADE RINGS, GRADE RINGS AND FRAMES, AND BETWEEN GRADE RINGS AND SLAB TOPS.
4. PRE-CAST CONCRETE BASE THICKNESS AND REINFORCEMENT MUST BE DESIGNED FOR THE SPECIFIC CATCH BASIN DEPTH AND SOIL CONDITIONS.
5. JOINTS BETWEEN GRADE RINGS, GRADE RINGS AND CONES, AND RINGS AND FRAMES MUST BE WATERTIGHT. NON-SHRINK GROUT MAY BE USED IF WATERTIGHT JOINTS CANNOT BE ACHIEVED.
6. WICK DRAINS TO CONNECT TO CATCH BASIN SUCH AS TO ENSURE WATERTIGHT JOINTS.
7. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.

CYPRESS COUNTY

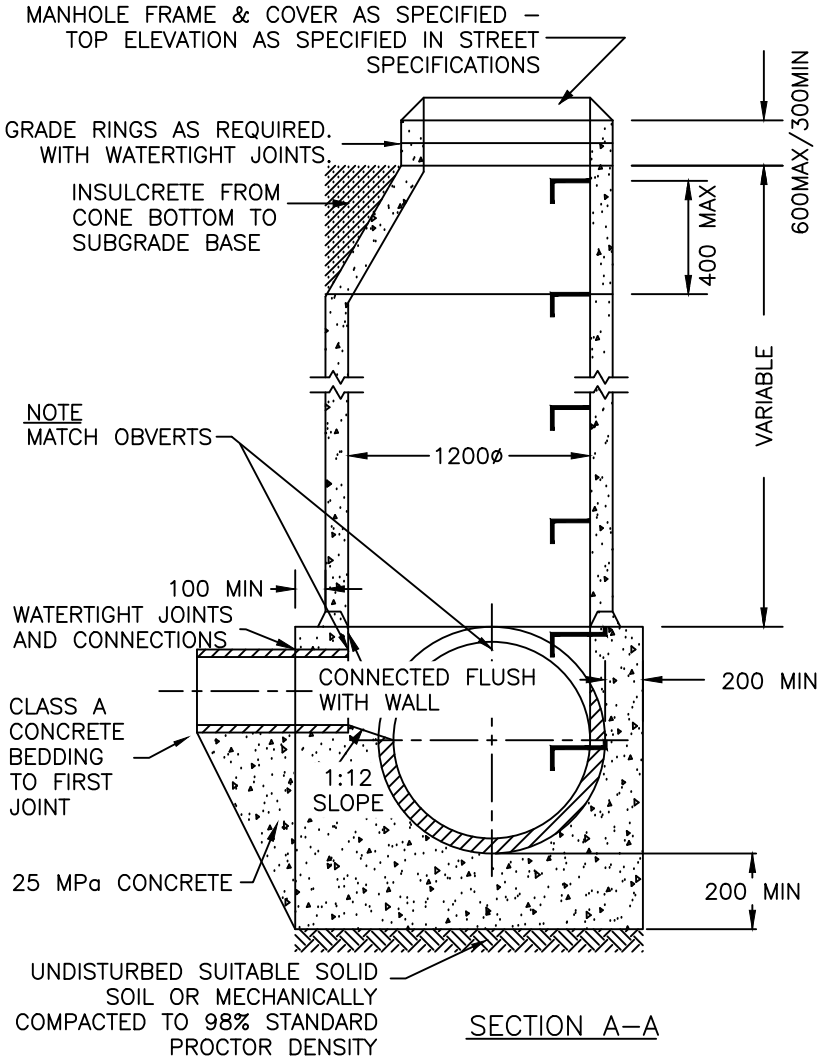
STANDARD DETAILS

CATCH BASIN TYPICAL-900mm

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
APR 2018	BRW	TDA	NTS	7-101



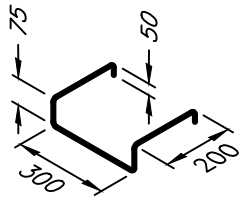
PLAN



SECTION A–A

NOTES:

1. PRE–CAST CONCRETE COMPONENTS MUST CONFORM TO A.S.T.M. SPECIFICATIONS C478.
2. POURED–IN–PLACE CONCRETE TO HAVE 28 DAYS COMPRESSIVE STRENGTH OF AT LEAST 25MPa.
3. ALL JOINTS TO BE SET WITH RUBBER GASKET AND FINISHED WITH NON–SHRINK GROUT, INSIDE AND OUTSIDE, FOR THE FULL CIRCUMFERENCE.
4. FORM FLOW TROUGH IN PARTIALLY SET CONCRETE AND TROWEL SMOOTH.
5. ALL DIMENSIONS GIVEN IN MILLIMETERS UNLESS OTHERWISE STATED.
6. MAX. DIST. FROM RIM TO TOP RUNG IS 600.
7. BACKFILL AROUND MH. WITH SELECT NATIVE MATERIAL COMPACT TO 98% S.P.D.
8. FLAT TOP SECTION TO BE USED FOR MANHOLES UP TO 1.8m BURY.
9. ALL JOINTS TO BE WATERTIGHT. METHODS TO BE CONSISTENT WITH SITE CONDITIONS.
10. FOR MANHOLES 5.0m IN DEPTH OR GREATER, A SAFETY PLATFORM SHALL BE INSTALLED.
11. MANHOLES TO MEET REQUIREMENTS OF MANHOLE DETAILS AND SPECIFICATIONS.
12. SAFETY STEPS TO BE SPACED AT 400 MAX. DISTANCE. FIRST STEP TO BE 150 MAX. BELOW FRAME, LAST STEP TO BE 300 MAX. ABOVE BENCHING.
13. CHANNELING AND BENCHING TO BE FINISHED TO TROWEL SMOOTHNESS.



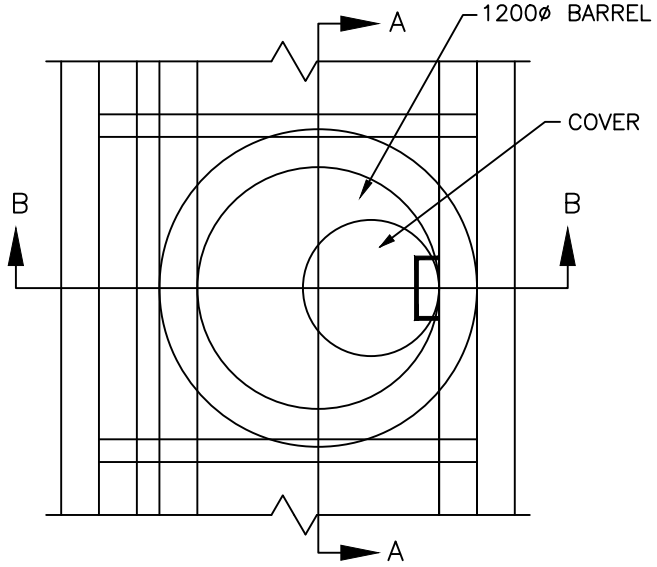
20ø EPOXY COATED MANHOLE SAFETY STEPS

CYPRESS COUNTY

STANDARD DETAILS

TYPICAL PERCHED MANHOLE FOR 600–1050mm DIAMETER PIPES

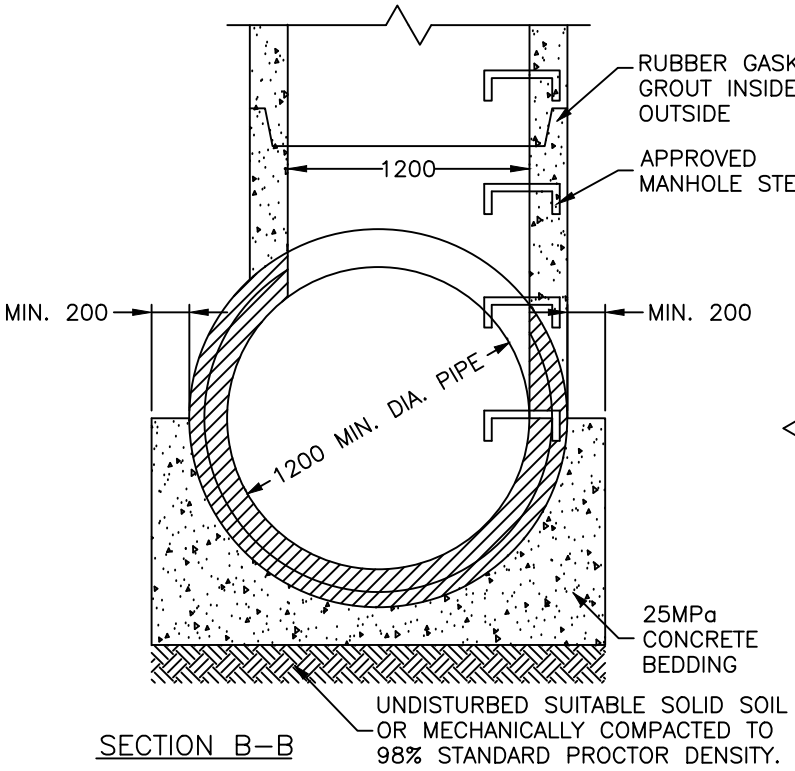
Date:	Drawn By:	Checked By:	Scale:	Drawing No.
APR 2018	BRW	TDA	NTS	7–102



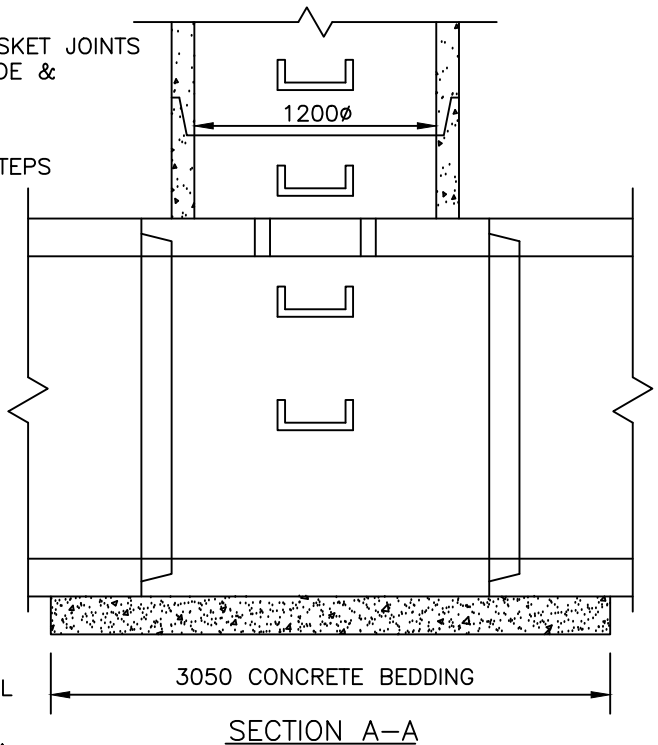
PLAN

NOTES:

1. THIS TYPE OF MANHOLE IS TO BE BUILT ONLY ON MAINS OF 1200 DIAMETER OR LARGER AND WHERE THERE IS NO CHANGE IN DIRECTION OF FLOW.
2. ALL PRE-CAST MANHOLES MUST CONFORM TO A.S.T.M. SPECIFICATIONS C478.
3. POURED-IN-PLACE CONCRETE SHALL HAVE A 28 DAYS COMPRESSIVE STRENGTH OF AT LEAST 25MPa.
4. ALL JOINTS TO BE SET WITH RUBBER GASKETS AND SET WITH NON-SHRINK GROUT, INSIDE AND OUT, FOR THE FULL CIRCUMFERENCE.
5. FORM FLOW TROUGH IN PARTIALLY SET CONCRETE AND TROWEL SMOOTH.
6. ALL DIMENSIONS GIVEN IN MILLIMETERS UNLESS OTHERWISE STATED.
7. MAX. DIST. FROM RIM TO TOP RUNG IS 800mm.
8. BACKFILL AROUND MH. WITH SELECT NATIVE MATERIALS AND COMPACT TO 98% S.P.D.
9. ALL JOINTS TO BE WATERTIGHT. METHODS TO BE CONSISTENT WITH SITE CONDITIONS.
10. FOR MANHOLES 5.0m IN DEPTH OR GREATER, A SAFETY PLATFORM SHALL BE INSTALLED.
11. MANHOLES TO MEET REQUIREMENTS OF MANHOLE DETAILS AND SPECIFICATIONS.
12. SAFETY STEPS TO BE SPACED AT 400 MAX. DISTANCE. FIRST STEP TO BE 600 MAX. BELOW FRAME, LAST STEP TO BE MAX. 300 ABOVE BENCHING.



SECTION B-B



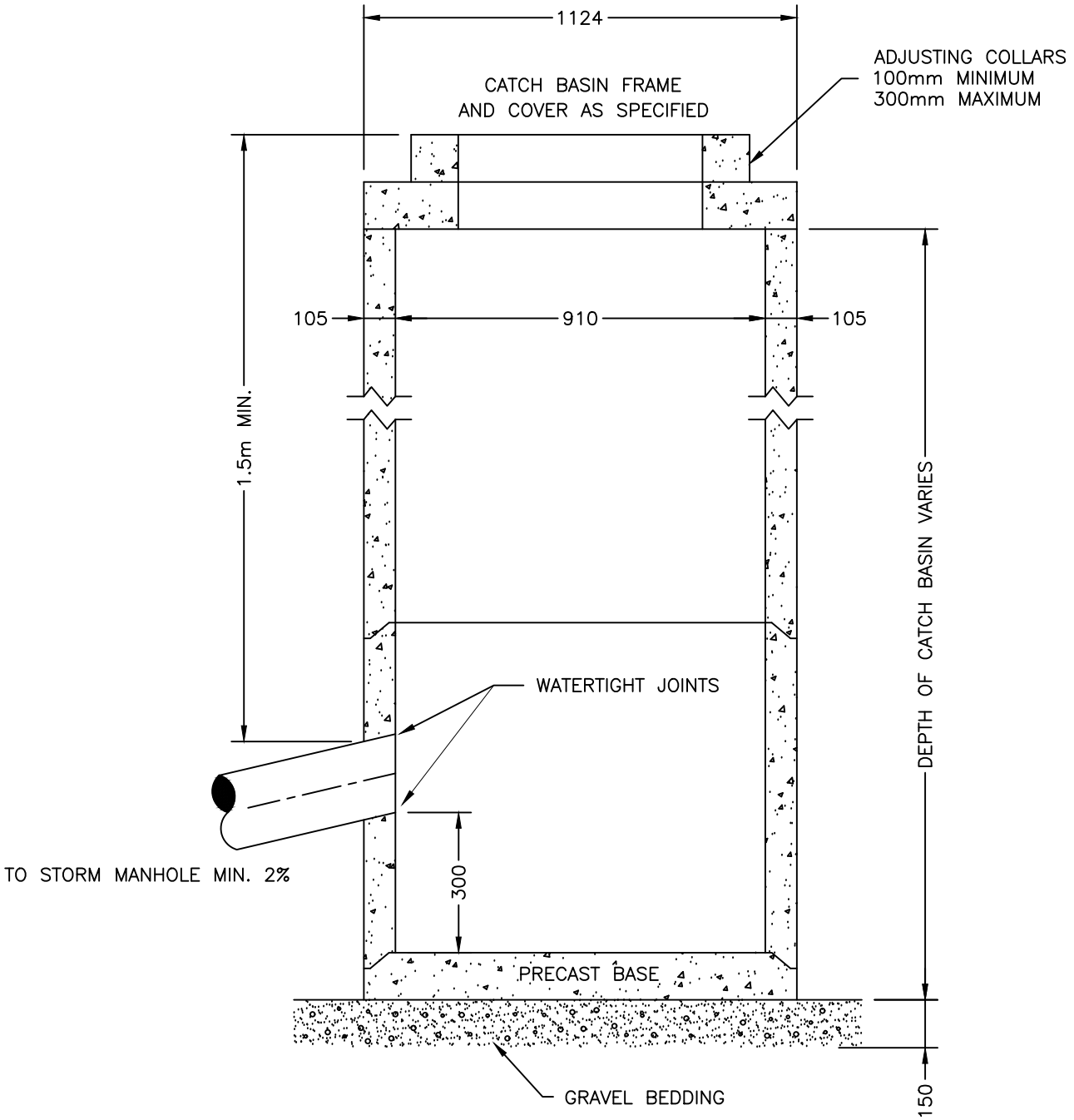
SECTION A-A

CYPRESS COUNTY

STANDARD DETAILS

T-RISER MANHOLE FOR PIPES 1200mm AND LARGER

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
APR 2018	BRW	TDA	NTS	7-103



NOTES:

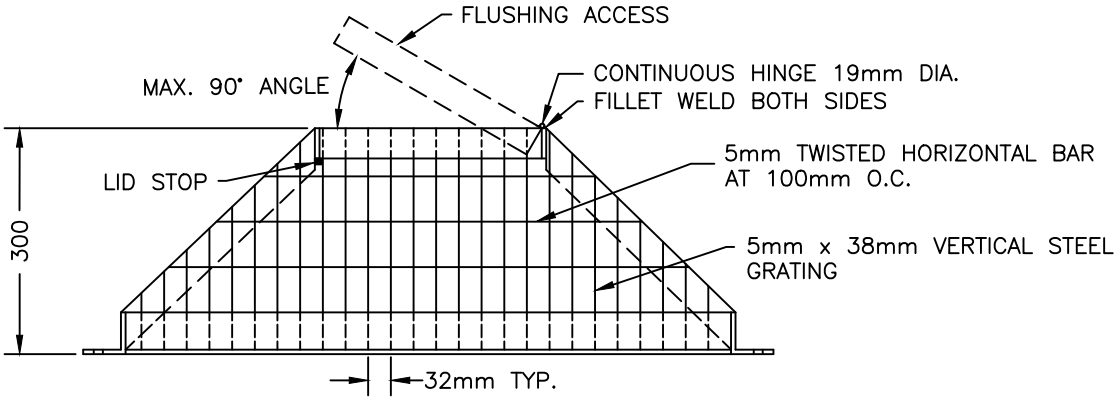
1. PRE–CAST CONCRETE COMPONENTS MUST CONFORM TO A.S.T.M. SPECIFICATIONS C478.
2. POURED–IN–PLACE CONCRETE SHALL HAVE A 28 DAYS COMPRESSIVE STRENGTH OF AT LEAST 25MPa.
3. ALL JOINTS TO BE SET WITH RUBBER GASKETS AND NON–SHRINK GROUT, INSIDE AND OUT, FOR THE FULL CIRCUMFERENCE.
4. ALL DIMENSIONS IN MILLIMETERS, UNLESS OTHERWISE STATED.
5. ALL JOINTS TO BE WATERTIGHT. METHODS TO BE CONSISTENT WITH SITE CONDITIONS.

CYPRESS COUNTY

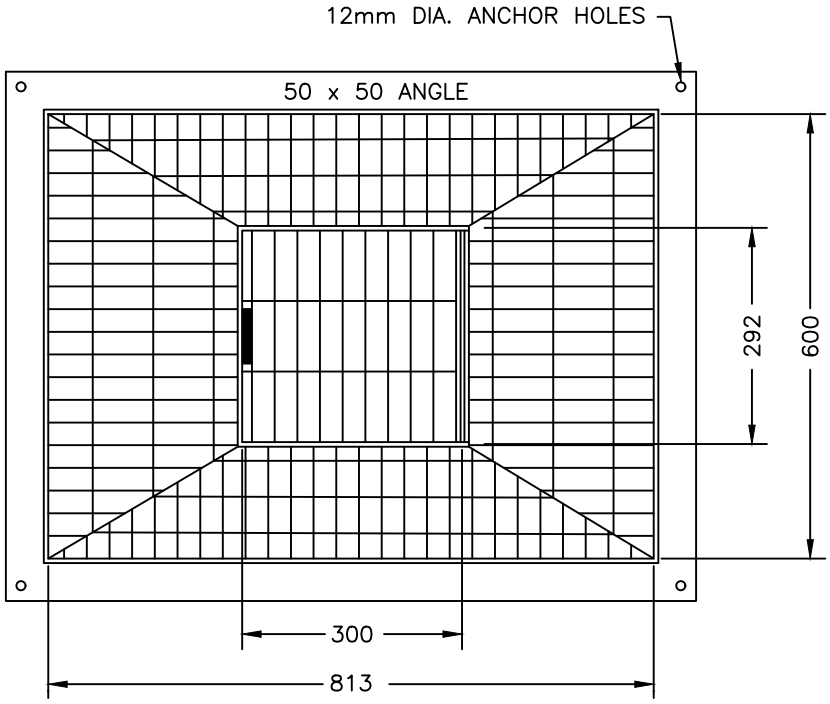
STANDARD DETAILS

STORM CATCH BASIN ASSEMBLY 300mm SUMP

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
APR 2018	BRW	TDA	NTS	7–201



PROFILE



PLAN VIEW

NOTES:

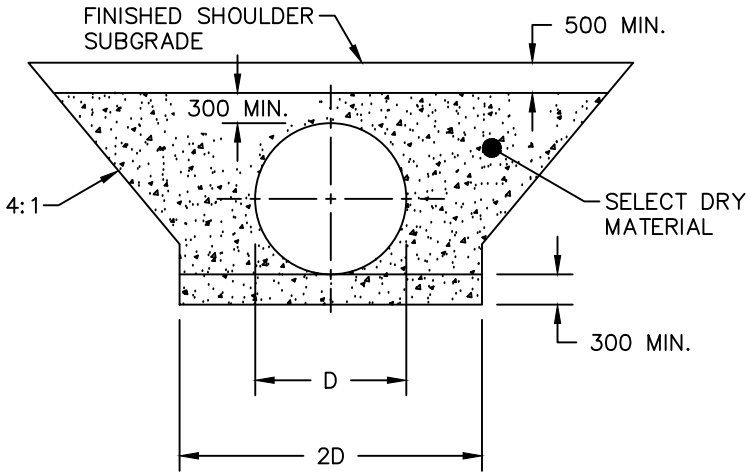
1. DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
2. GALVANIZED STEEL MATERIAL.

