PINE RIVERS SHIRE COUNCIL

DESIGN MANUAL

CIVIL INFRASTRUCTURE DESIGN

DESIGN STANDARDS

Part 1 Design Standards for Roadworks

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PINE RIVERS SHIRE COUNCIL

DESIGN STANDARDS

PART 4
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PINE RIVERS SHIRE COUNCIL

PART 4 - DESIGN STANDARDS FOR SEWERAGE WORKS

SECTION 2
DESIGN PROCEDURE

2.1.0 PREAMBLE

The Pine Rivers Shire Council adopts, from time to time, sewerage planning reports which set out the major transport sewers, pumping stations and pressure mains throughout the Pine Rivers Shire. The sewered area is based on three major catchments being Kedron Brook, Brendale and Murrumba Downs and two smaller catchments surrounding the Dayboro and Samford townships. Therefore, a development for which the provision of sewerage infrastructure has been made a condition can be located in its respective catchment. This will indicate to the developer and his/her consulting engineer how the sewerage service is to be provided.

The developer having reached agreement with the Pine Rivers Shire Council on the scope of works to be provided both within and external to the development shall engage a consulting engineer to carry out the design of the works.

All designs shall comply with the requirements of these design standards, the Department of Natural Resources (Water Resources) Sewerage Guidelines, the Sewerage and Water Supply Act, the Pine Rivers Shire Council included specifications, the relevant standard drawings and relevant legislation. The Pine Rivers Shire Council is prepared to allow the consulting engineer to incorporate such specifications and drawings, as he/she deems appropriate, into the working documents. By so doing, the consulting engineer accepts responsibility for their use as if he/she was the author of the specification and drawings.

In the event that works are to be constructed through property not under the control of the developer, arrangements shall be made with the Pine Rivers Shire Council to obtain the names of the affected property owners. Works shall not be undertaken in property not under control of the developer without prior written consent of the registered property owner. A copy of the owner's written consent shall be provided to a Pine Rivers Shire Council engineer.

Prior to the Pine Rivers Shire Council accepting work constructed in private property "on maintenance" a Pine Rivers Shire Council engineer shall be provided with a letter from the registered owner stating that all reinstatement work has been satisfactorily carried out.

2.2.0 HEADWORKS OR PRIORITY INFRASTRUCTURE PLANS

The headworks or works toward priority infrastructure for which the Pine Rivers Shire Council will require a contribution, are those identified as such in the headworks report or Priority Infrastructure Plan (PIP). Works internal can be identified as those works generally within the area of land which is the subject of the development application. Works external will be the balance of works necessary in order that the sewerage service can be provided.

Matters relating to sewerage headworks or priority infrastructure charges should be raised by the developer at the time of lodging the development application with the Pine Rivers Shire Council.

Charges will be levied in accordance with the relevant Headworks or Priority Infrastructure Plan on all properties where the property or new allotments are required to be connected to the sewerage network.

2.3.0 DESIGN OF SEWERS

2.3.1 GENERAL

In designing the sewers, the consulting engineer shall make allowance for any land, external to the subject land, which ultimately will be serviced via the proposed works. The consulting engineer shall obtain from the Pine Rivers Shire Council details of existing sewerage infrastructure into which the proposed works will connect.

All sewerage works whether internal or external to the site, or both as the case may be, relevant or reasonably required in respect of the proposed development shall be provided at the developer's cost.

In particular, the developer is required to meet the full cost of providing an appropriate sewerage system, with capacity sufficient to pass through his or her land the design flow from all upstream catchments, as determined by a Pine Rivers Shire Council engineer, when such catchments are fully developed in accordance with the Pine Rivers Shire Council strategic plan.

The sewerage works shall be extended from an approved point of discharge to the upstream boundary of the development site unless otherwise approved by a Pine Rivers Shire Council engineer.

The consultant shall verify that the existing downstream sewerage system has sufficient capacity to cater for the proposed development.

Any works necessary to upgrade downstream sewerage systems to cater for a particular development shall be at the developer's cost.