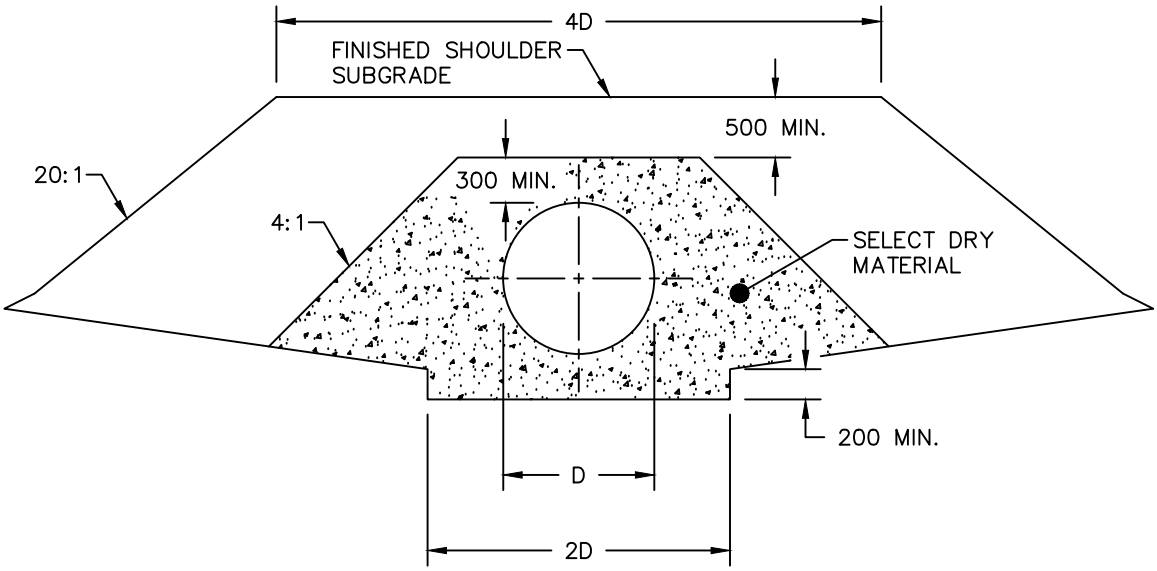
CYPRESS COUNTY

STANDARD DETAILS

TRASH GRATE INLET

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
APR 2018	BRW	TDA	NTS	7-300





NOTES:

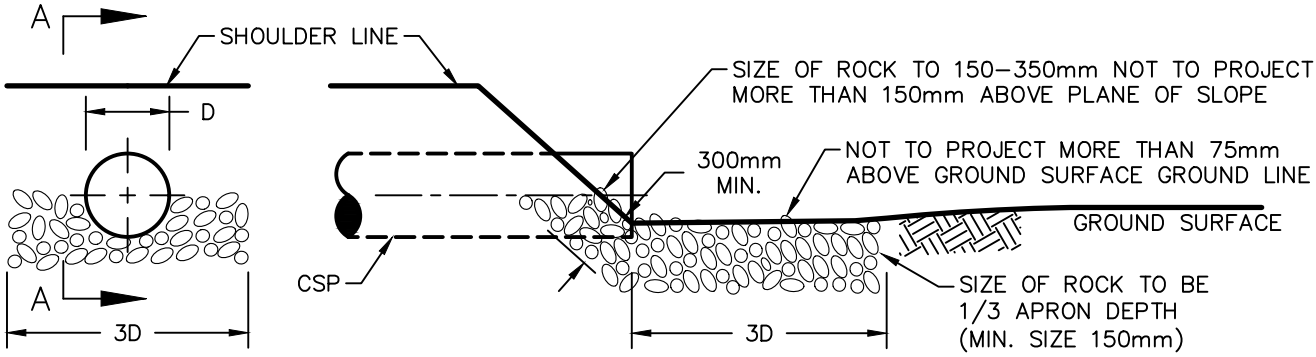
1. SELECT DRY MATERIAL SHALL BE PLACED IN 150mm COMPACTED LIFTS. IF SAND BACKFILL IS USED A 600mm CLAY PLUG SHALL BE PLACED ON INLET AND OUTLET ENDS OF THE PIPE.
2. IN SOFT WET AREAS DEPTH OF SUBCUT BELOW THE PIPE WILL BE DETERMINED BY THE DEVELOPERS ENGINEER AS APPROVED BY THE COUNTY.
3. WHEN PIPES ARE PLACED PRIOR TO EMBANKMENT CONSTRUCTION, A MINIMUM OF 1000mm OF MATERIAL SHALL BE PLACED OVER TOP OF PIPES FOR PROTECTION DURING CONSTRUCTION.
4. ALL CULVERT INVERTS WILL BE STAKED IN THE FIELD BY THE DEVELOPERS ENGINEER.
5. GEOTEXTILE FABRIC TO BE WOVEN POLYPROPYLENE MONOFILAMENT WHICH FORMS A DIMENSIONALLY STABLE CONSTRUCTION FABRIC AND WITH A MINIMUM OPEN PERCENTAGE OF 10%.
6. ALL UNITS ARE mm UNLESS OTHERWISE NOTED.

CYPRESS COUNTY

STANDARD DETAILS

HAMLET CULVERT INSTALLATION

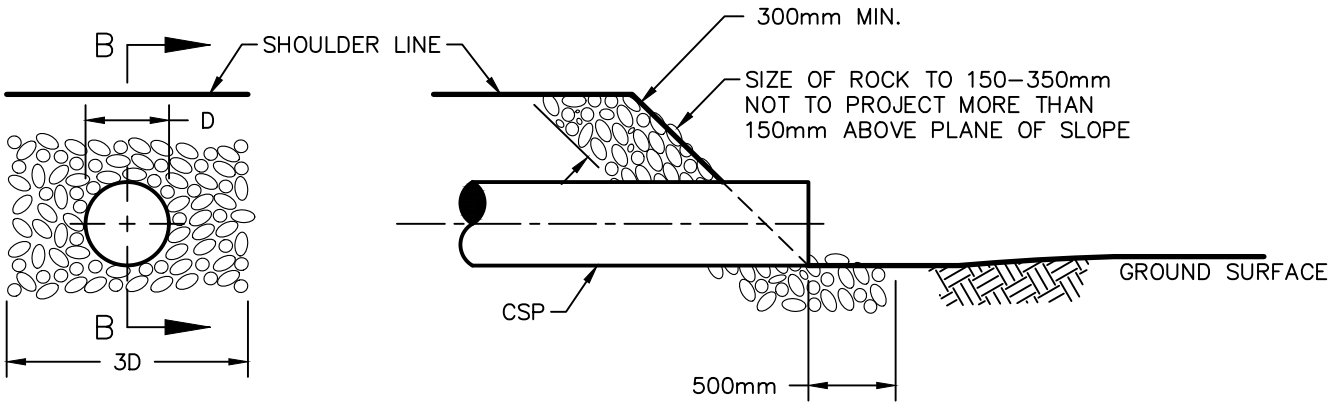
Date:	Drawn By:	Checked By:	Scale:	Drawing No.
APR 2018	BRW	TDA	NTS	7–301



FRONT ELEVATION

SECTION A–A

OUTLET



FRONT ELEVATION

SECTION B–B

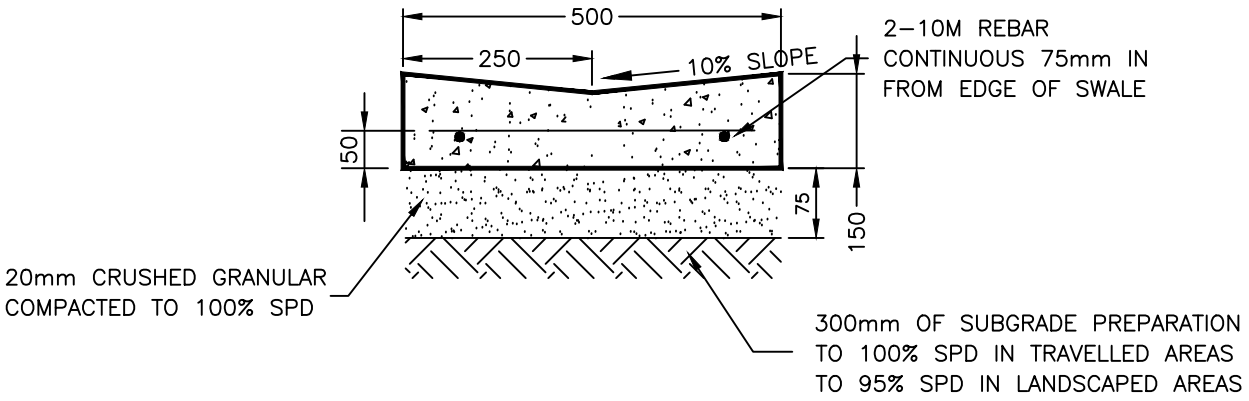
INLET

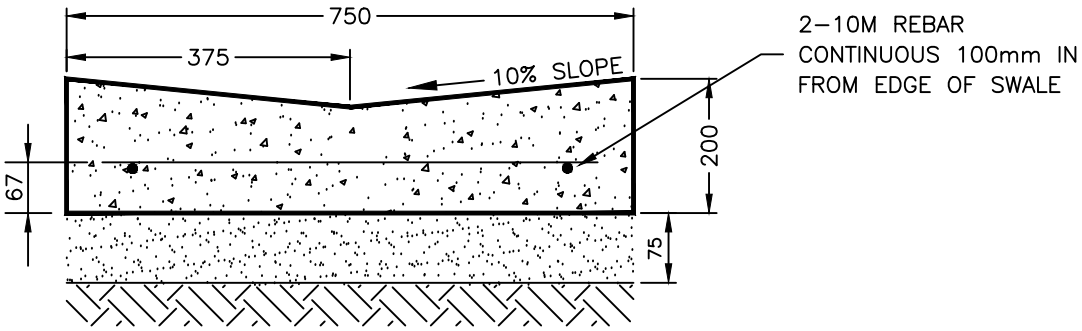
CYPRESS COUNTY

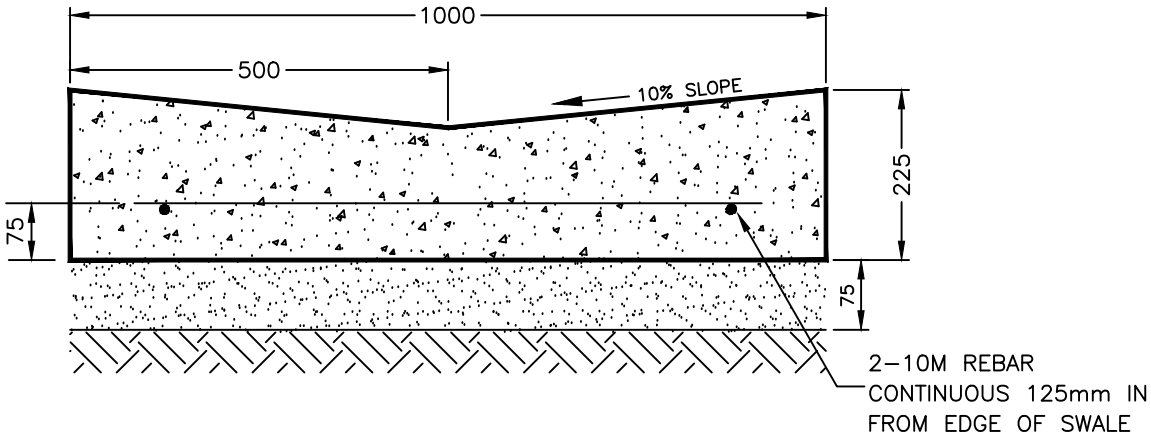
STANDARD DETAILS

TYPICAL RIP–RAP FOR RURAL CULVERT SIZE 400–1200mm DIAMETER

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
APR 2018	BRW	TDA	NTS	7–302







NOTES:

1. REINFORCING BARS ARE REQUIRED AT CONSTRUCTION JOINTS AND FUTURE TIE–IN LOCATIONS.
2. REINFORCING BARS SHALL EXTEND INTO CONCRETE A MINIMUM OF 300mm.
3. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
4. CONCRETE TO MEET REQUIREMENTS OF SPECIFICATIONS.

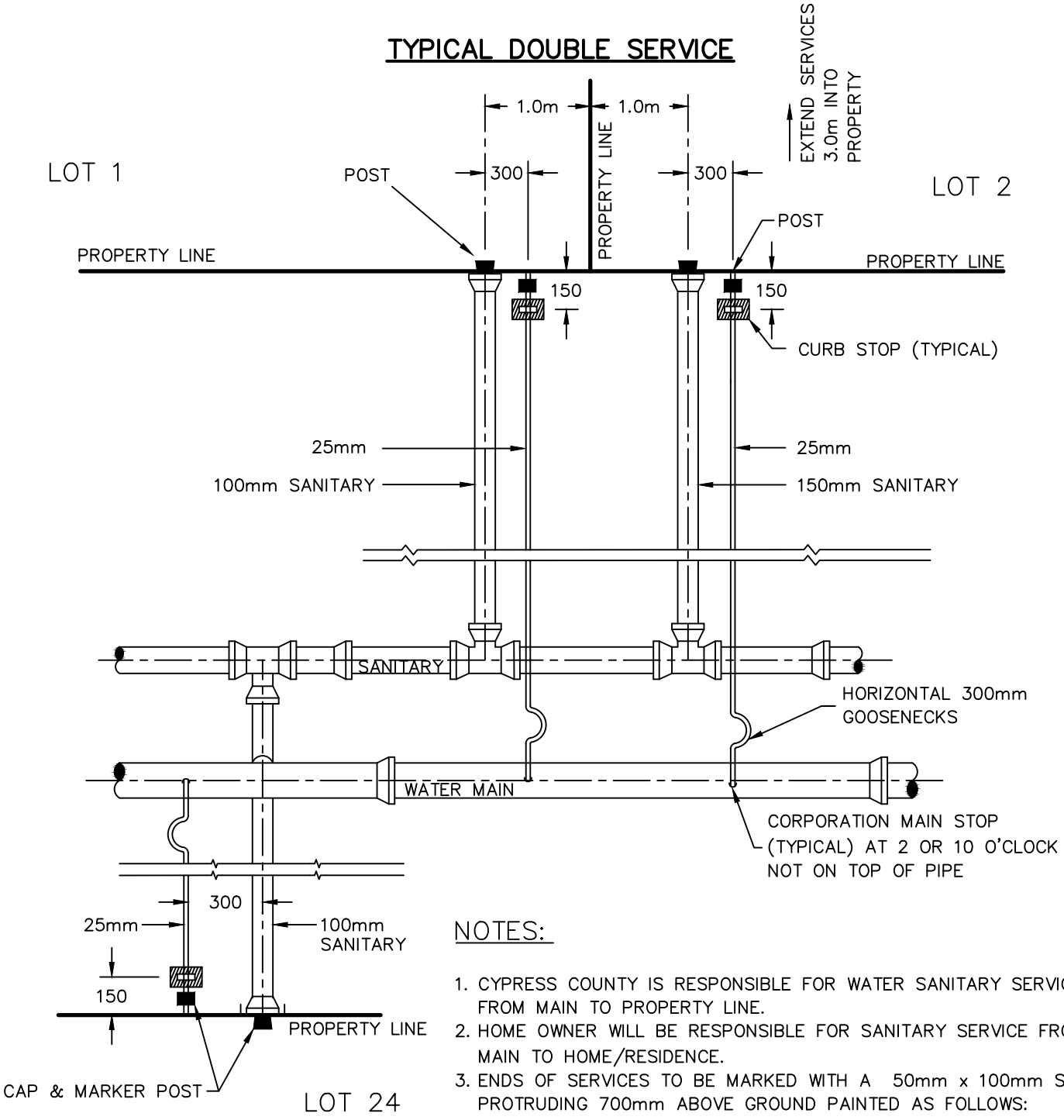
CYPRESS COUNTY

STANDARD DETAILS

CONCRETE DRAINAGE SWALE

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
APR 2018	BRW	TDA	NTS	7–400

TYPICAL DOUBLE SERVICE



TYPICAL SINGLE SERVICE

NOTES:

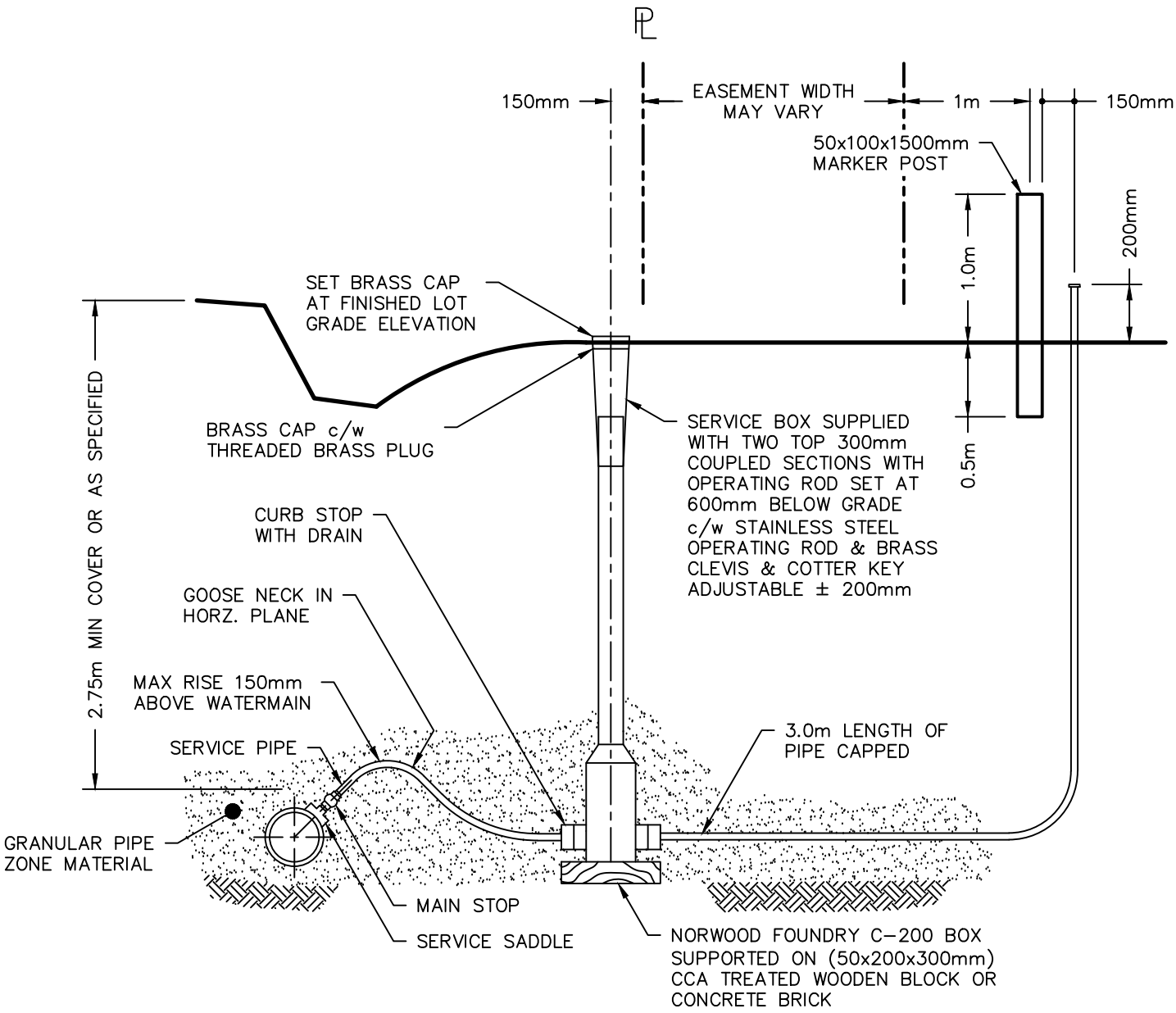
1. CYPRESS COUNTY IS RESPONSIBLE FOR WATER SANITARY SERVICE FROM MAIN TO PROPERTY LINE.
2. HOME OWNER WILL BE RESPONSIBLE FOR SANITARY SERVICE FROM MAIN TO HOME/RESIDENCE.
3. ENDS OF SERVICES TO BE MARKED WITH A 50mm x 100mm STAKE PROTRUDING 700mm ABOVE GROUND PAINTED AS FOLLOWS:
   A. CURBSTOP – BLUE
   B. END OF SERVICE IN SEPARATE TRENCH – GREEN
   C. END OF WATER SERVICE INSIDE PRIVATE PROPERTY – BLUE
4. WHERE STORM SEWER SERVICE IS TO BE INSTALLED, PLACE 0.3m FROM SANITARY ON FAR SIDE FROM WATER.
5. SEWER SERVICES MUST BE PROPERLY CAPPED.
6. ALL DIMENSIONS GIVEN IN MILLIMETRES UNLESS OTHERWISE STATED.
7. CYPRESS COUNTY MAY REQUIRE ALTERNATE PLACEMENT OF CURB STOP.
8. SINGLE SERVICE TO ENTER LOT WITHIN 2.25m OF CENTRE.
9. SERVICES TO BE EXTENDED 3m INTO PROPERTY LINE.

CYPRESS COUNTY

STANDARD DETAILS

SINGLE AND DOUBLE SERVICE LAYOUT

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
APR 2018	BRW	TDA	NTS	8–100



NOTES:

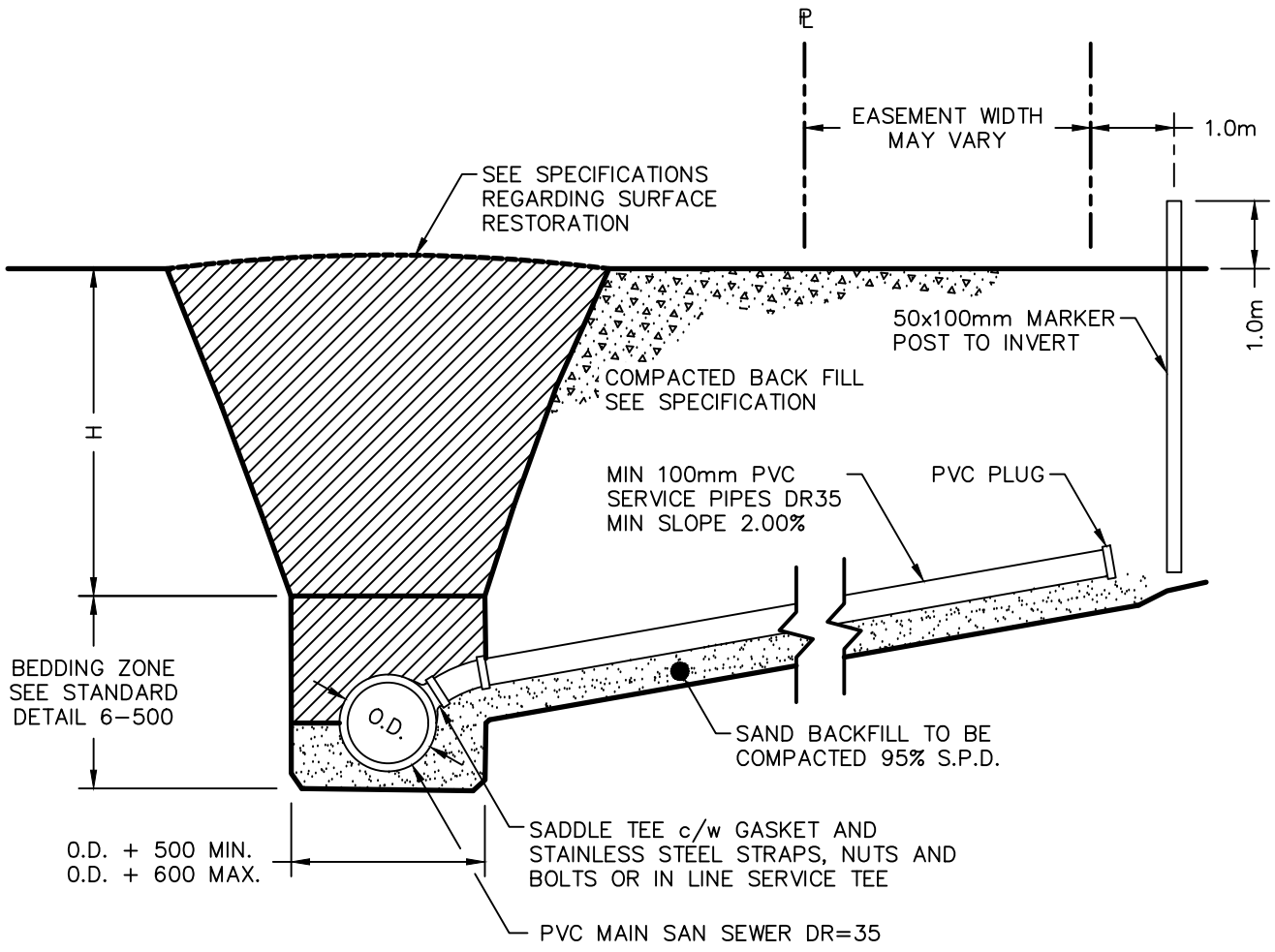
1. MARKER POST ONLY REQUIRED ON NEW CONSTRUCTION.
2. NEW SERVICES TO BE BROUGHT TO GROUND SERVICES ON NEW CONSTRUCTION.
3. EXTEND SERVICE 3m PAST PROPERTY LINE.

CYPRESS COUNTY

STANDARD DETAILS

TYPICAL WATER SERVICE CONNECTION

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
APR 2018	BRW	TDA	NTS	8-101



NOTES:

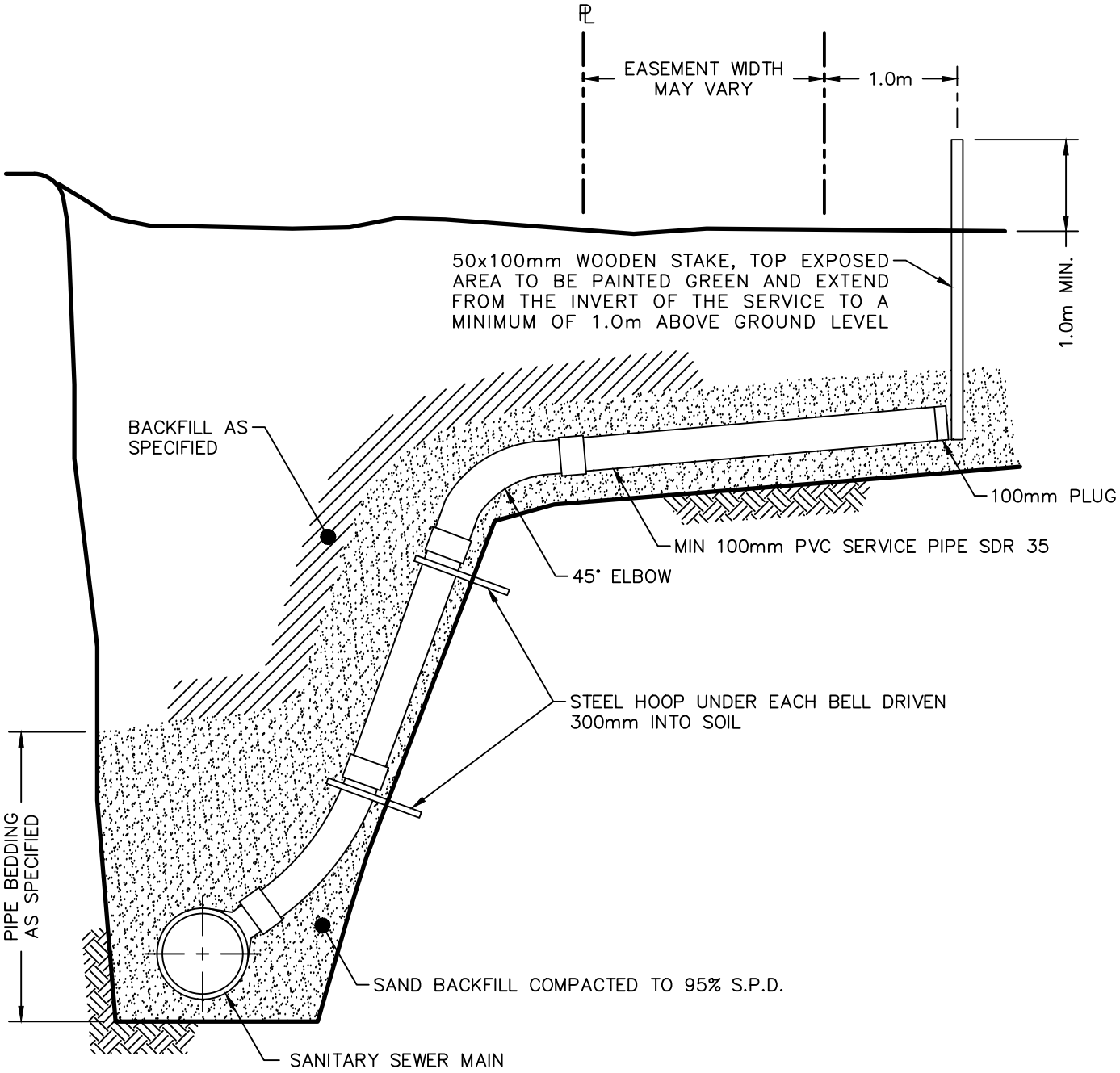
1. WHEN CUT BACK SLOPES ARE TO BE USED IN LIEU OF CAGES AND SHORING, THESE SLOPES ARE TO MEET REQUIREMENTS OF LOCAL CODES.
2. SEE SPECIFICATIONS FOR MINIMUM COVER ABOVE PIPE.
3. MIN. PIPE ZONE WIDTH IS SPECIFIED TO ALLOW PROPER PIPE ZONE COMPACTION. THIS ZONE MAY VARY DEPENDING ON SOIL CONDITIONS.
4. O.D. = OUTSIDE PIPE DIAMETER.
5. EXTEND SERVICES 3.0m PAST PROPERTY.

CYPRESS COUNTY

STANDARD DETAILS

TYPICAL SANITARY SERVICE CONNECTION

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
APR 2018	BRW	TDA	NTS	8-102



NOTES:

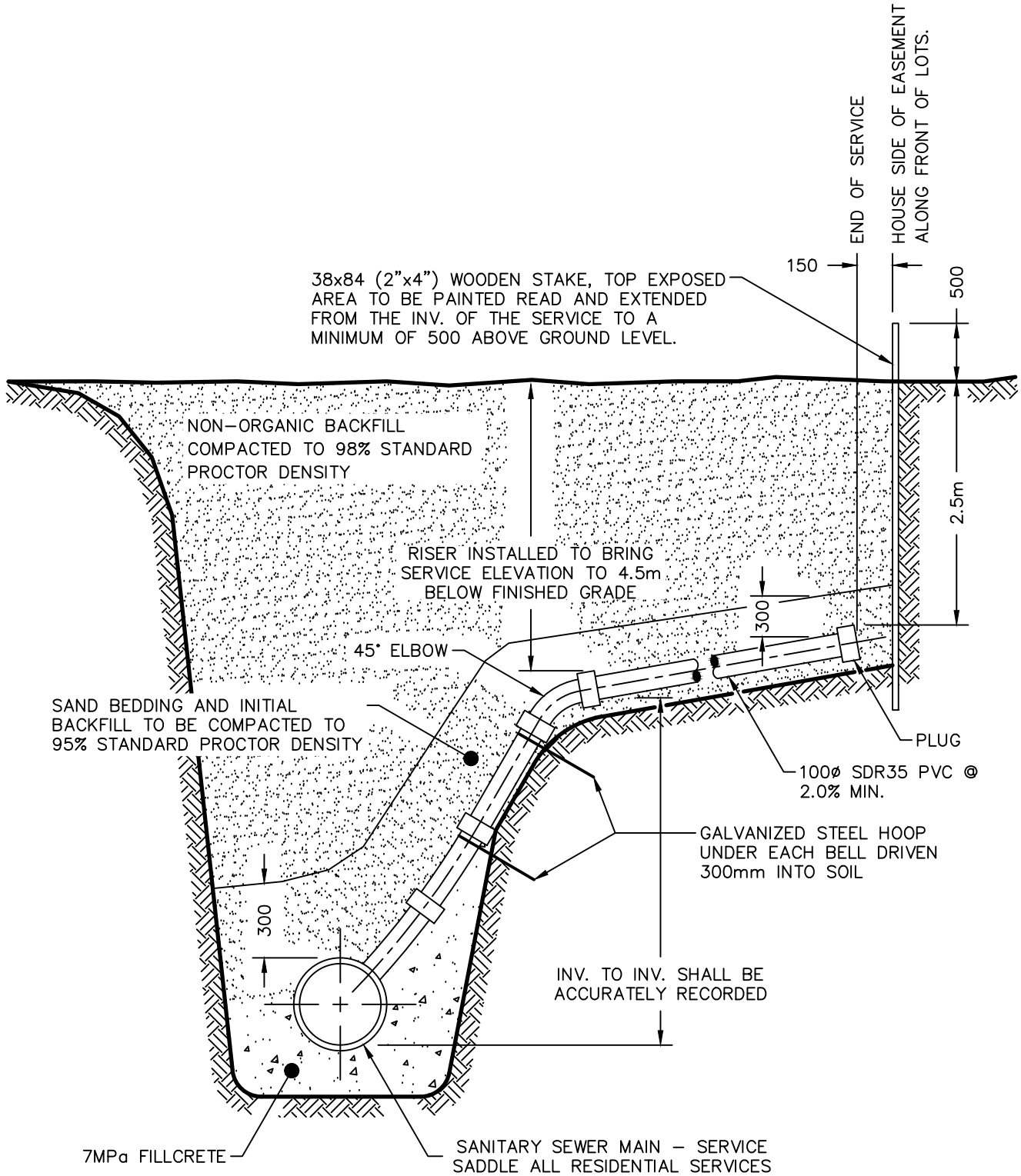
1. WHEN CUT BACK SLOPES ARE TO BE USED IN LIEU OF CAGES AND SHORING. THESE SLOPES ARE TO MEET REQUIREMENTS OF LOCAL CODES.
2. MINIMUM COVER ABOVE PIPE 2.5m.
3. MINIMUM PIPE WIDTH IS SPECIFIED TO ALLOW PROPER PIPE ZONE COMPACTION.

CYPRESS COUNTY

STANDARD DETAILS

TYPICAL STANDARD RISER DETAIL

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
APR 2018	BRW	TDA	NTS	8–103



NOTES:

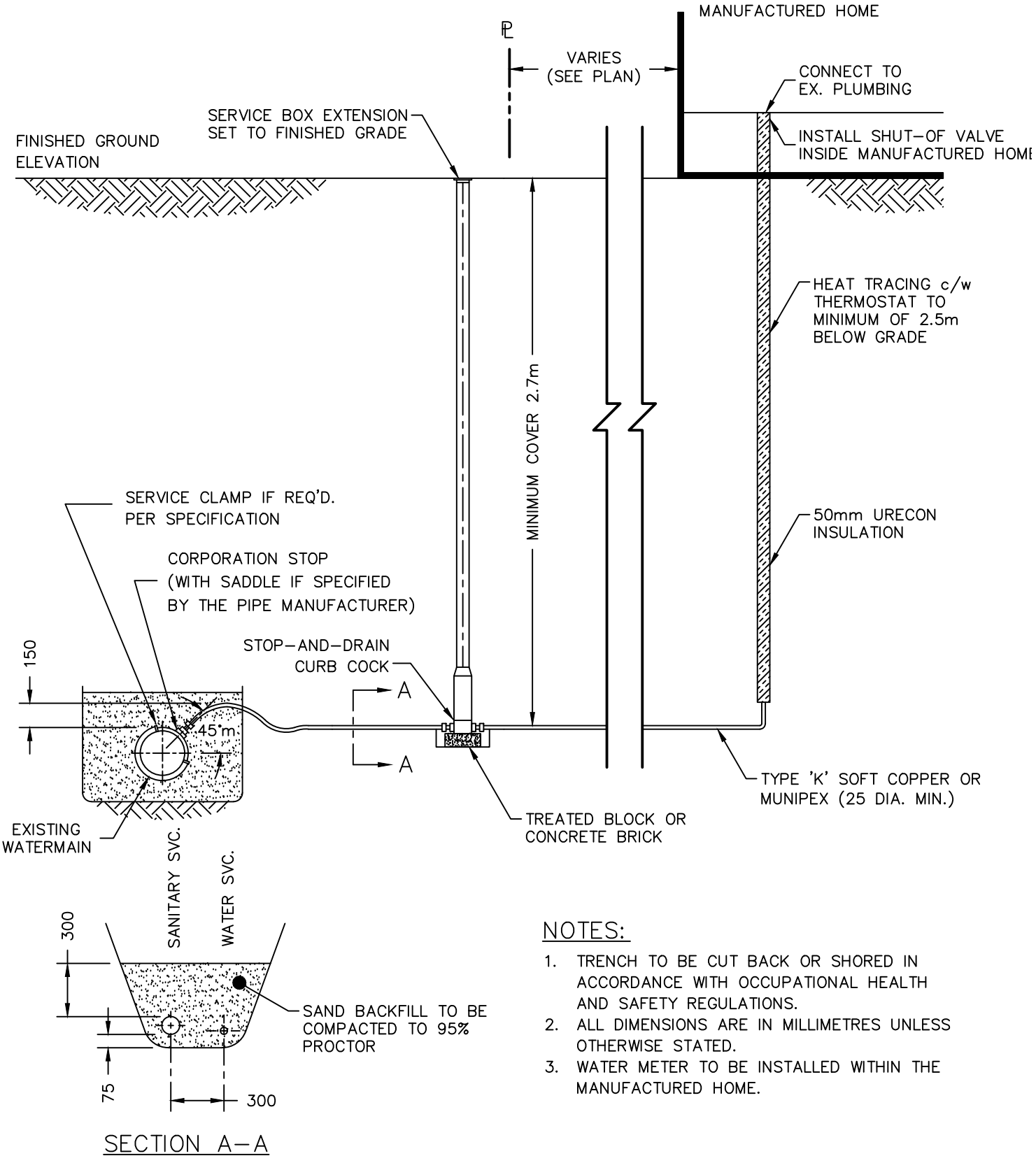
1. ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE STATED.

CYPRESS COUNTY

STANDARD DETAILS

RESIDENTIAL SANITARY SEWER SERVICE RISER CONNECTION

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
APR 2018	BRW	TDA	NTS	8-104



SECTION A–A

NOTES:

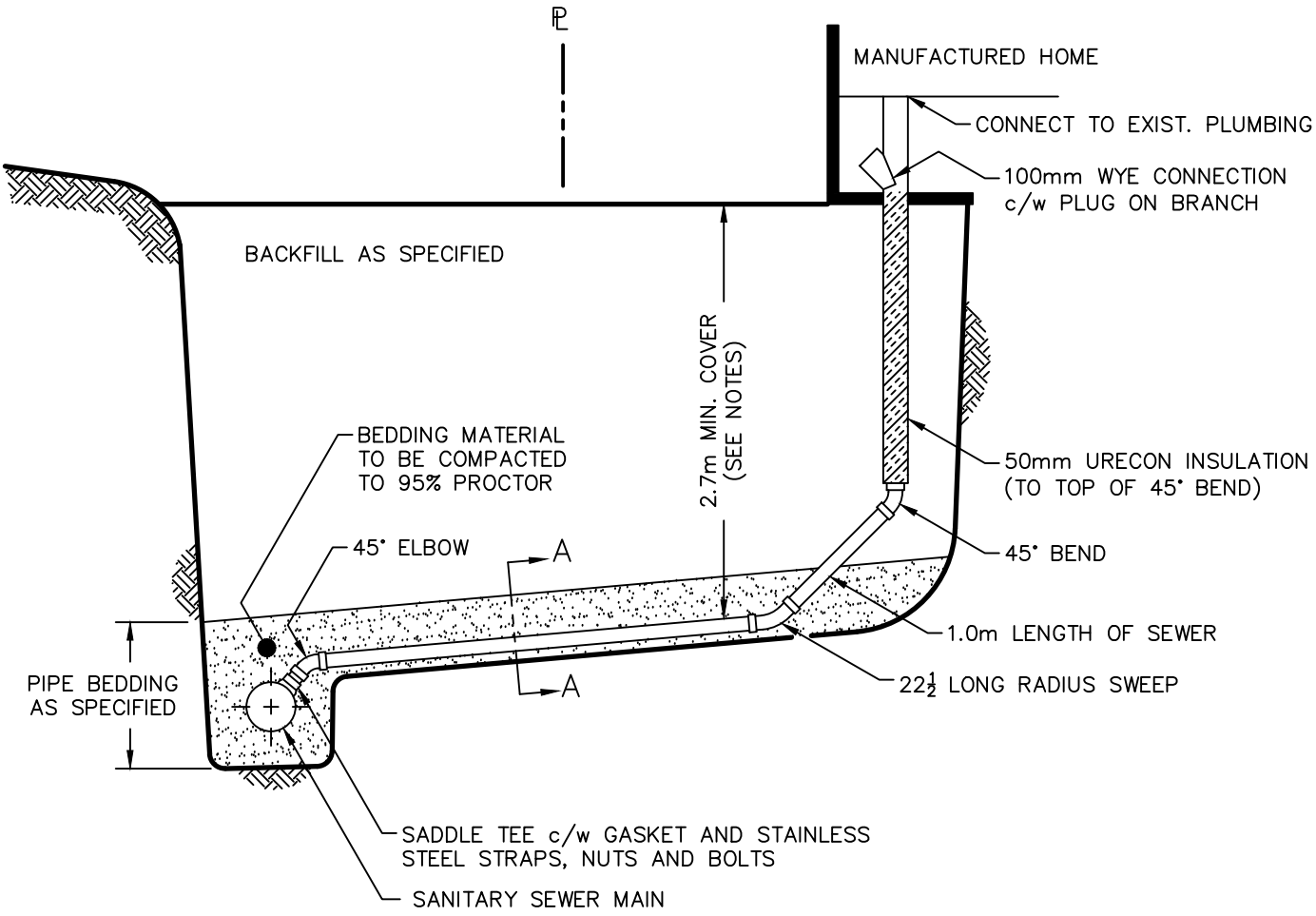
1. TRENCH TO BE CUT BACK OR SHORED IN ACCORDANCE WITH OCCUPATIONAL HEALTH AND SAFETY REGULATIONS.
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
3. WATER METER TO BE INSTALLED WITHIN THE MANUFACTURED HOME.