2.3.2 QUANTITY OF SEWAGE

The quantity of sewerage shall be calculated in accordance with the Pine Rivers Shire Council sewerage transportation study, sewerage headworks and PIP documents and the Queensland Department of Natural Resources and Mines Guidelines for Planning & Design of Sewerage Schemes.

For normal sewer reticulation design the criteria shown in Table 2.3.0 shall be used.

Table 2.3.0

SEWERAGE DESIGN PARAMETERS

Item	Description	Adopted Design Parameter	Comments
Occupancy Ratio			
1	Equivalent Person/ Equivalent Tenement (EP / ET)	2.8 - for areas within the existing headworks boundary 2.6 - for areas outside the existing headworks boundary	Population model indicates a long term reduction in occupancy ratios
Density of Development			
2	Demand generated by existing and future development	Refer to Part 4 – Calculations and Supporting Data	
Sewage Loading			
3	Average Dry Weather Flow (ADWF)	225 l / EP / d	Based upon analysis of pump station flows and STP inflow records during dry weather
4	Peak Wet Weather Flow (PWWF)	5 x ADWF	Refer section 3.2.4 of the QNRM Guidelines
5	Peak Dry Weather Flow (PDWF)	C_2 x ADWF	C_2 = Peaking factor shown on Drawing Number A3-99480 of the QDNRM Guidelines
6	Maximum Possible Flow	C_1 except, Sewer serving <1000 EP 5 x ADWF Sewer serving >23000 EP 3x ADWF	C_1 derived from Drawing Number A3-99480 of the QDNRM Guidelines

2.3.3 DESIGN OF GRAVITY SEWERS

the deign of gravity sewers shall be in accordance with these Design Standards for Sewerage Works, and the relevant Pine Rivers Shire Council standard drawings and specifications. Design criteria are provided in Table 2.3.1. Sewer pipes shall be sized in accordance with AS2200.

Table 2.3.1

GRAVITY SEWER DESIGN

Item	Description	Adopted Design Parameter	Comments
1	Flow calculation method	Mannings Equation	In accordance with Section 3.2.5 of the QDNRM Guidelines
2	Mannings 'n'	0.013	In accordance with Section 3.2.5 of the QDNRM Guidelines
3	Minimum Velocity at PWWF	0.6 m / s	In accordance with Section 3.2.5 of the QDNRM Guidelines
4	Minimum Velocity at PDWF	0.3 m / s	In accordance with Section 3.2.5 of the QDNRM Guidelines
5	Depth of Flow at PWWF – Existing System	Up to 1.0m below MH cover level and no spillage through overflow structures	Not addressed in Guidelines. Adopted for majority of system analyses.
6	Depth of Flow at PWWF – Proposed sewers	Water surface level must not exceed obvert level of pipe	Best Practice

2.3.4 MINIMUM GRADES

The minimum grade on sewer lines shall be as follows. Sewers shall be designed on steeper grades where possible, rather than the minimum grades.

Table 2.3.2

MINIMUM CONSTRUCTION GRADES FOR SEWERS

DIAMETER OF SEWERS	GRADE (Residential)	GRADE (Commercial & Industrial)
150 mm	1 in 80 for first 6 lots 1 in 150 thereafter	1 in 100 first 3 lots 1 in 150 thereafter
225 mm	1 in 290	1 in 290
300 mm	1 in 420	1 in 420
375 mm	1 in 570	1 in 570
450 mm	1 in 730	1 in 730
525 mm	1 in 900	1 in 900
600 mm	1 in 1000	1 in 1000
675 mm	1 in 1200	1 in 1200
750 mm	1 in 1500	1 in 1500

The minimum drop through manholes shall be 40 mm or the difference between upstream and downstream pipe diameters which ever is greater.

Where sewers are laid under new or existing road pavements levels shall be taken prior to pre-seal inspection, to confirm that the minimum sewer grades have been achieved.

2.3.5 STEEP SEWERS

Where sewers are laid on longitudinal grades steeper than 1 in 15, concrete stops shall be provided in accordance with the relevant standard drawing and specification.