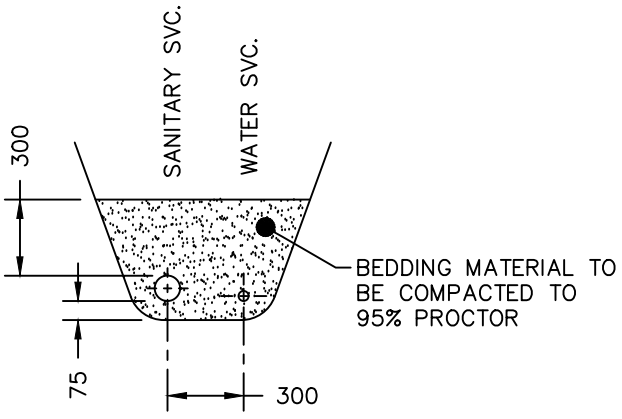
CYPRESS COUNTY

STANDARD DETAILS

WATER SERVICE CONNECTION MANUFACTURED HOME

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
APR 2018	BRW	TDA	NTS	8–200





SECTION A–A

NOTES:

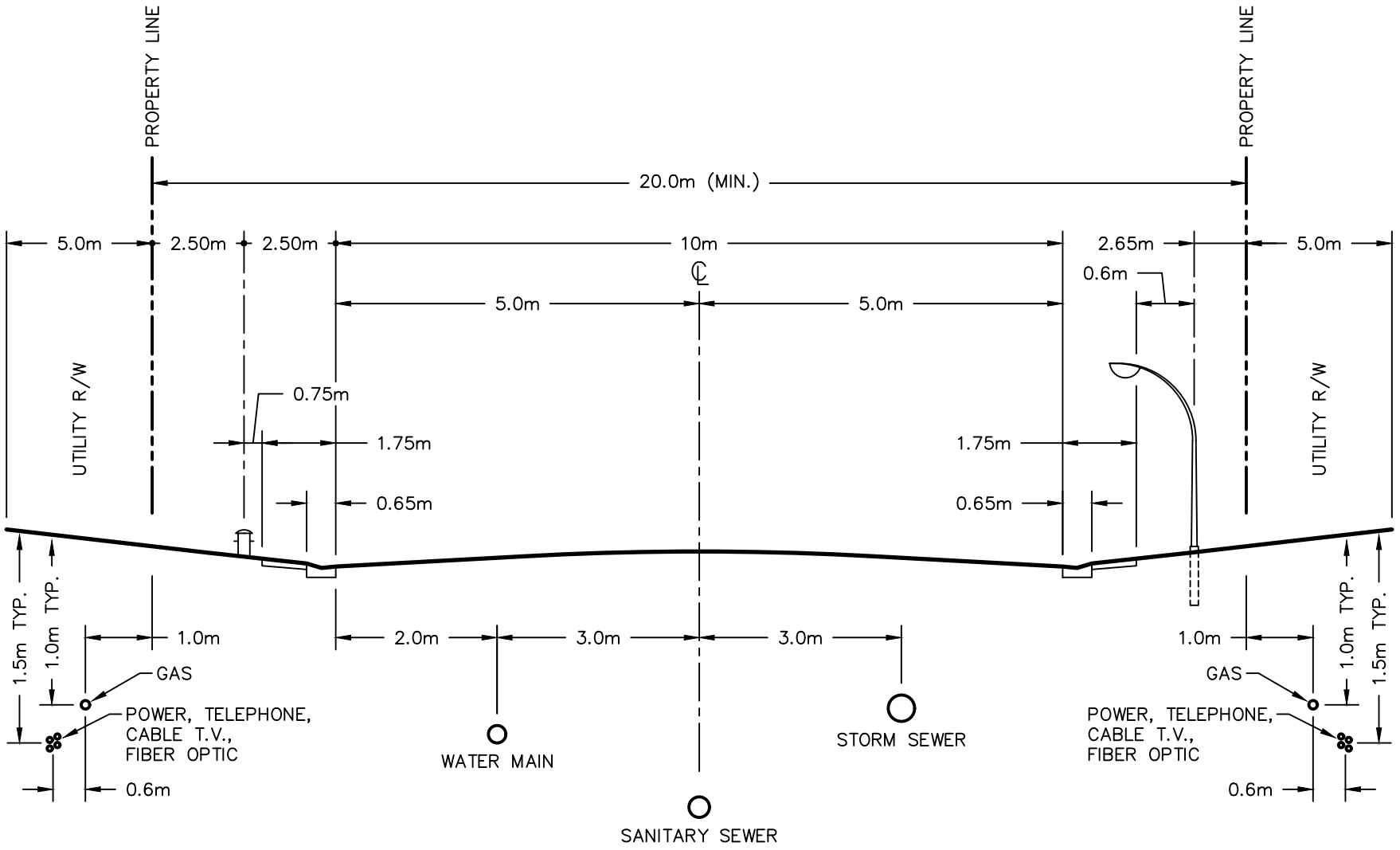
1. MIN. SLOPE FOR 100mm DIA. PIPE IS 2%.
2. SERVICE CONNECTIONS SHALL BE 100mm UNLESS SPECIFICALLY SHOWN ON THE DRAWINGS.
3. 50mm URECON INSULATION WILL BE REQUIRED.
4. TRENCH TO BE CUT BACK OR SHORED IN ACCORDANCE WITH OCCUPATIONAL HEALTH AND SAFETY REGULATIONS.
5. ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE STATED.

CYPRESS COUNTY

STANDARD DETAILS

SANITARY SERVICE CONNECTION MANUFACTURED HOME

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
APR 2018	BRW	TDA	NTS	8–201



NOTE:

1. IF NO GAS EASEMENT, CURB STOP TO BE INSTALLED 0.3m INSIDE PROPERTY LINE.

SECTION

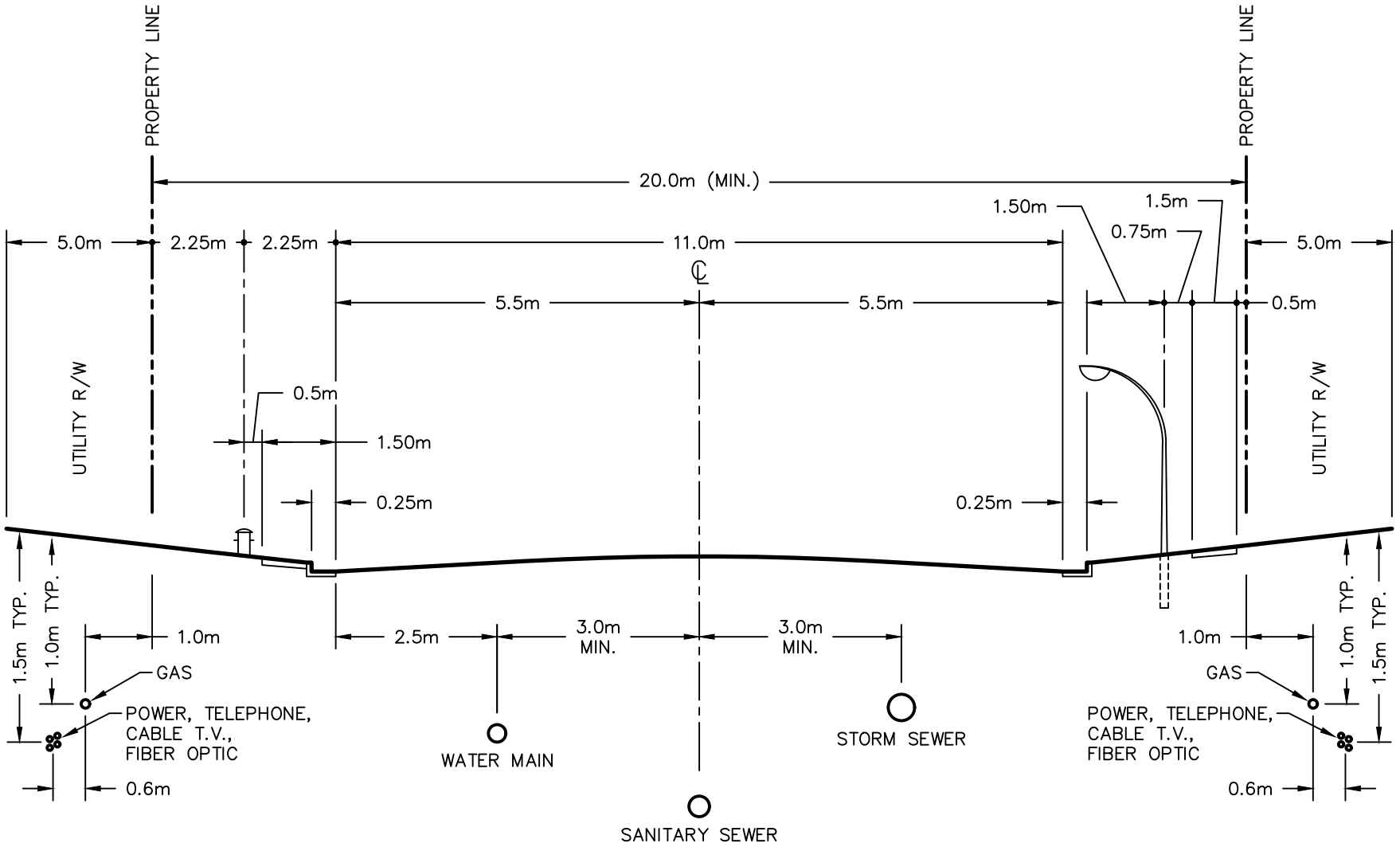
N.T.S.

CYPRESS COUNTY

STANDARD DETAILS

LOCAL RESIDENTIAL (URBAN)

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
MAY 2018	BRW	TDA	NTS	9–100



NOTE:

1. SIDEWALK MAY BE EITHER SEPARATE OR MONOLITHIC AS REQUIRED BY COUNTY.
2. IF NO GAS EASEMENT, CURB STOP TO BE INSTALLED 0.3m INSIDE PROPERTY LINE.

SECTION

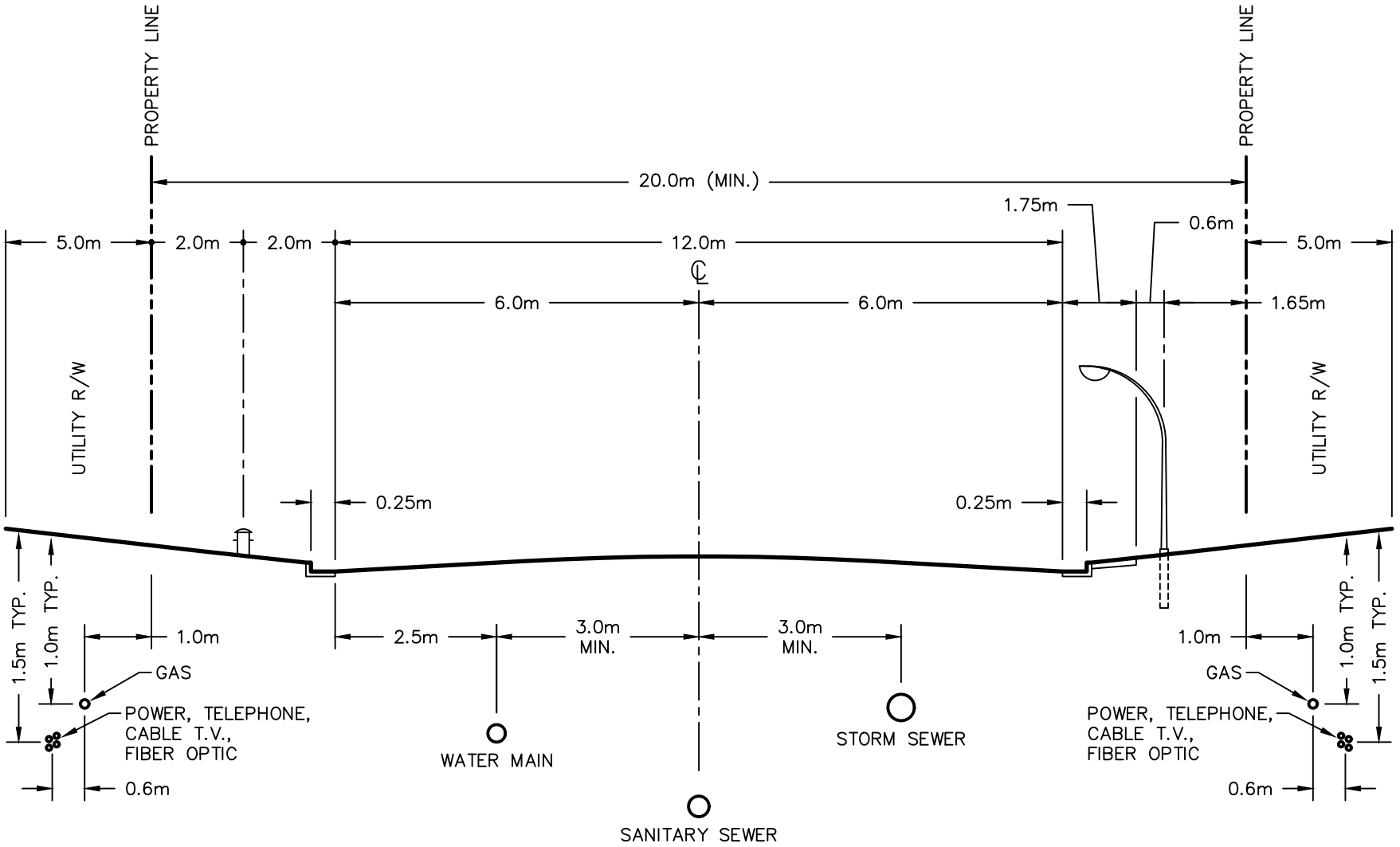
N.T.S.

CYPRESS COUNTY

STANDARD DETAILS

MINOR RESIDENTIAL COLLECTOR (URBAN)

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
MAY 2018	BRW	TDA	NTS	9–104



NOTE:

1. SIDEWALK MAY BE EITHER SEPARATE OR MONOLITHIC AS REQUIRED BY COUNTY.
2. IF NO GAS EASEMENT, CURB STOP TO BE INSTALLED 0.15m INSIDE ROAD RIGHT-OF-WAY.

SECTION

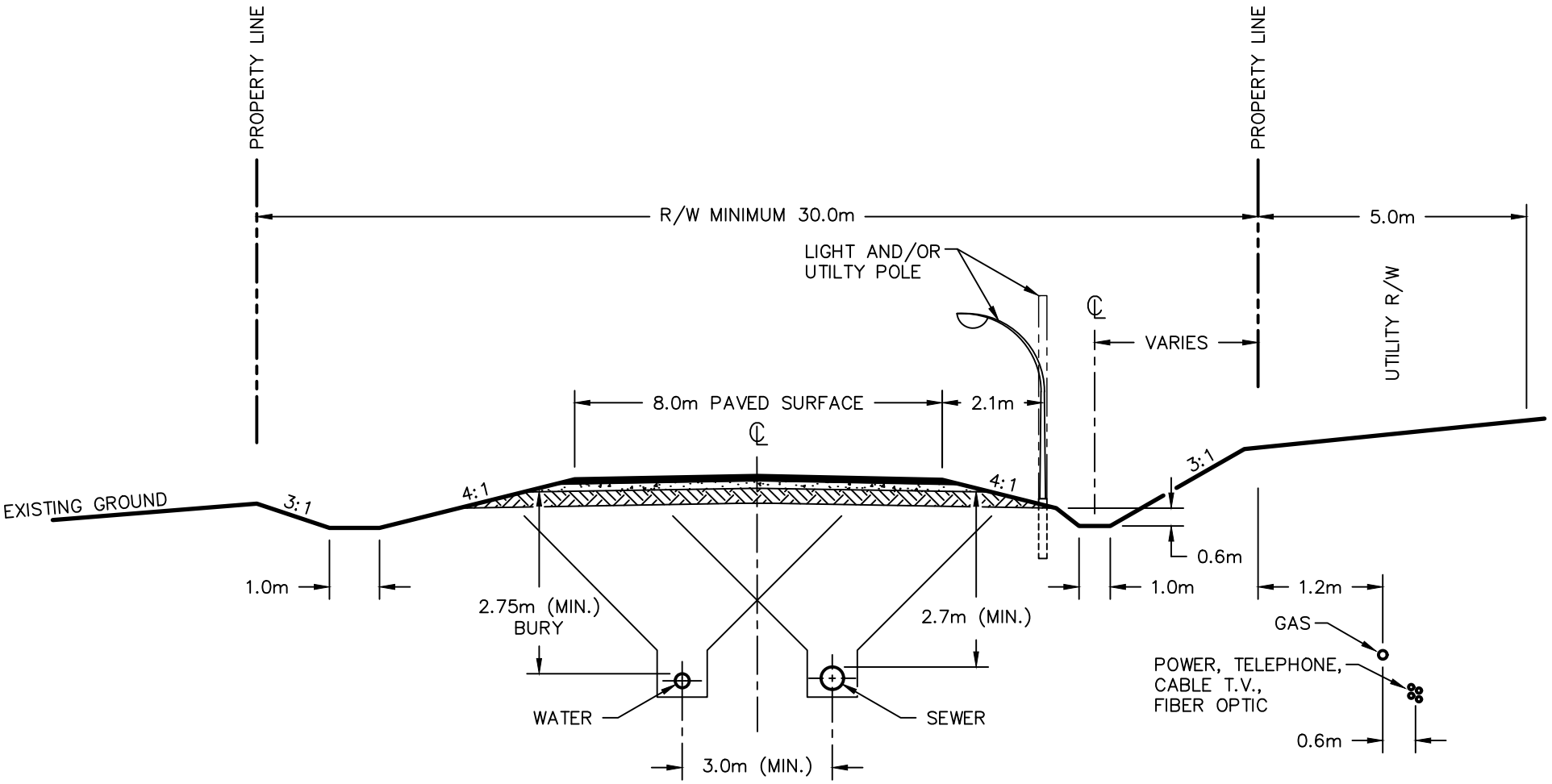
N.T.S.

CYPRESS COUNTY

STANDARD DETAILS

LOCAL INDUSTRIAL (URBAN)

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
MAY 2018	BRW	TDA	NTS	9-105

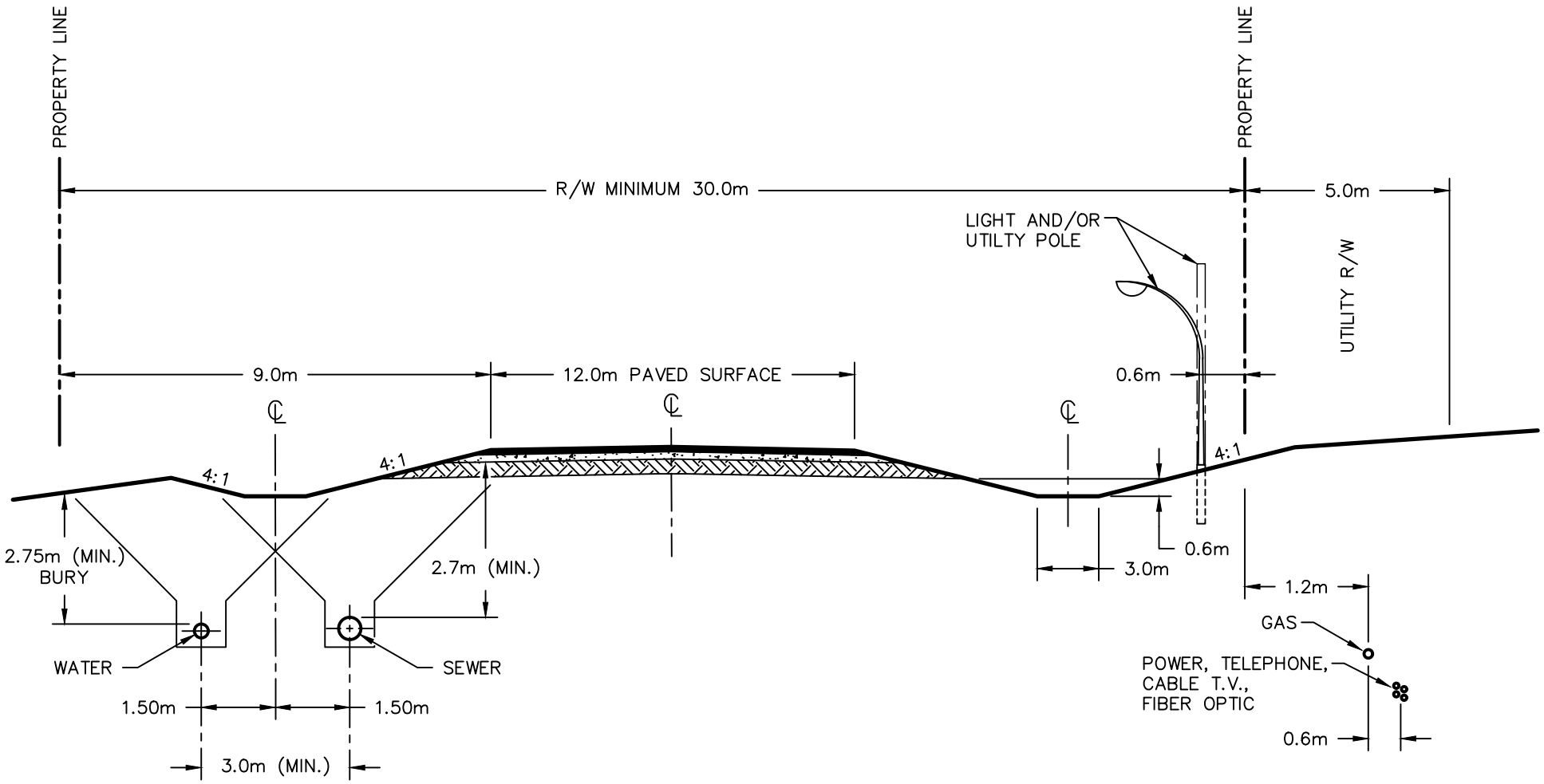


CYPRESS COUNTY

STANDARD
DETAILS

RURAL RESIDENTIAL – 30.0m R/W UTILITIES IN ROAD

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
MAY 2018	BRW	TDA	NTS	9–106

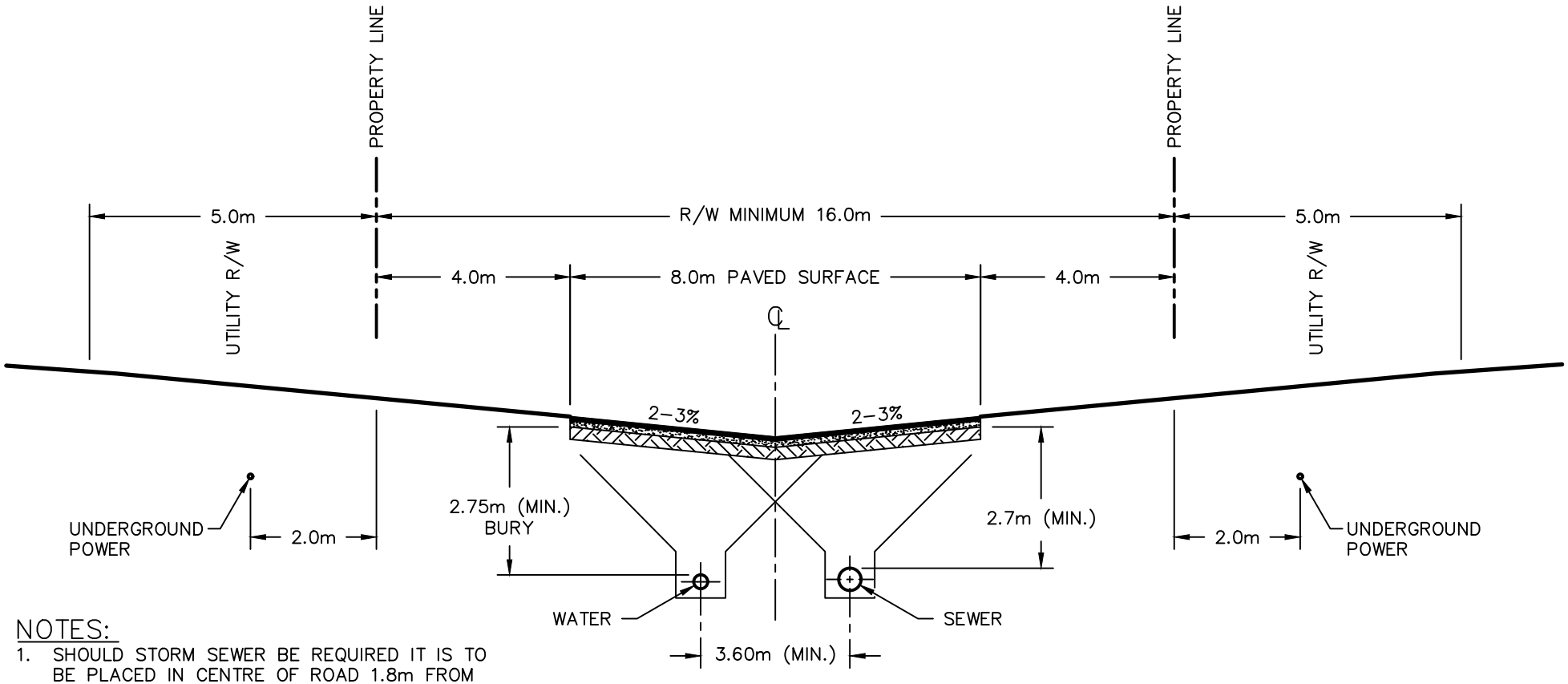


CYPRESS COUNTY

STANDARD DETAILS

RURAL INDUSTRIAL – 30.0m R/W UTILITIES BELOW DITCH

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
MAY 2018	BRW	TDA	NTS	9–107



NOTES:

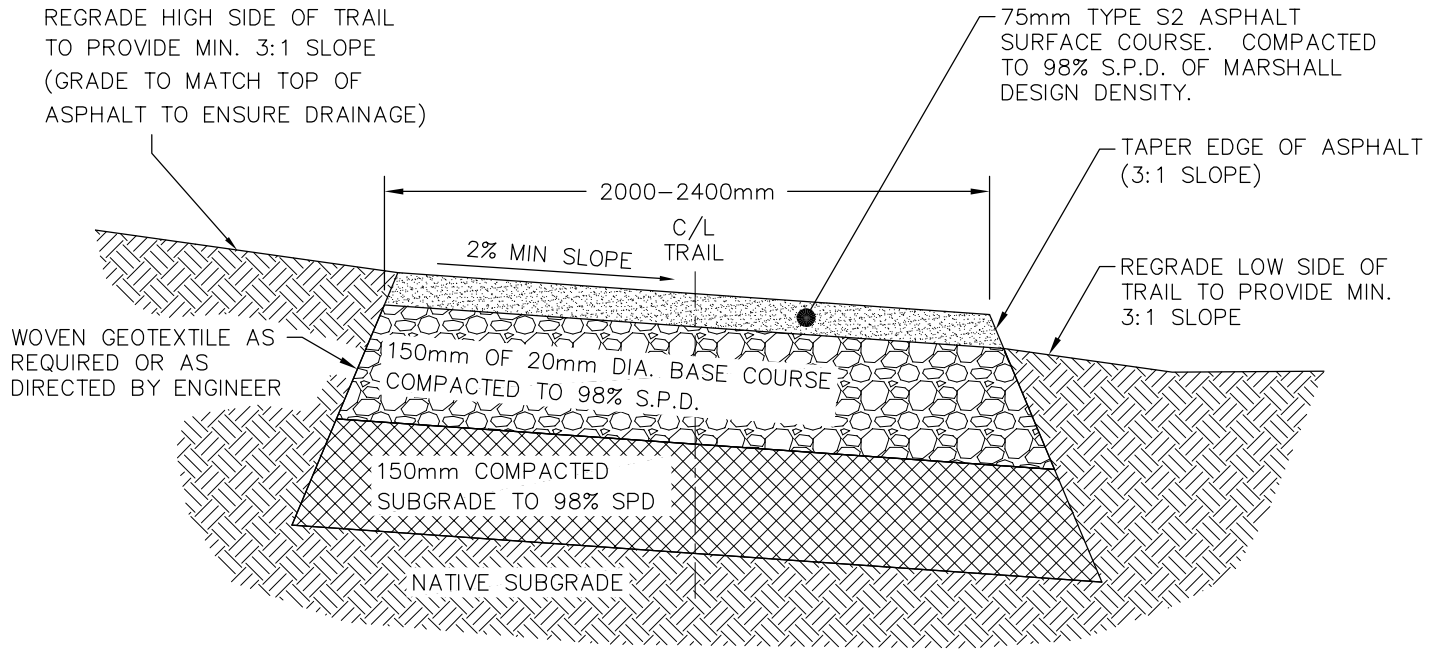
1. SHOULD STORM SEWER BE REQUIRED IT IS TO BE PLACED IN CENTRE OF ROAD 1.8m FROM WATER AND SANITARY.

CYPRESS COUNTY

STANDARD DETAILS

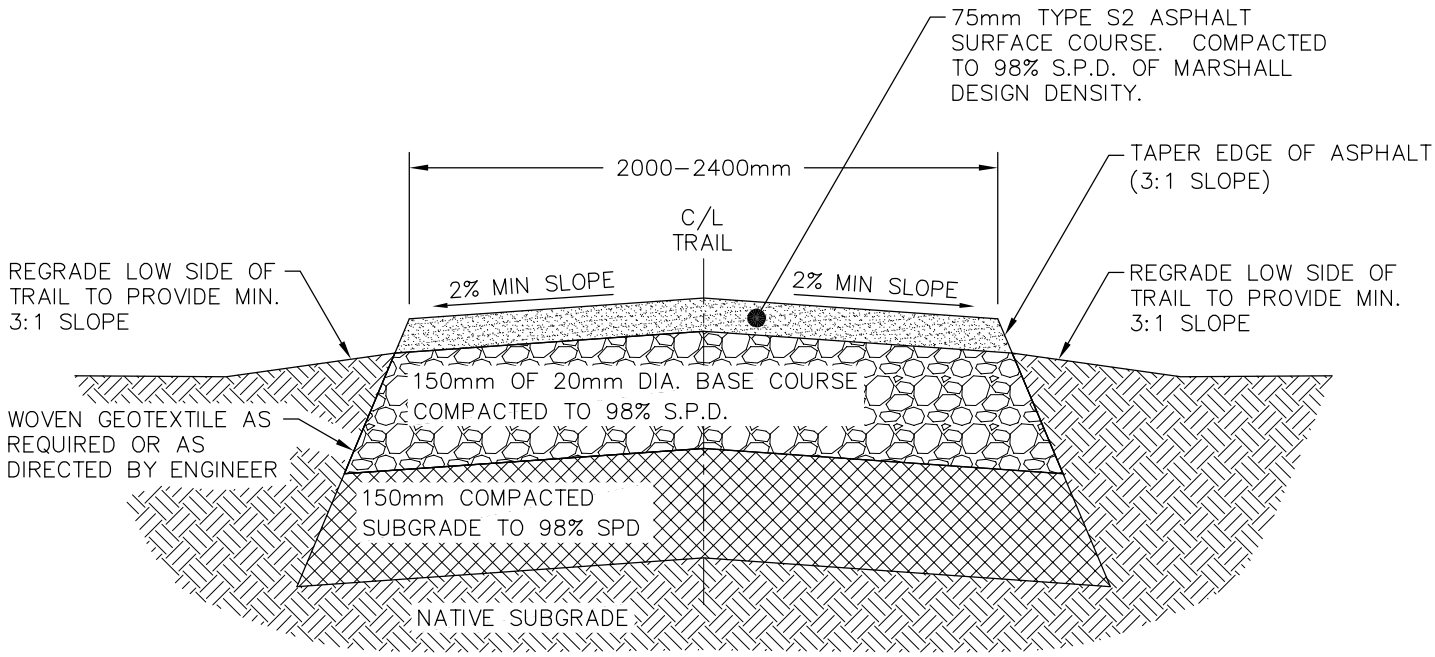
RV RESORT CROSS SECTION

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
MAY 2018	BRW	TDA	NTS	9-108



TYPICAL TRAIL SECTION – CROSSFALL

NTS



TYPICAL TRAIL SECTION – CROWN

NTS

NOTES:

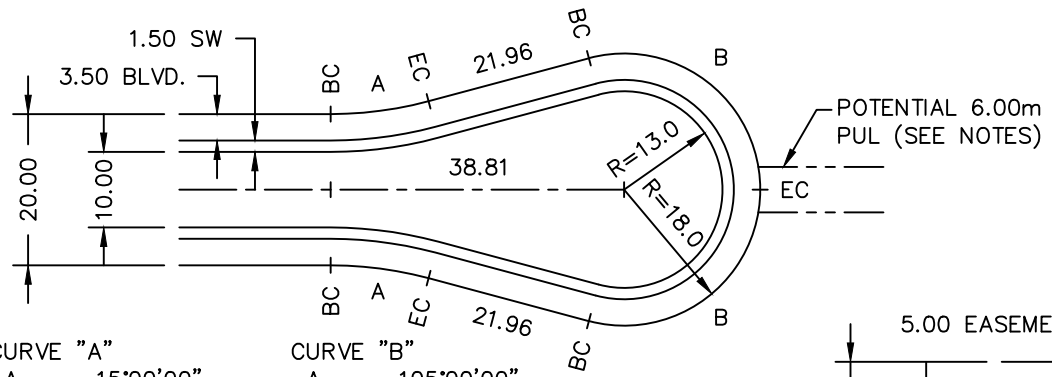
1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. MAKE ALL TRANSITIONS WITH EXISTING SMOOTH AND CONTINUOUS, WHERE NECESSARY TRIM BACK ROOTS AND CLEAR DEBRIS.
3. WHERE CYPRESS COUNTY CHOOSES TO DELETE ASPHALT, INCREASE GRAVEL THICKNESS ACCORDINGLY. MAINTAIN GRADE AS SHOWN.

CYPRESS COUNTY

STANDARD DETAILS

TYPICAL TRAIL CROSS–SECTIONS

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
MAY 2018	BRW	TDA	NTS	9–109

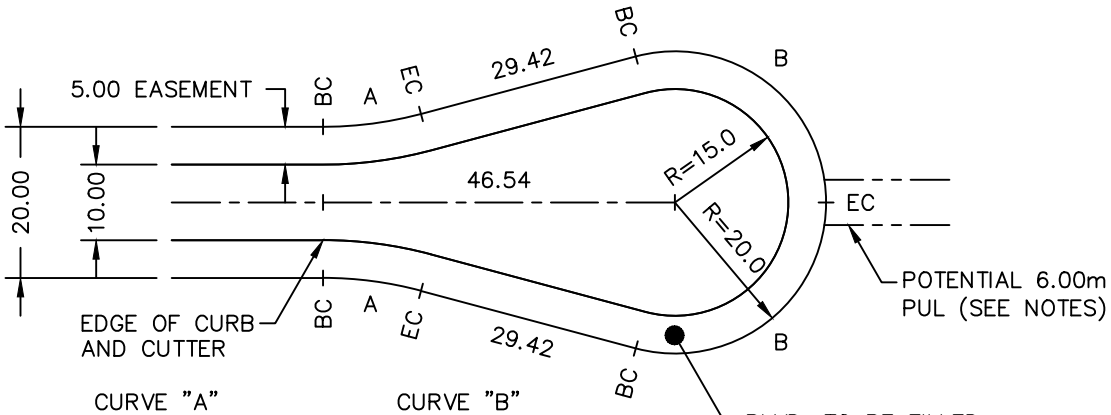


CURVE "A"
Δ = 15°00'00"
R = 50.00
ARC = 13.09
TAN = 6.58
(at property line)

CURVE "B"
Δ = 105°00'00"
R = 18.0
ARC = 32.99
TAN = 23.46
(at property line)

NOTES:

1. A PUL WITH A WIDTH NO LESS THAN 5.0m MUST BE ADDED TO ALLOW FOR SNOW MOVEMENT AND STORAGE
2. THE CURB AND GUTTER MUST BE DEPRESSED AT THE PUL TO ALLOW FOR SNOW MOVEMENT

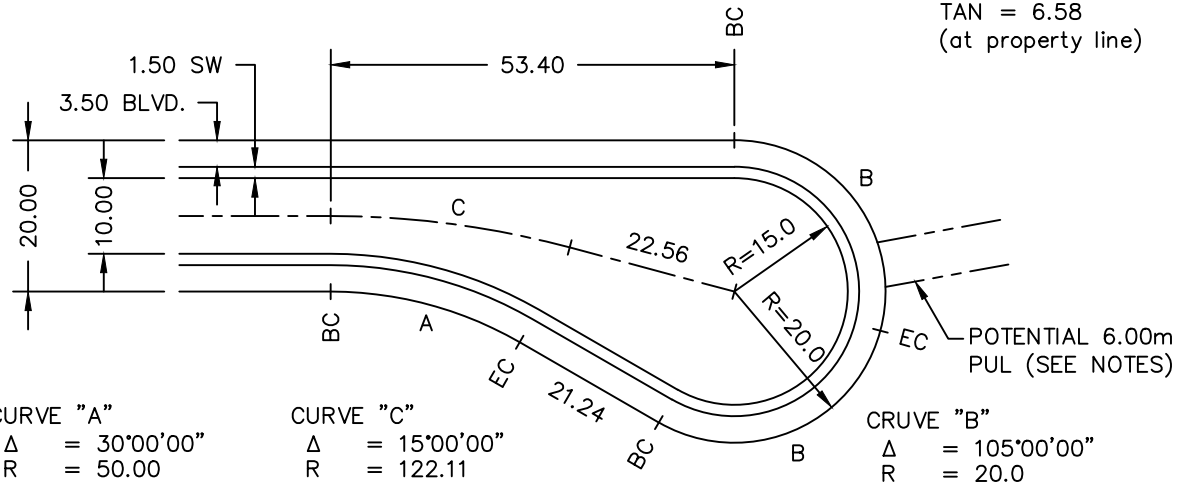


CURVE "A"
Δ = 15°00'00"
R = 50.00
ARC = 13.09
TAN = 6.58
(at property line)

CURVE "B"
Δ = 105°00'00"
R = 20.0
ARC = 36.65
TAN = 26.07
(at property line)

NOTES:

1. A PUL WITH A WIDTH NO LESS THAN 6.0m MUST BE PROVIDED TO ALLOW FOR STORM DRAINAGE IF THE CUL-DE-SAC CAN NOT BE GRADED TO DRAIN TOWARDS THE INTERSECTION.
2. OVERLAND DRAINAGE MAY BE CONSIDERED AT THE DISCRETION OF CYPRESS COUNTY, SEE DETAIL.



CURVE "A"
Δ = 30°00'00"
R = 50.00
ARC = 26.18
TAN = 13.40
(at property line)

CURVE "C"
Δ = 15°00'00"
R = 122.11
ARC = 31.97
TAN = 16.08

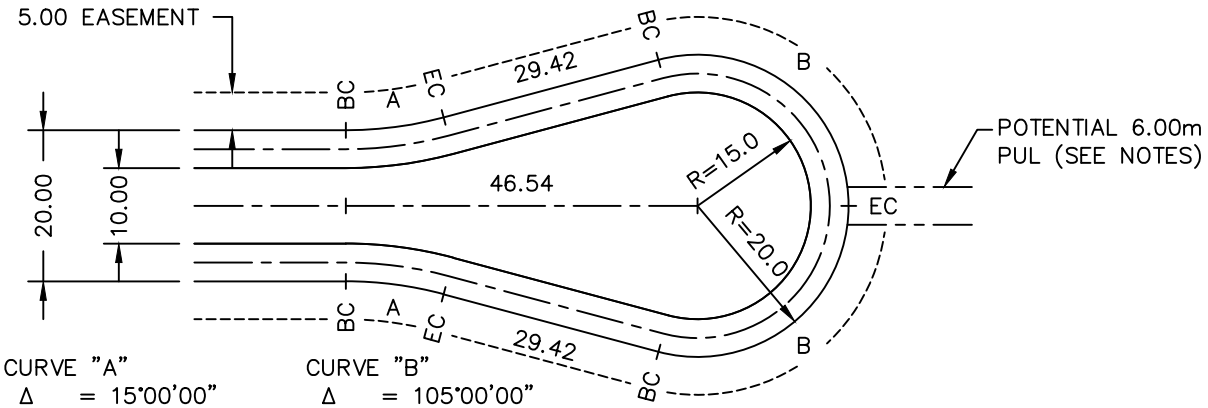
CRUVE "B"
Δ = 105°00'00"
R = 20.0
ARC = 36.65
TAN = 26.07
(at property line)

CYPRESS COUNTY

STANDARD DETAILS

URBAN RESIDENTIAL CUL-DE-SAC CURB, GUTTER AND SIDEWALK

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
MAY 2018	BRW	TDA	NTS	9-110



CURVE "A"
Δ = 15°00'00"
R = 50.00
ARC = 13.09
TAN = 6.58
(at property line)

CURVE "B"
Δ = 105°00'00"
R = 20.0
ARC = 36.65
TAN = 26.06
(at property line)

— — — — CENTRE OF DITCH
——————— PROPERTY LINE / EDGE OF ROAD
---------- 5m EASEMENT

NOTES:

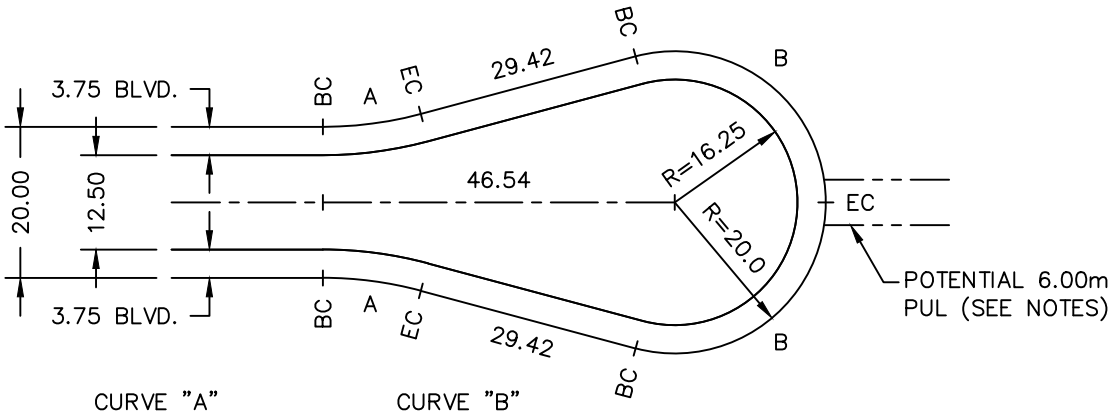
1. A PUL WITH A WIDTH NO LESS THAN 6.0m MUST BE PROVIDED TO ALLOW FOR STORM DRAINAGE IF THE CUL-DE-SAC CAN NOT BE GRADED TO DRAIN TOWARDS THE INTERSECTION.

CYPRESS COUNTY

STANDARD DETAILS

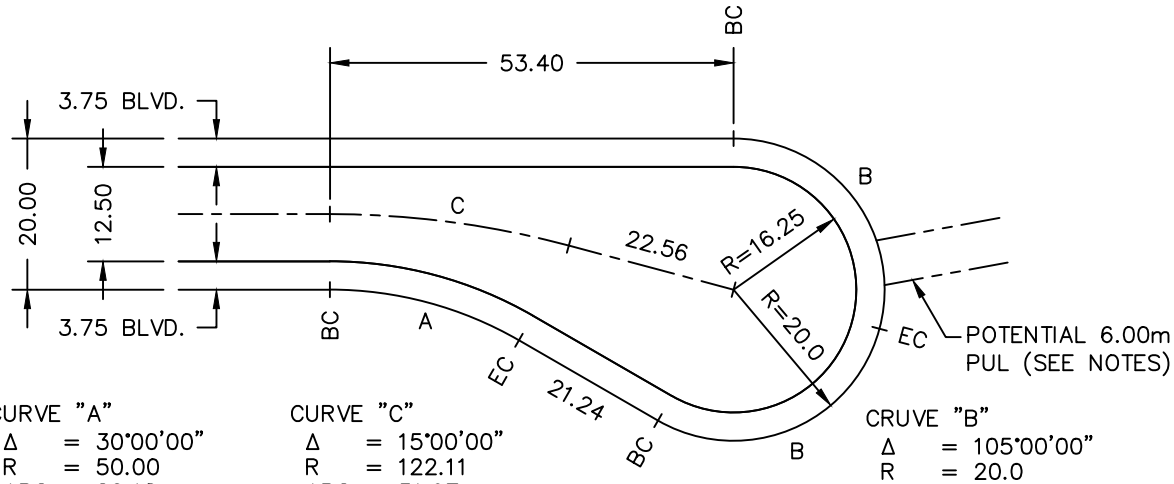
RURAL RESIDENTIAL CUL-DE-SAC

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
MAY 2018	BRW	TDA	NTS	9-112



CURVE "A"
Δ = 15°00'00"
R = 50.00
ARC = 13.09
TAN = 6.58
(at property line)

CURVE "B"
Δ = 105°00'00"
R = 20.0
ARC = 36.65
TAN = 26.07
(at property line)



CURVE "A"
Δ = 30°00'00"
R = 50.00
ARC = 26.18
TAN = 13.40
(at property line)

CURVE "C"
Δ = 15°00'00"
R = 122.11
ARC = 31.97
TAN = 16.08

CRUVE "B"
Δ = 105°00'00"
R = 20.0
ARC = 36.65
TAN = 26.07
(at property line)

NOTES:

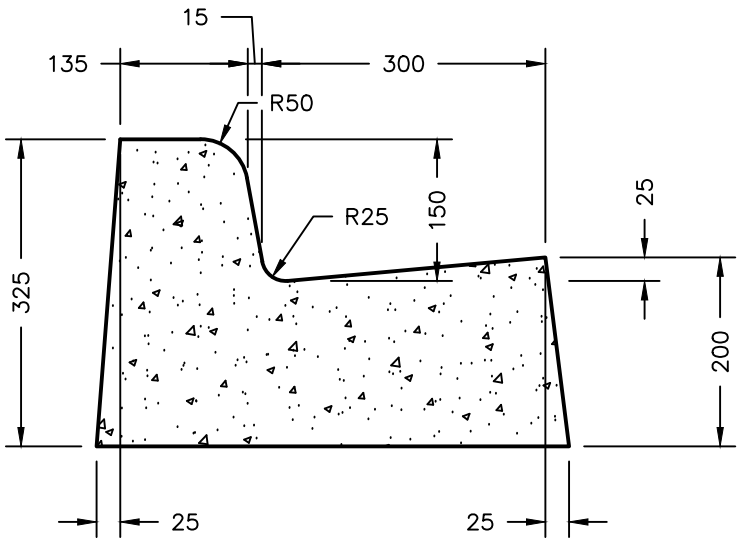
1. A PUL WITH A WIDTH NO LESS THAN 6.0m MUST BE ADDED TO ALLOW FOR SNOW MOVEMENT AND STORAGE.
2. THE CURB AND GUTTER MUST BE DEPRESSED AT THE PUL TO ALLOW FOR SNOW MOVEMENT.