The spacing of concrete stops for the various pipe materials and diameter shall be in accordance with the Table 2.3.3.

Table 2.3.3

SPACING FOR CONCRETE STOPS

PIPE DIAMETER	GRADE	SPACING OF CONC. STOPS	
		VC PIPE	OTHER THAN VC PIPE
150	1 in 6	2 m	6 m
225	1 in 10	2 m	6 m
300 or greater	1 in 15	2 m	6 m

Concrete stops may be omitted where the grade of the sewer is less than indicated above.

Sewer grades steeper than 1 in 4 are subject to approval of a Pine Rivers Shire Council engineer. The maximum flow velocity shall not exceed the pipe manufacturer's recommendations.

The absolute maximum grade for any sewer shall be 1:3.

2.3.6 MINIMUM COVER

The minimum cover to the top of the barrel of unprotected sewer pipes shall be as follows:-

- house connection branches in properties 0.6 m
- sewer inside properties 0.6 m
- sewer in footpaths 0.9 m
- sewer under pavements 1.2 m

Where sewers are constructed in the fronts of allotments, the sewers shall be designed to have 0.25 m cover below the invert of the kerb and channel fronting the allotment or 0.6 m below any future driveway grading which ever is greater.

Where practical, the minimum clearance from the outside surface of a sewer to the outside surface of an adjacent stormwater line or similar service shall be 300 mm. The space between the pipes shall be backfilled with sand.

Where a sewer crosses another service and 300 mm clearance is not possible an absolute minimum clearance of 100mm between maximum outside faces (including sockets) may be permitted provided a complete length (5.5 m) of DICL pipe shall be provided, and the space between pipes is filled with a inert compressible filler.

The minimum cover under a roadway to the outside surface of a DICL sewer shall be in accordance with the Pine Rivers Shire Council adopted standard drawing

2.3.7 DEEP SEWERS

Deep sewers requiring special trenching techniques such as benching should be avoided in existing and proposed residential, industrial or commercial allotments.

Where, in the opinion of a Pine Rivers Shire Council engineer, the location of such sewers within an existing or proposed allotment is unavoidable, the design documentation shall include the proposed method of construction, together with full detail of all stages of the work including compaction testing frequency for the backfilling operation to ensure that future building foundation problems are not likely to occur. Earthworks shall comply with AS3798. The final design and construction method for deep sewers shall be to the satisfaction of a Pine Rivers Shire Council engineer. Consideration should be given to amendments of the allotment size such that a 25 m x 15 m building site is retained clear of trenches and associated earthworks.

Flexible pipes shall generally not be approved for sewers in excess of 4.5 m depth without prior specific approval from the Pine Rivers Shire Council General Manager, Pine Water.

House connections shall not be constructed on sewers where depth to invert of the sewer exceeds 3m. Where this occurs, connections shall be made at manholes or a shallower secondary sewer shall be constructed parallel to the deep line.

2.3.8 ALLOTMENT RESTRICTIONS

The primary function of the sewerage system is to serve allotments and not impose undue restrictions on the usable area of the allotment.

The consulting engineer should ensure that the following matters are addressed in the design:-

- sewer and / or roof water and allotment drain lines should not exist along more that two boundaries of the allotment
- sewers should not be located along side boundaries of allotments which are less that 19 m in width
- where allotment slopes exceed 1 in 10 extra cover may need to be provided to the sewer in order to ensure that adequate cover is maintained after building or access earthworks are carried out

- sewer pipe and manhole type should take into account the effect of possible future building or allotment earthworks. Particular attention should be given when flexible pipes and Type 1 manholes are proposed on the low side or rear of allotments with slopes in excess of 1 in 10. The possible increased sewer depth may result in a heavier class of sewer pipe or Type 2 manholes being required.

- where allotment earthworks involve the placement of fill to a depth of 2 m or greater over an existing or proposed sewer, house connections shall be provided into manholes in accordance with the Pine Rivers Shire Council standard drawings

- sewers shall not be located where future building envelopes are likely to limit or prevent reasonable access to the sewer, manholes and connections for maintenance purposes e.g. commercial and industrial buildings, where zero building lines are likely. In these areas it is preferable that the sewer be located along the front boundaries of allotments.