CYPRESS COUNTY

STANDARD DETAILS

LOCAL INDUSTRIAL/COMMERCIAL CUL-DE-SAC CURB AND GUTTER

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
MAY 2018	BRW	TDA	NTS	9-113



NOTES:

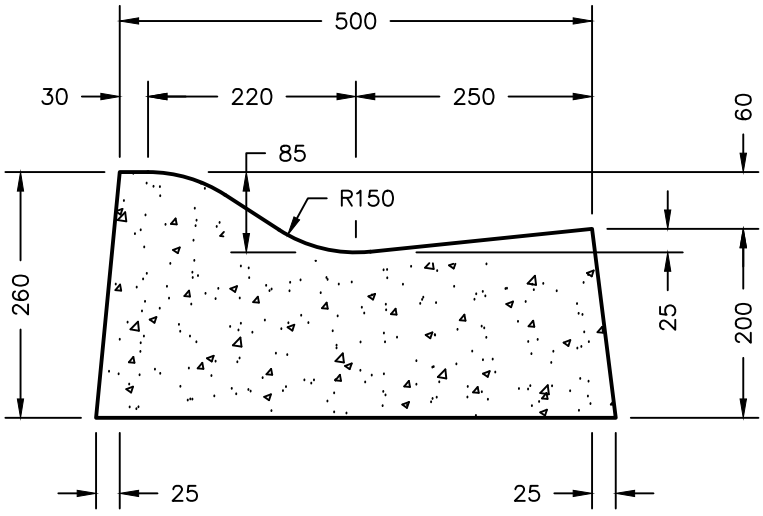
1. 25mm BATTER NOT REQUIRED FOR HANDFORMED.
2. ALL DIMENSIONS IN MILLIMETRES.

CYPRESS COUNTY

STANDARD DETAILS

400mm STANDARD CURB AND GUTTER

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
MAY 2018	BRW	TDA	NTS	9–201



NOTES:

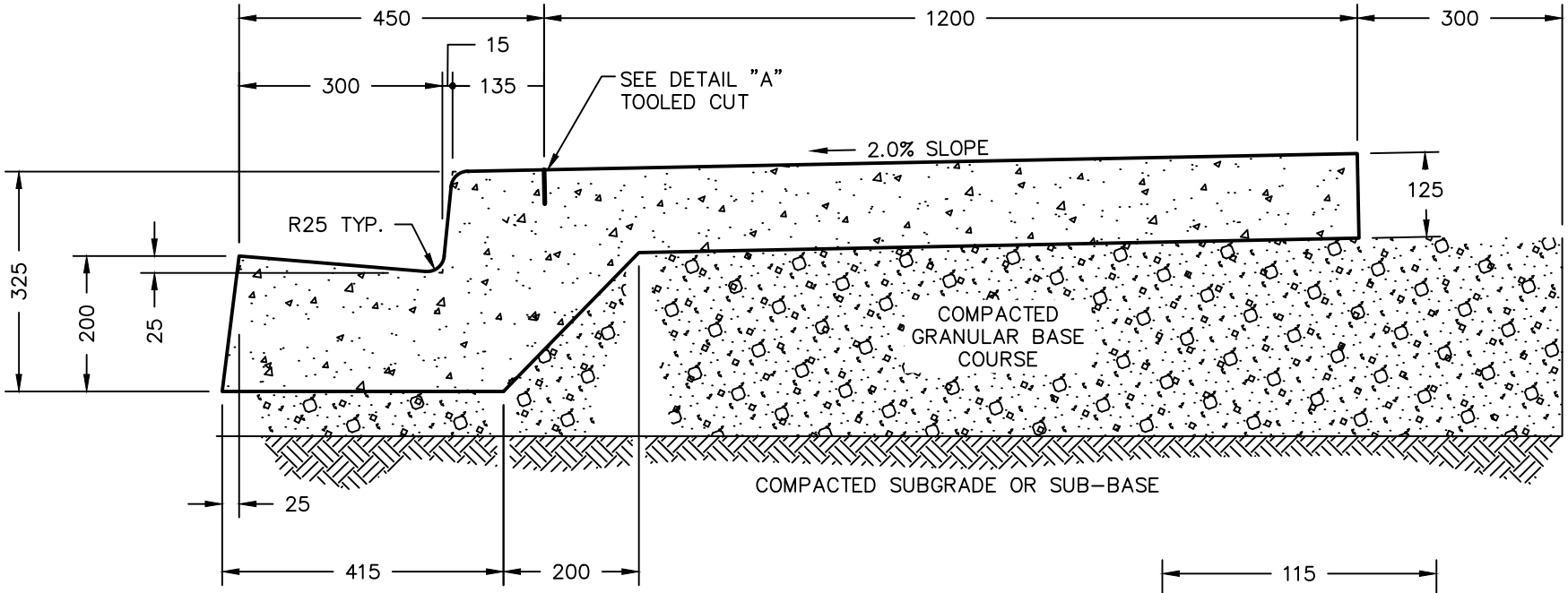
1. 25mm BATTER NOT REQUIRED FOR HANDFORMED.
2. ALL DIMENSIONS IN MILLIMETRES.

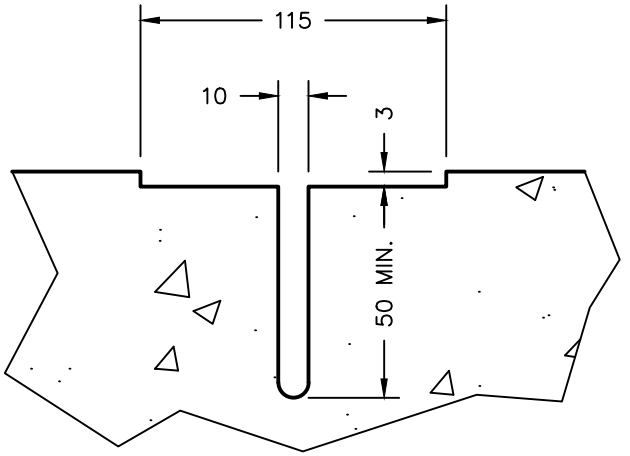
CYPRESS COUNTY

STANDARD DETAILS

500mm ROLLED CURB AND GUTTER

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
MAY 2018	BRW	TDA	NTS	9–202





DETAIL "A"

NOTE:

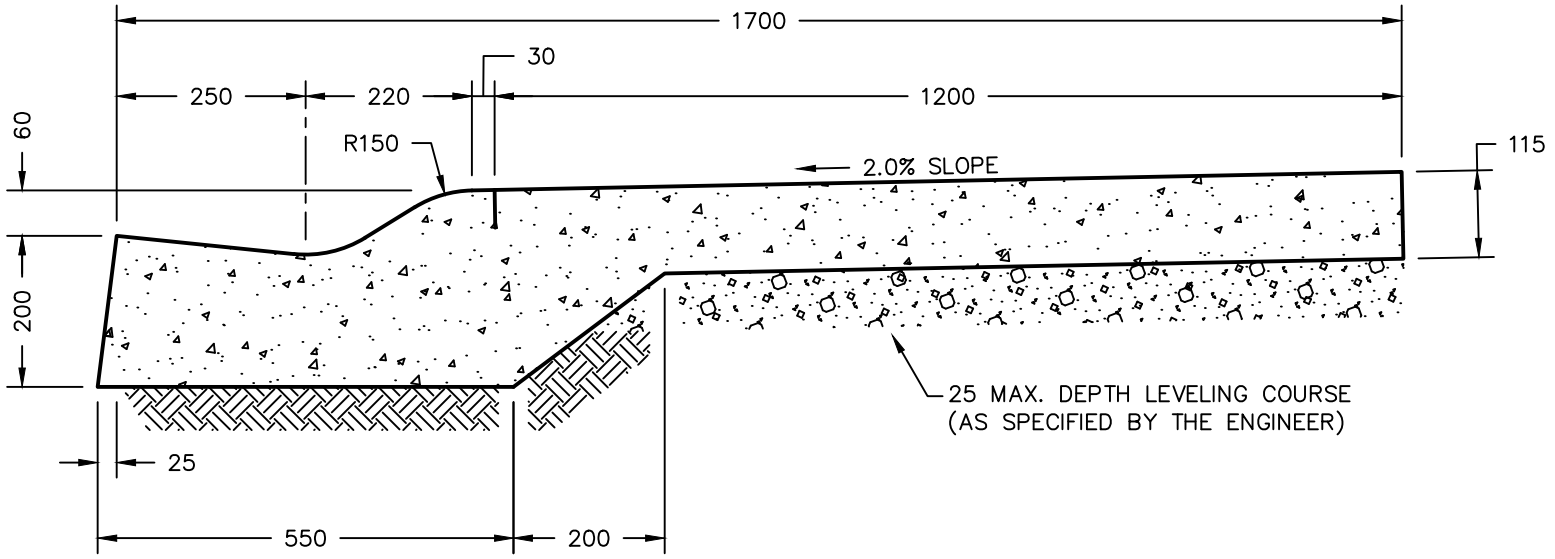
1. ALL DIMENSIONS ARE IN MILLIMETRES.

CYPRESS COUNTY

STANDARD
DETAILS

STANDARD MONOLITHIC SIDEWALK

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
MAY 2018	BRW	TDA	NTS	9-203



NOTES:

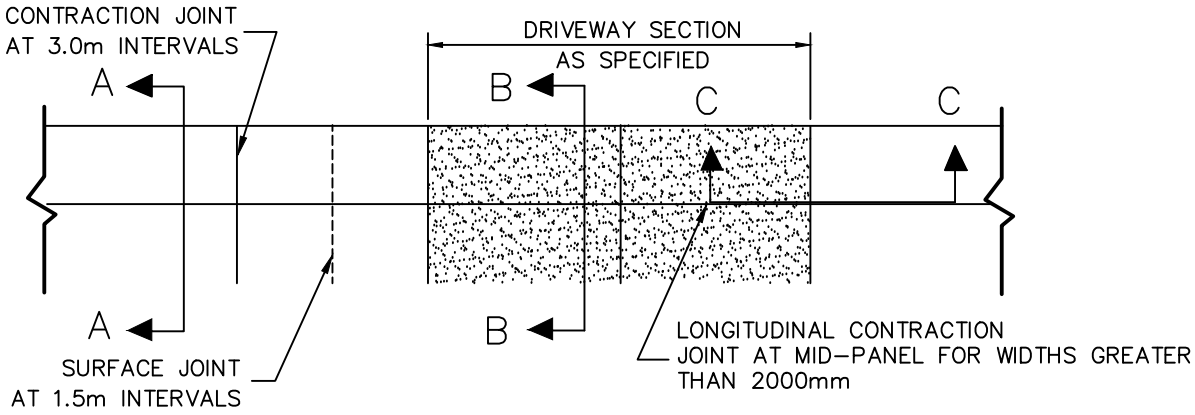
1. 25mm BATTER NOT REQUIRED FOR HAND FORMED.
2. ALL DIMENSIONS ARE IN MILLIMETRES.

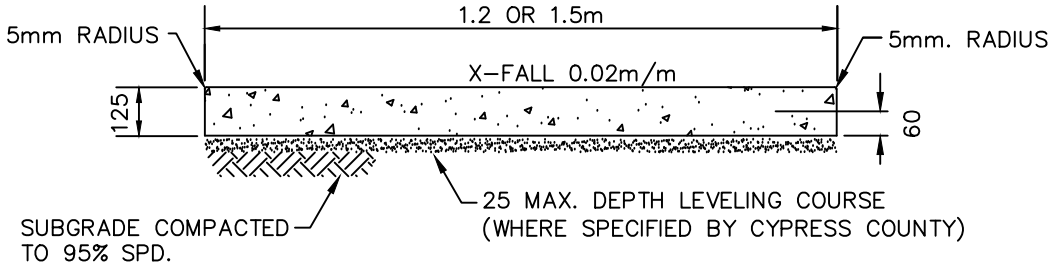
CYPRESS COUNTY

STANDARD DETAILS

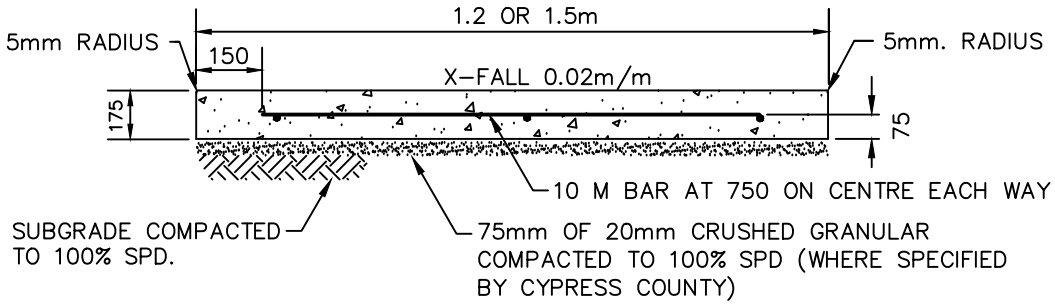
ROLLED MONOLITHIC SIDEWALK

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
MAY 2018	BRW	TDA	NTS	9–204

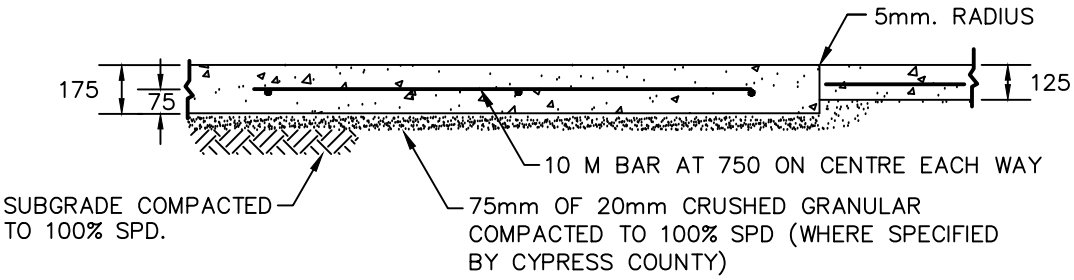




SECTION A-A STANDARD SIDEWALK



SECTION B-B DRIVEWAY SECTION



SECTION C-C TRANSITION

NOTES:

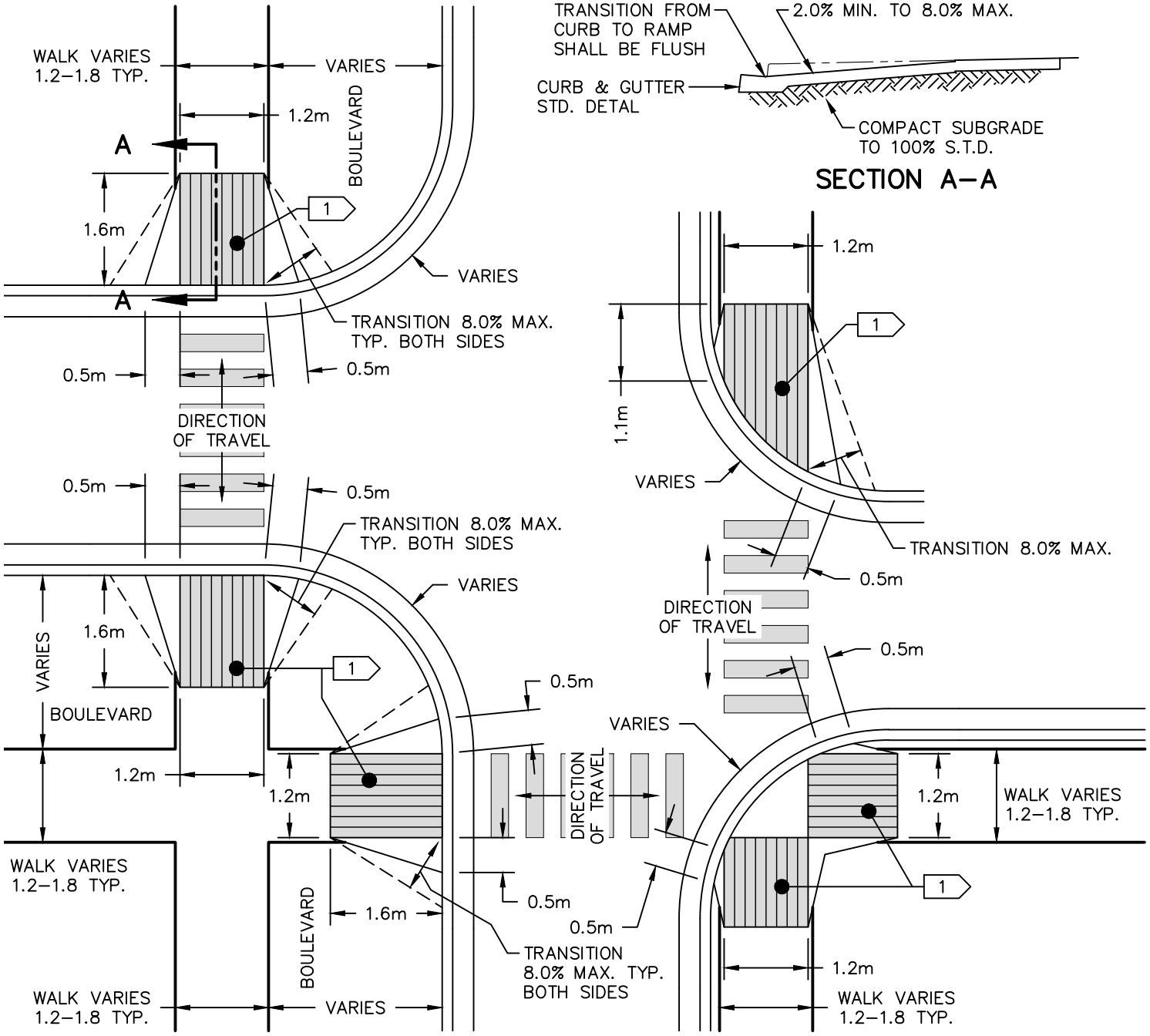
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.

CYPRESS COUNTY

STANDARD DETAILS

SEPARATE SIDEWALK

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
MAY 2018	BRW	TDA	NTS	9-205



NOTES:

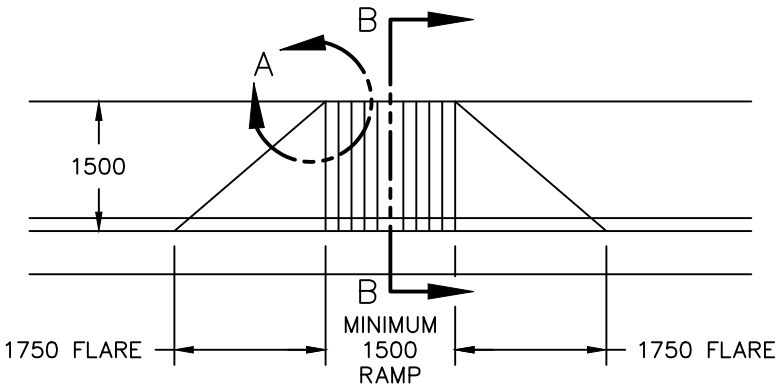
1. SCORE LINES MUST LINE UP IN DIRECTION OF TRAVEL AND BE PARALLEL WITH THE CROSSING OR MARKED CROSSWALK. MINIMUM 7 SCORE LINES 15cm APART. USE 3/8" TROWEL. SCORE LINES ARE TO ALERT PERSONS, WHO ARE VISUALLY IMPAIRED, OF THE CURB–CUT AND STREET CROSSING.
2. RAMPS FOR USERS OF WHEELCHAIRS & BICYCLES SHOULD BE LOCATED AT ALL JUNCTIONS OF CROSSWALKS AND SIDEWALKS. RAMPS MUST BE LOCATED WITHIN A CROSSWALK.
3. WHERE CROSSWALKS ARE CONTROLLED BY SIGNALS WITH A PUSH BUTTON SYSTEM, THE SIDEWALKS AND RAMPS MUST ALLOW ACCESS BY WHEEL–CHAIR TO THE PUSH BUTTON.
4. CONCRETE SIDEWALKS, CURBS, AND RAMPS TO BE POURED MONOLITHICALLY.
5. MINIMUM WIDTH OF RAMP IS 1.5m. IT MAY BE NECESSARY TO BUILD WIDER RAMPS IN BUSY URBAN AREAS WHERE THE VOLUME OF PEDESTRIAN TRAFFIC IS HIGH.
6. CONCRETE TO BE 25MPa, 5%–7% AIR CONTENT, WITH 300 kg/m^3 CEMENT, TO A MAX, 360kg/m^3 OF CEMENTATIOUS MATERIAL.
7. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.