- Trunk sewers of 300 mm diameter or greater shall not be located within proposed allotments unless specifically approved by a Pine Rivers Shire Council engineer.

2.4.0 CONNECTION OF UNSEWERED DWELLINGS

Where an unsewered dwelling is located on land which is being subdivided, the developer shall connect the dwelling to the sewerage reticulation at the developer's cost as part of the subdivision work. The subdivider shall be responsible for the removal of any septic tanks and backfilling of the excavation to the satisfaction of a Pine Rivers Shire Council engineer.

Unsewered occupied dwellings adjacent to a subdivision or development may be connected to sewer at the discretion of a Pine Rivers Shire Council engineer. The owner of the dwelling shall be responsible for all costs associated with the private drainage connection in accordance with the relevant Pine Rivers Shire Council Policy.

2.5.0 TYPES OF SEWER PIPE

The minimum diameter for sewer pipes is 150mm.

The types of pipe allowable for use in sewers are as follows:-

Flexible Pipes

- Unplasticised Polyvinyl Chloride (uPVC) Class SN 4 (< 4.5m deep) - approved products only

- Unplasticised Polyvinyl Chloride (uPVC SN 8 (4.5m - 6.0m deep) - approved products only - Also Refer Section 2.3.7 of the Design Standards for Sewerage Works

- Glass Filament Reinforced Thermosetting Plastics (GRP) - special approval required

- Medium or High Density Polyethylene - special approval required

Rigid Pipes

- Ductile Iron Cement Lined Class K9 / K12 or PN 20 / PN35 - Cement Lined. Soil tests shall be carried out to determine the coating type required. A tar epoxy coating with the pipe installed in polythene sleeving is the minimum requirement. Cement lining shall be sulphate resistant or Calcium Aluminate mortar. Preferably the pipe socket and spigot shall be coated with a polymeric coating in accordance with AS 4158.

- Vitrified Clay Class 4

- Steel Reinforced Concrete - special approval and pipe types required

- Fibre Reinforced Concrete - special approval required

In industrial subdivisions, the sewer main and house connection branches shall be constructed in vitrified clay pipe only. The house connection branches shall be 150 mm diameter minimum and be constructed as inlets into manholes, unless an access chamber (manhole) is provided at the end of the house connection branch. The access chamber shall be located within the allotment being served and be as close as practical to the sewer.

Ductile iron pipes may be used where cover or depth to other services is insufficient and shall be used at creek crossings or other locations where the design requires the sewer to be aboveground.

Different types of pipe may be used if approved in any one particular system, but any change in type shall be made at a manhole unless otherwise approved by a Pine Rivers Shire Council engineer.

The family of PVC pipes and fittings shall be wrapped with bitumastic felt or polyethylene sleeving when laid with concrete stops or concrete surround.

2.6.0 MANHOLES

2.6.1 GENERAL

Manholes shall be constructed in accordance with the Pine Rivers Shire Council standard drawings and specifications and shall be used in the following locations:-

- changes of direction
- changes of grade
- intersections of sewers
- changes of sewer diameter or pipe material
- ends of sewer lines except where there is a maximum of two house connections to the end of the sewer and the distance from the end of the sewer to the next downstream manhole does not exceed 30 m

The minimum / maximum depths of manholes shall conform to the Pine Rivers Shire Council standard drawings. An allowance should be made for any potential future earthworks necessary to establish building platforms.

Manholes located in private property shall have concrete filled covers and cast iron frames. Manholes located in roadways or trafficable areas, including verges and parks etc. shall have cast iron covers and frames. Manholes located within parks, reserves and other areas subject to flooding or vandalism, and control manholes at pumping stations shall have bolt down cast iron covers and frames.

Manholes accepting pressure main discharges shall have bolt down cast iron covers and frames. These manholes shall be corrosion protected as per the Pine Rivers Shire Council standard drawing and must be the cast *in-situ* type. Pre-cast manholes shall not be used in this instance

Cast *in-situ* manholes Type 1 and / or approved pre-cast manholes shall be used for all sewer lines up to and including 375 mm diameter or sewer depths up to 6.0 m. Where larger diameter or deeper sewers are required, the manholes shall be Type 2.