CYPRESS COUNTY

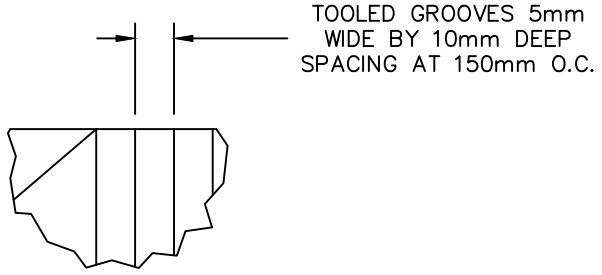
STANDARD DETAILS

RAMP DETAILS ON TANGENT

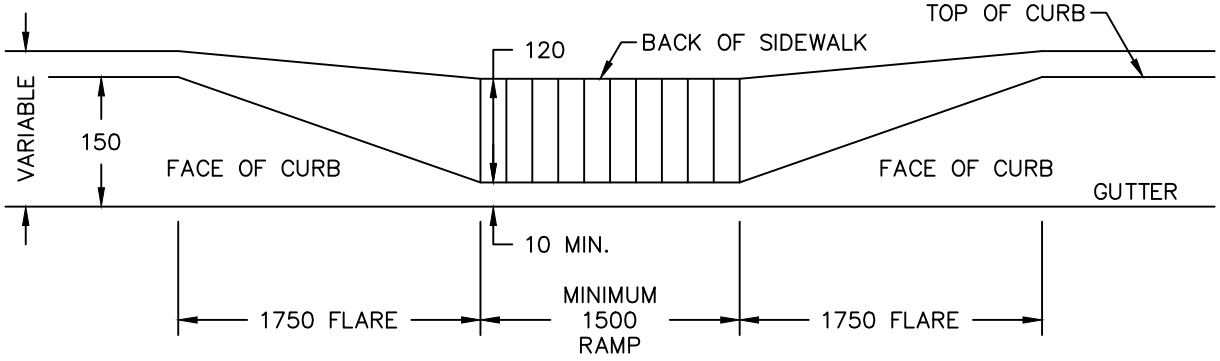
Date:	Drawn By:	Checked By:	Scale:	Drawing No.
MAY 2018	BRW	TDA	NTS	9–300



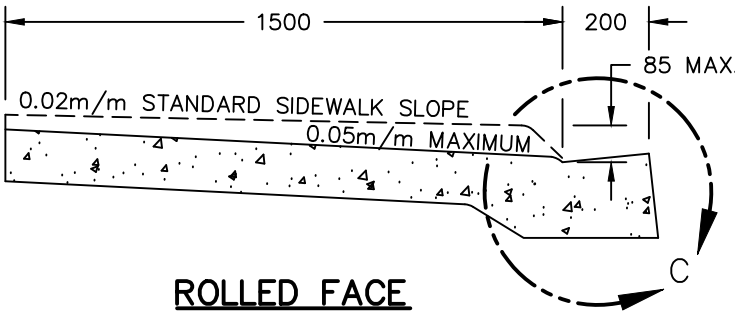
TYPICAL PLAN VIEW



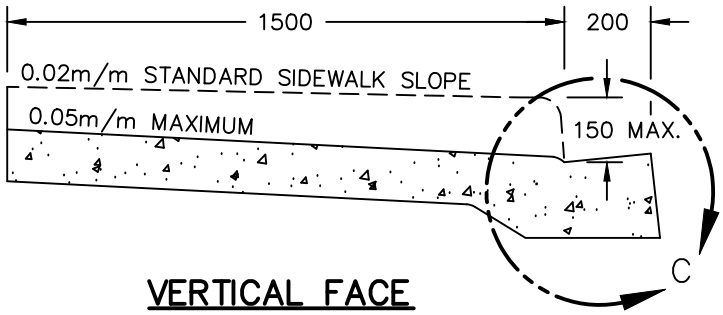
DETAIL A



TYPICAL ELEVATION



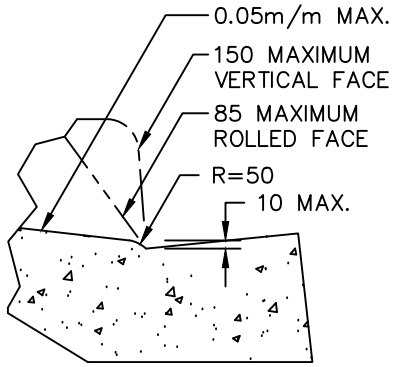
ROLLED FACE
TYPICAL CROSS SECTION (B–B)



VERTICAL FACE
TYPICAL CROSS SECTION (B–B)

NOTES:

1. RAMPS FOR USERS OF WHEELCHAIRS & BICYCLES SHOULD BE LOCATED AT ALL JUNCTIONS OF CROSSWALKS AND SIDEWALKS. RAMPS MUST BE LOCATED WITHIN A CROSSWALK.
2. GROOVES ON SIDEWALK RAMPS ARE TO ALERT PERSONS, WHO ARE VISUALLY IMPAIRED, OF THE CURB–CUT AND A STREET CROSSING.
3. WHERE CROSSWALKS ARE CONTROLLED BY SIGNALS WITH A PUSHBUTTON. SYSTEM, THE SIDEWALKS AND RAMPS MUST ALLOW ACCESS BY WHEEL–CHAIR TO THE PUSH BUTTON.
4. CONCRETE SIDEWALKS, CURBS, AND RAMPS TO BE POURED MONOLITHICALLY.
5. MINIMUM WIDTH OF RAMP IS 1.5m. IT MAY BE NECESSARY TO BUILD WIDER RAMPS IN BUSY URBAN AREAS WHERE THE VOLUME OF PEDESTRIAN TRAFFIC IS HIGH.
6. CONCRETE TO BE 25MPa, 5%–7% AIR CONTENT, WITH 300kg/m^3 CEMENT, TO A MAX. 360kg/m^3 OF CEMENTATIOUS MATERIAL.
7. THE 0.05m/m MAXIMUM SLOPE SHOULD NOT BE EXCEEDED AND THEREFORE THE BACK OF THE SIDEWALK MUST BE LOWERED ACCORDINGLY.
8. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED.



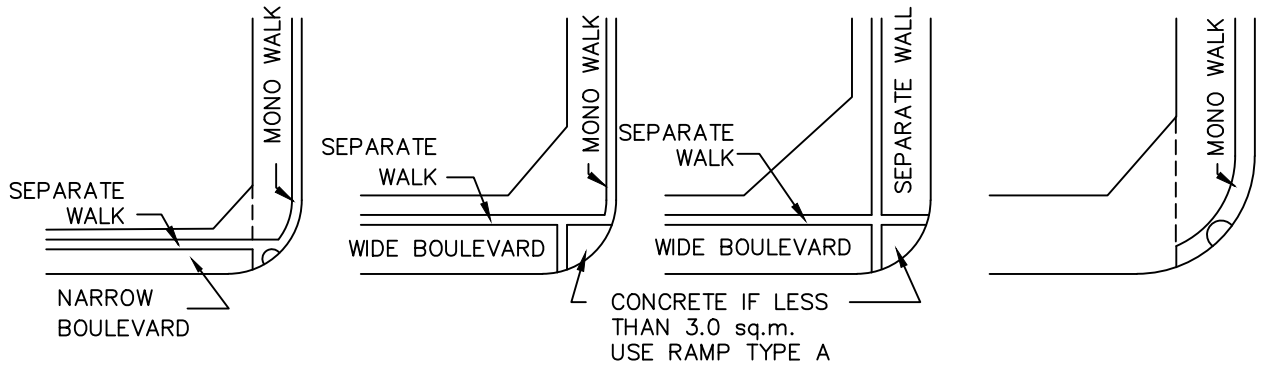
DETAIL C

CYPRESS COUNTY

STANDARD DETAILS

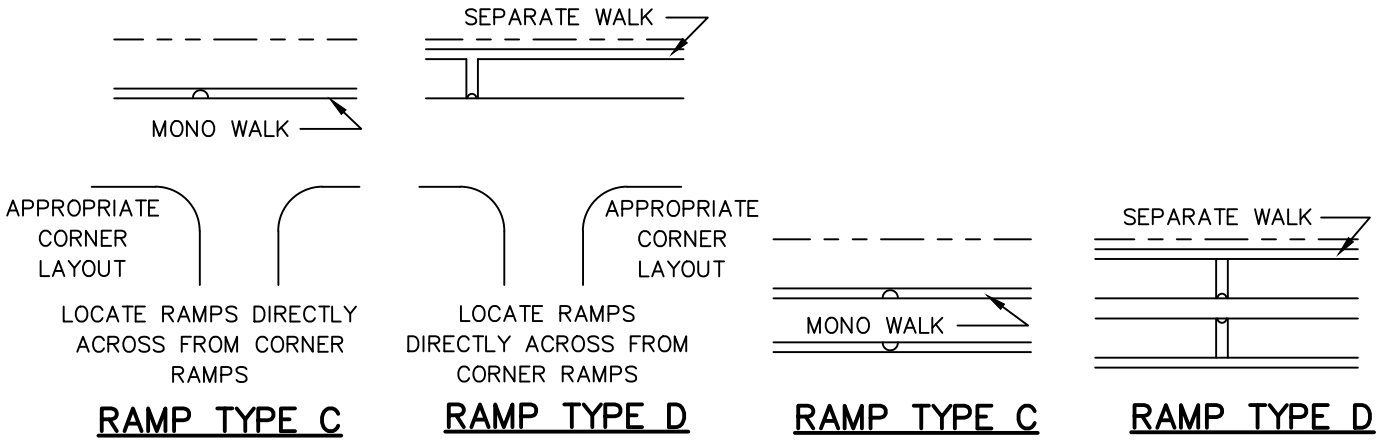
ACCESSIBILITY RAMP DETAILS AT BOTH CURB RETURNS

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
MAY 2018	BRW	TDA	NTS	9–301



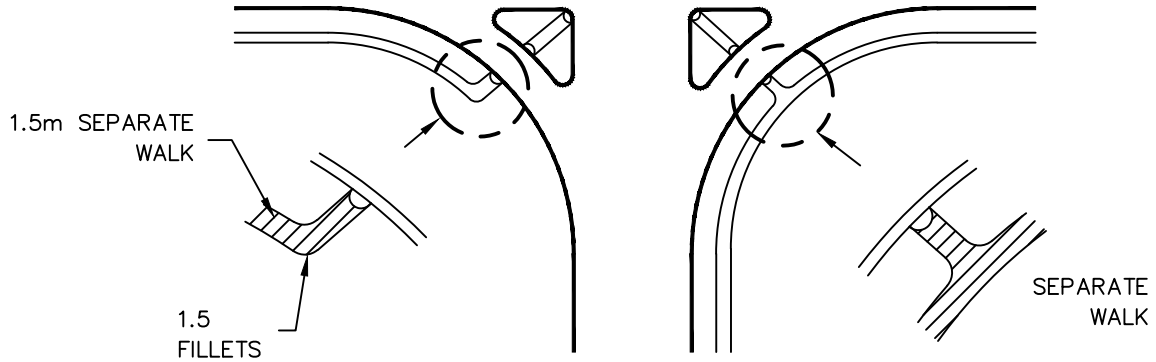
RAMP TYPE A | RAMP TYPE B | RAMP TYPE B | RAMP TYPE A

CORNER LAYOUT



RAMP TYPE C | RAMP TYPE D | RAMP TYPE C | RAMP TYPE D

TANGENT LAYOUT



RAMP TYPE D

INTERSECTION LAYOUT

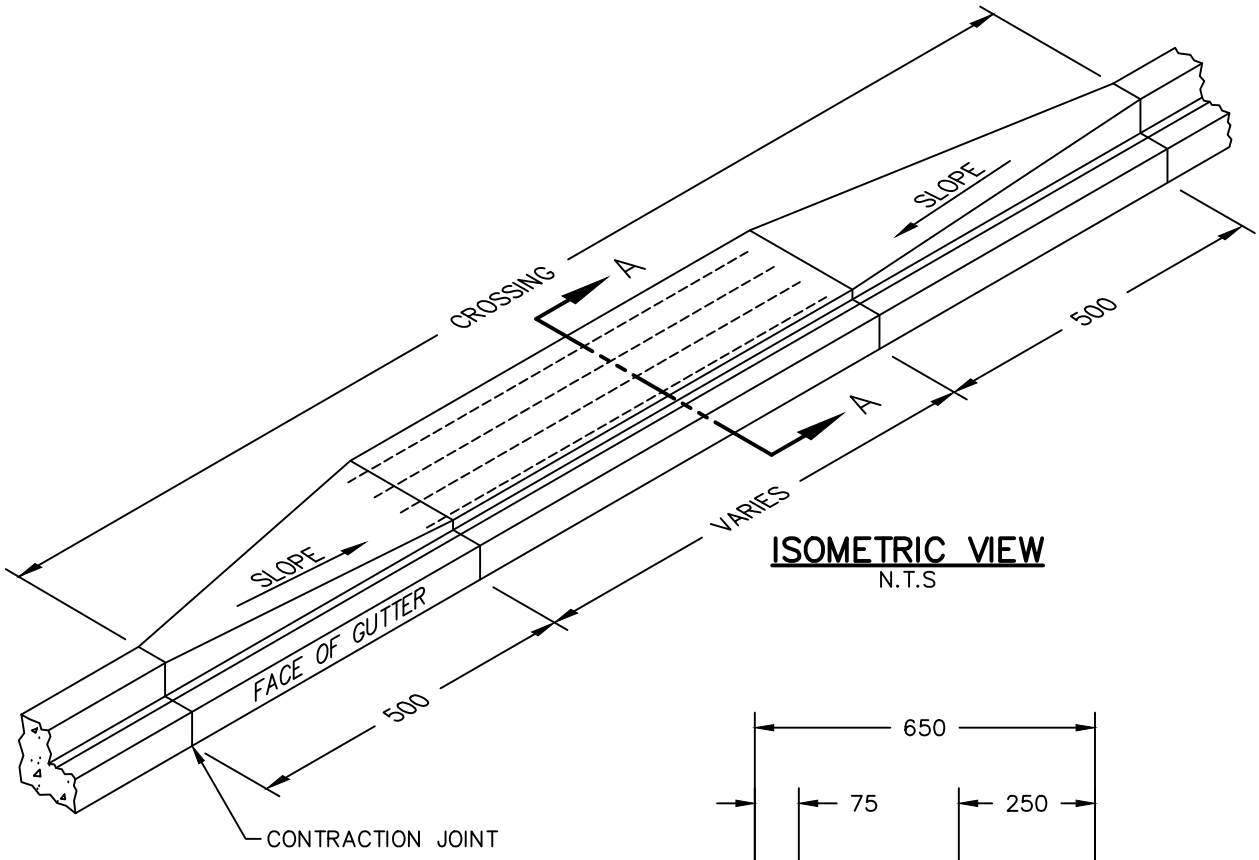
N.T.S.

CYPRESS COUNTY

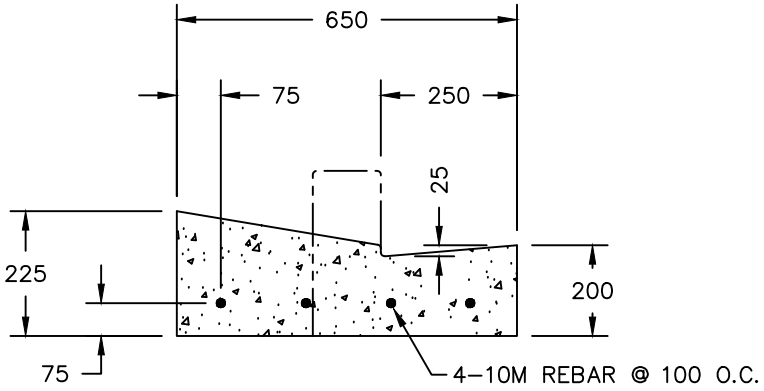
STANDARD DETAILS

WHEEL CHAIR/BIKE RAMP LOCATIONS

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
MAY 2018	BRW	TDA	NTS	9-303



ISOMETRIC VIEW
N.T.S



SECTION A–A

NOTES:

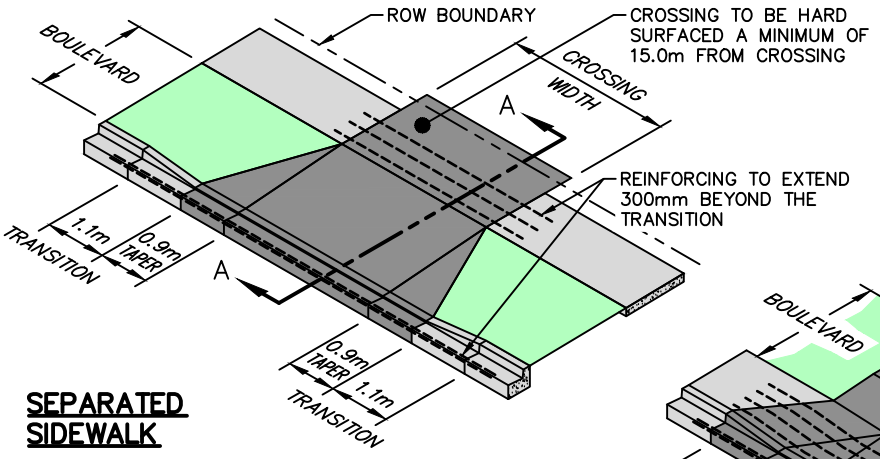
1. MAINTAIN THICKENED DEPTH THROUGHOUT.
2. ALL DIMENSIONS ARE IN MILLIMETRES.

CYPRESS COUNTY

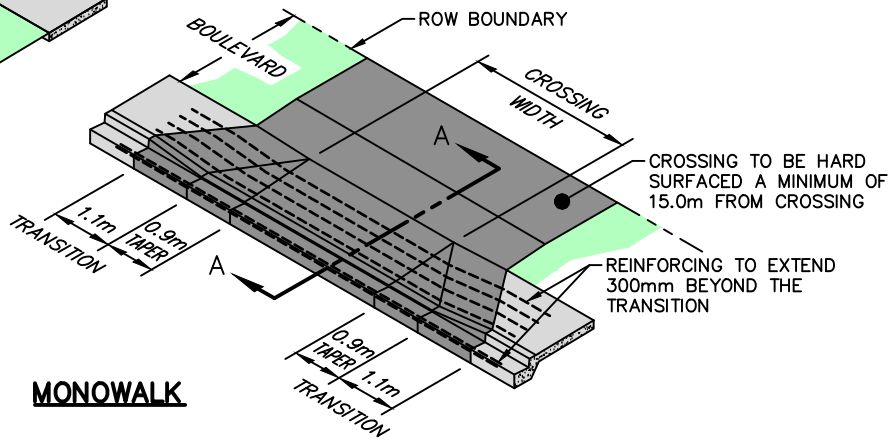
STANDARD DETAILS

INDUSTRIAL/COMMERCIAL CURB AND GUTTER CROSSING

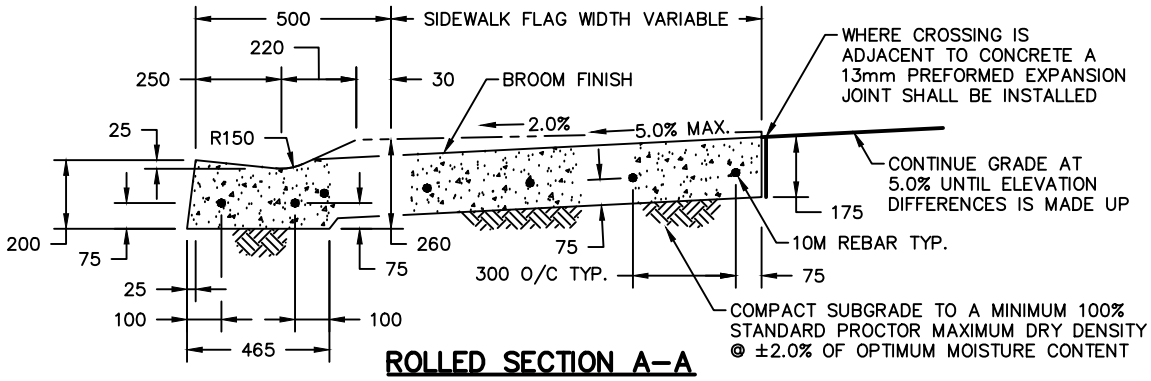
Date:	Drawn By:	Checked By:	Scale:	Drawing No.
MAY 2018	BRW	TDA	NTS	9–400



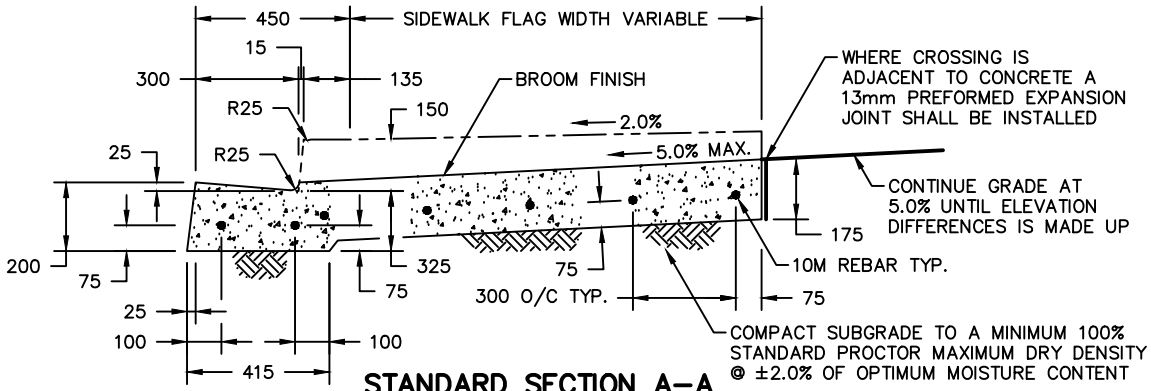
SEPARATED SIDEWALK



MONOWALK



ROLLED SECTION A–A



STANDARD SECTION A–A

NOTES:

1. EXISTING SIDEWALK, CURB & GUTTER TO BE REMOVED AND REPLACED WITH TRANSITIONS, TAPER AND DROP CURB SECTIONS.
2. REINFORCING BARS SHALL BE CSA 6.30.12 Fy = 400 MPa.
3. ALTERNATIVE REINFORCING 150 x 150 P18/P18 GAUGE WELDED WIRE FABRIC.
4. CONCRETE TO BE TYPE 50, 25 MPa, 5%–8% AIR CONTENT.
5. ALL DIMENSIONS ARE IN MILLIMETRES.

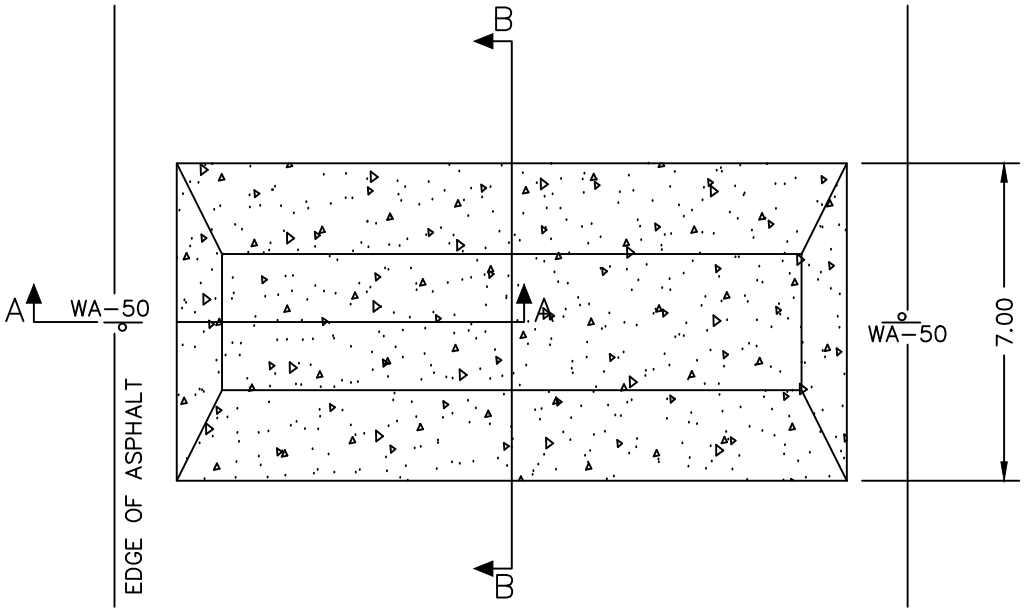
CROSSING	
TYPE	WIDTH
6.0m LANE	6.0m
9.0m LANE	9.0m
DRIVEWAY	7.5–9.0m

CYPRESS COUNTY

STANDARD DETAILS

LOW VOLUME LAND & DRIVEWAY CROSSING

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
MAY 2018	BRW	TDA	NTS	9–401



TWO WAY STREET/LANE

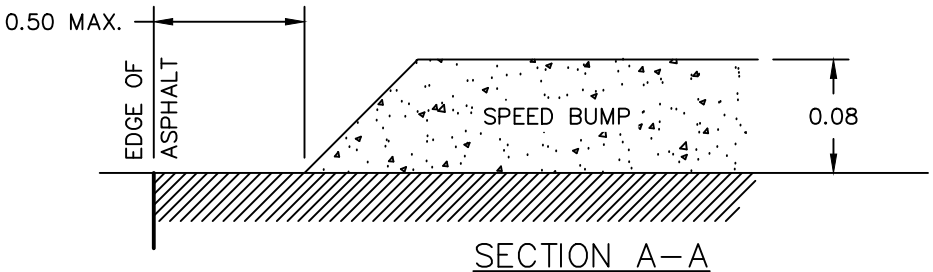
N.T.S.

WA–50

450mm X 450mm
SPEED BUMP

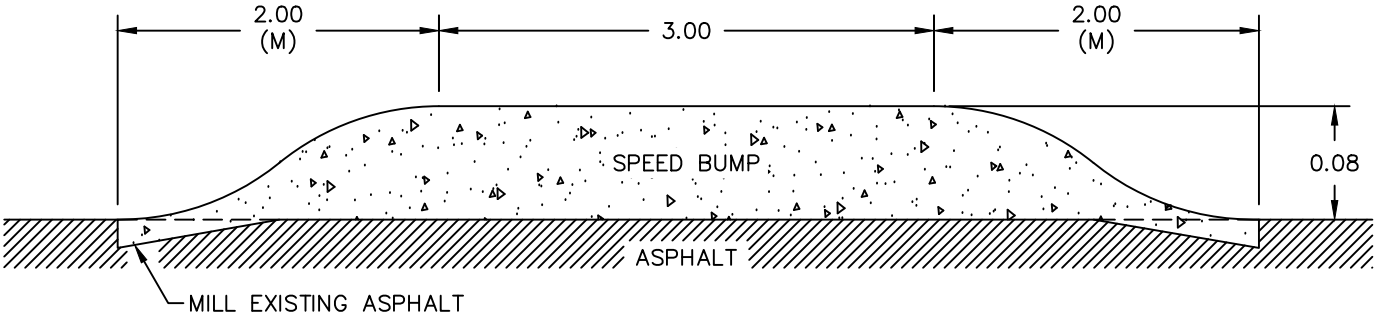
NOTES:

1. PAINT 1.0m WIDE YELLOW LINE ACROSS BOTH FACES OF BUMP.
2. PAINT 0.6m WIDE CHEVRON PATTERN ON ENTIRE SURFACE.
3. ALL DIMENSIONS ARE IN MILLIMETRES.



SECTION A–A

N.T.S.



SECTION B–B

N.T.S.

SINUSOIDAL SPEED BUMP DEVELOPMENT:

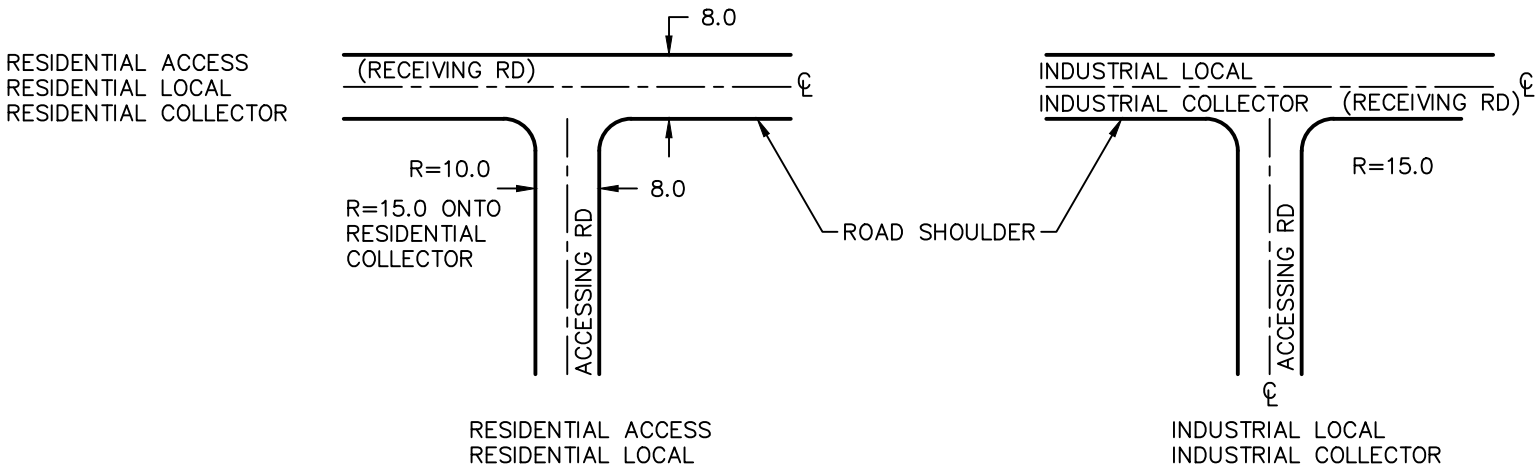
DISTANCE (M)	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875	1.000	1.125	1.250	1.375	1.500	1.625	1.750	1.875	2.000
FINISHED HEIGHT(mm)	0	1	3	7	12	18	26	32	40	48	55	62	68	73	77	79	80

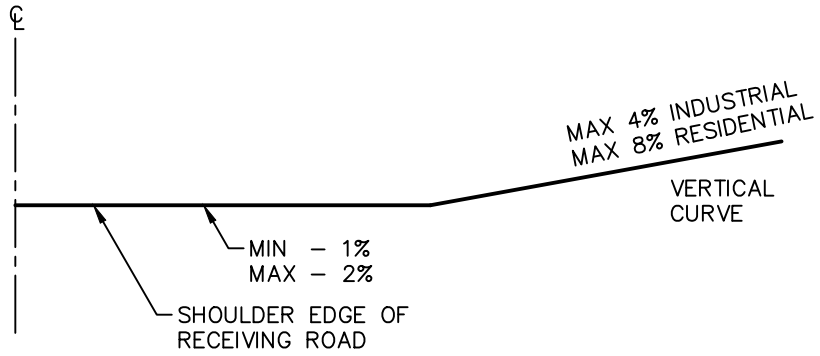
CYPRESS COUNTY

STANDARD DETAILS

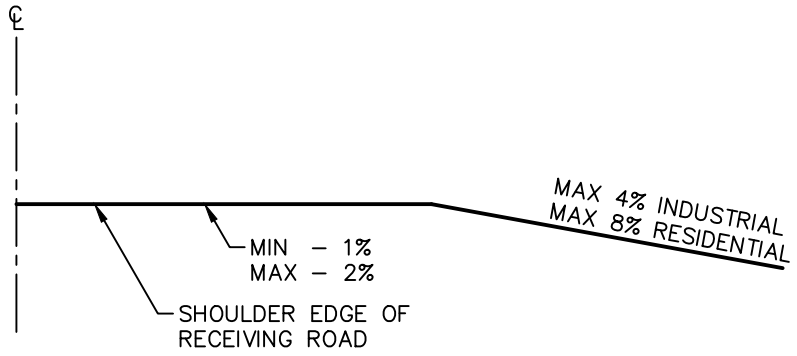
ASPHALT SPEED BUMP

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
MAY 2018	BRW	TDA	NTS	9–402





PROFILE – ACCESSING ROAD IN CUT



PROFILE – ACCESSING ROAD IN FILL

NOTES:

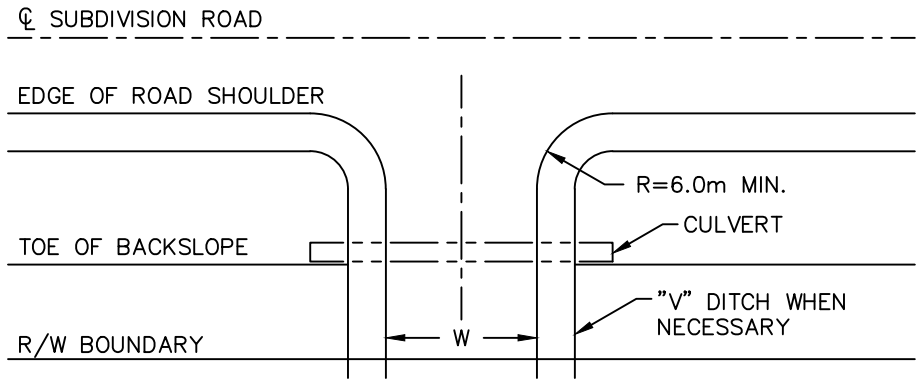
1. LENGTH OF VERTICAL CURVE SHALL CONFORM TO T A C MANUAL
2. ALL DIMENSIONS ARE IN METERS
3. REFER TO Z–8A FOR SIGHT DISTANCE GUIDELINES

CYPRESS COUNTY

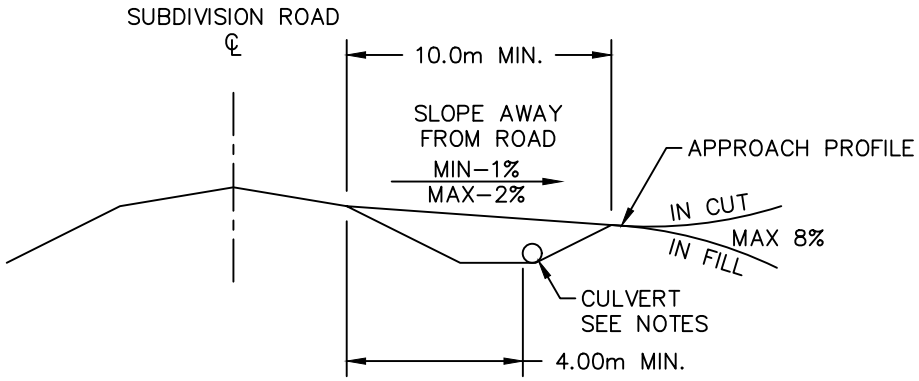
STANDARD
DETAILS

TYPICAL ROAD INTERSECTIONS

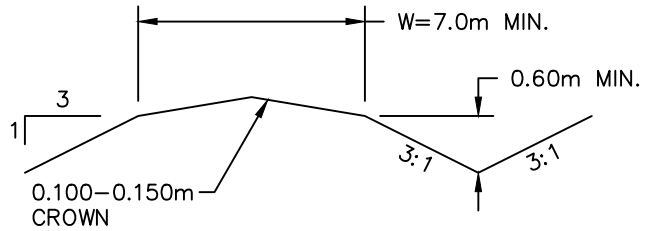
Date:	Drawn By:	Checked By:	Scale:	Drawing No.
MAY 2018	BRW	TDA	NTS	9–500



APPROACH PLAN



DITCH AND CULVERT LOCATION



APPROACH CROSS SECTION

NOTES:

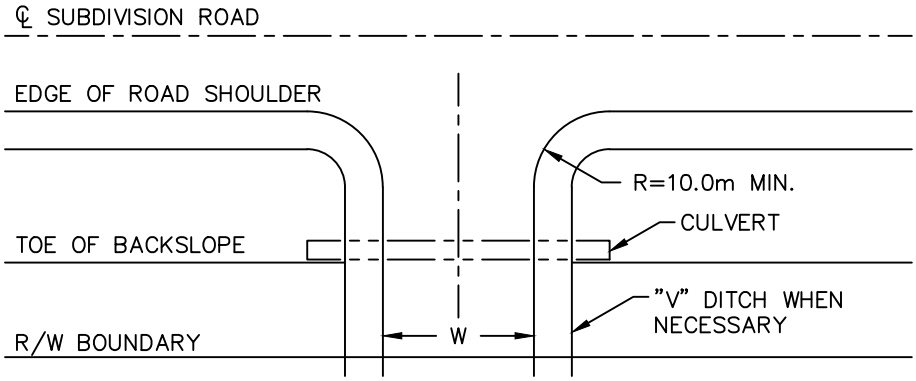
1. WHEN CULVERTS ARE REQUIRED THEY MUST BE C.S.P. CULVERTS AND BE A MINIMUM DIAMETER OF 0.500m
2. CULVERTS MUST BE SET BACK A MINIMUM OF 4m FROM SHOULDER OF ROAD
3. ALL DIMENSIONS SHOWN ARE IN METRES.

CYPRESS COUNTY

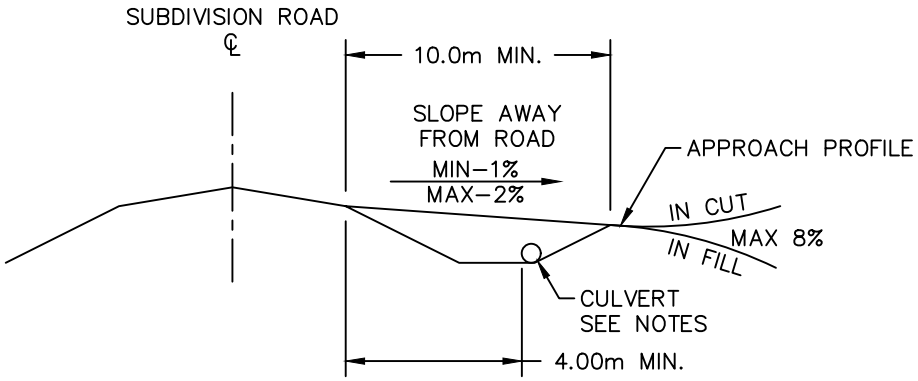
STANDARD DETAILS

TYPICAL RESIDENTIAL APPROACHES

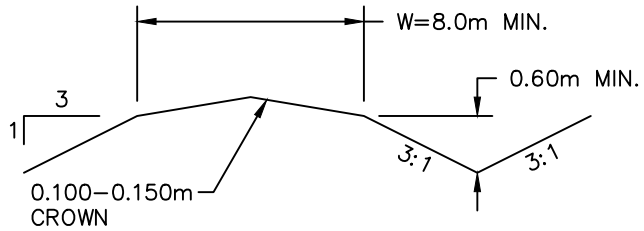
Date:	Drawn By:	Checked By:	Scale:	Drawing No.
MAY 2018	BRW	TDA	NTS	9–501



APPROACH PLAN



DITCH AND CULVERT LOCATION



APPROACH CROSS SECTION

NOTES:

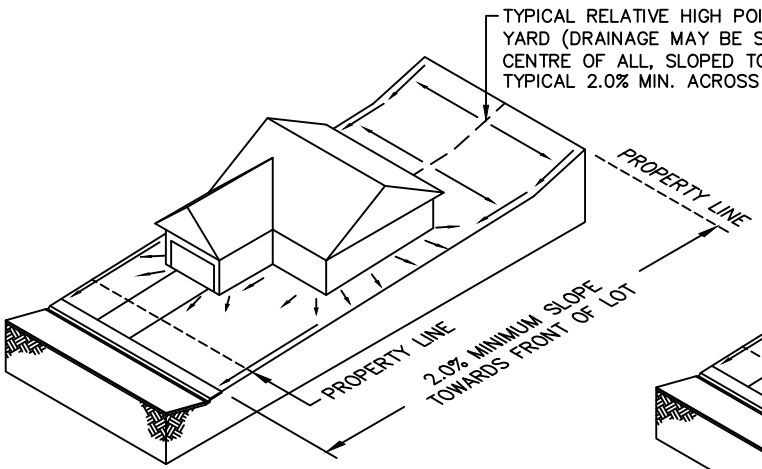
1. WHEN CULVERTS ARE REQUIRED THEY MUST BE C.S.P. CULVERTS AND BE A MINIMUM DIAMETER OF 0.500m
2. CULVERTS MUST BE SET BACK A MINIMUM OF 4m FROM SHOULDER OF ROAD
3. ALL DIMENSIONS SHOWN ARE IN METRES.

CYPRESS COUNTY

STANDARD DETAILS

TYPICAL INDUSTRIAL APPROACHES

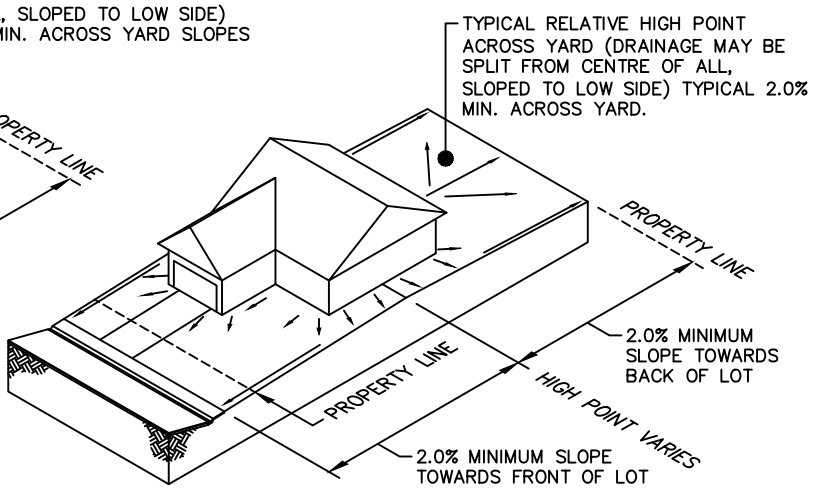
Date:	Drawn By:	Checked By:	Scale:	Drawing No.
MAY 2018	BRW	TDA	NTS	9–502



REAR TO FRONT DRAINAGE

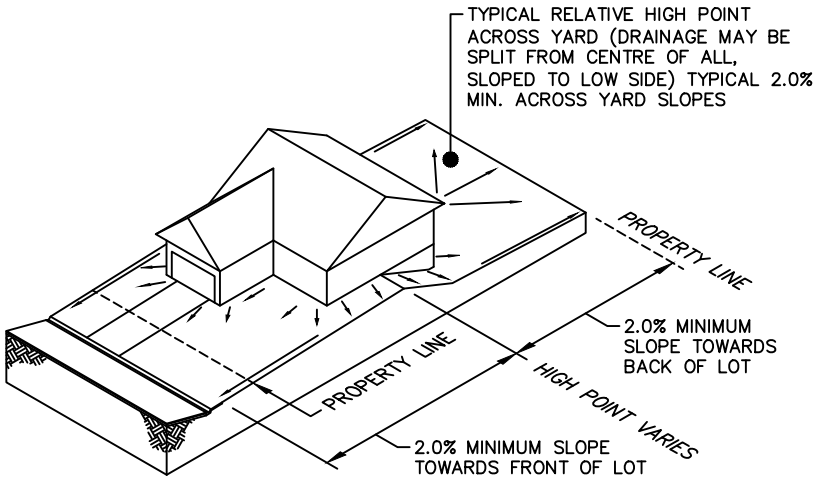
TYPE A/B/C

TYPE A 2–3% OVERALL LOT SLOPE
TYPE B 3–6% OVERALL LOT SLOPE
TYPE C 6%+ OVERALL LOT SLOPE



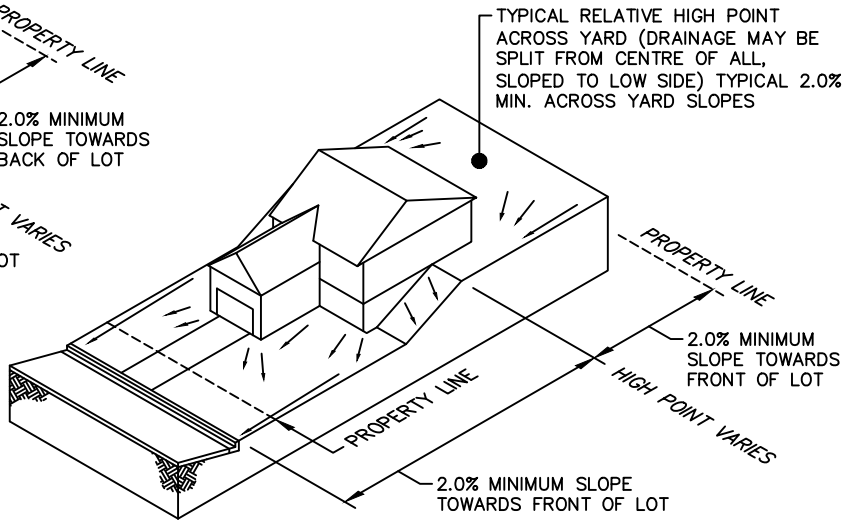
STANDARD SPLIT DRAINAGE

TYPE D



WALKOUT BASEMENT

TYPE W



REVERSE WALKOUT BASEMENT

TYPE R

FOR REVERSE WALKOUT

LOT DESIGNATION	DESCRIPTION
A	BACK TO FRONT DRAINAGE 2–3% OVERALL SLOPE
B	BACK TO FRONT DRAINAGE 3–6% OVERALL SLOPE
C	BACK TO FRONT DRAINAGE 6% OVERALL SLOPE
D	SPLIT DRAINAGE
R	REVERSE WALKOUT
S	BI–LEVEL WALKOUT
W	FULL WALKOUT

CYPRESS COUNTY

STANDARD DETAILS

TYPICAL LOT GRADING

Date:	Drawn By:	Checked By:	Scale:	Drawing No.
APR 2018	BRW	TDA	NTS	12–100