The maximum spacing of manholes shall be 90 m centre to centre for sewer lines up to and including 450 mm diameter; for sewer diameters greater than this the maximum distance shall be 120 m.

Pre-cast manholes conforming to the Pine Rivers Shire Council specification for non-pressure pipelines and standard drawings may be used with the approval of a Pine Rivers Shire Council engineer.

The top of the manhole ring shall be 600 mm above ground in unmaintained areas of scrub or adjacent to creeks, 100 mm above finished ground surface in maintained open space and private property, 25 mm above finished ground surface in verges or flush with road pavement construction, trafficable areas or concrete footpaths.

Where possible, manholes should be positioned such that the top of the manhole ring is above the 1 in 20 year ARI flood level. Manholes in flood prone areas below the 1 in 10 year ARI shall be fitted with bolt down cast iron covers and frames.

2.6.2 CONTROL MANHOLES AT PUMP STATIONS

Control manholes at pumping station sites shall be a maximum of 10 m from the station unless otherwise approved.

2.6.3 PIPE CONNECTIONS TO MANHOLES

All pipe connections to manholes shall be constructed with stubs cast out into the manhole base, with short pipes immediately adjacent to the manhole in accordance with the Pine Rivers Shire Council standard drawing.

2.6.4 CONNECTION TO EXISTING MANHOLES

Connection to existing sewer manholes shall only be made at such times as approved by a Pine Rivers Shire Council engineer.

Where the existing downstream manhole is carrying live sewage, the connection to the manhole shall include an inspection opening (I0) or plain junction in lieu of the normal short pipe on the upstream side of the manhole. The line into the manhole shall be plugged and the inspection opening or plain junction shall be used for testing and pumping out of flushing water. The inspection opening or plain junction shall be capped and/or brought to the surface as directed by a Pine Rivers Shire Council engineer.

2.7.0 HOUSE DRAINS

Requirements for house drains are laid down in the standard sewerage by-laws of the Sewerage and Water Supply Act.

House drainage lines for other than industrial allotments shall be graded at 1:40 with a minimum cover at the head of the line of 0.6 m. A grade 1:60 and a minimum cover of 0.4 m are acceptable for control allotments only.

House drainage lines for industrial allotments are to be graded at a minimum of 1:60.

The types of pipes allowable for use in house drains are:-

- unplasticised polyvinyl chloride (uPVC) Class SN4 (≥ 150 ∅) or SN6 (< 150 ∅)
- vitrified clay

Vents on house drainage systems, connected to a sewer within 700 m downstream of a rising main discharge point, shall preferably be 100 mm diameter.

Where house drains are laid at a depths greater than those discussed in Section 2.8.3 of the Design Standards for Sewerage Work, (usually for large developments), the designer should give consideration to the class of pipe required.

2.8.0 LOCATION OF SEWERS, MANHOLES AND HOUSE CONNECTIONS

2.8.1 LOCATION OF SEWERS

Bearing and distances and / or distances shown on the drawings for the setting out of sewerage lines should only be used to assist in the setting out of these works. The required offsets for sewers from property alignments shall be nominated on the drawings. The drawings should state that the required offsets from property boundaries take precedence over the bearings and distances shown on the drawings and that the offsets shall be checked prior to and on completion of installation of the sewerage mains.

Where sewers are proposed through land other than that owned by the developer, written approval shall be obtained from the property owner and submitted to the Pine Rivers Shire Council with the design drawings. House connection branches and stubs out of manholes for future connections shall also be provided.

Where practicable, all sewer lines shall be located within properties on the following alignments:-

- 1.5 m from the property boundary for sewers located parallel to front and rear boundaries and
- 1.0 m from the property boundary for sewers located parallel to side boundaries

Where necessary, variations to the above alignments may be approved, provided the sewer location cannot be relocated. Manholes and sewers may be located within an envelope of 0.5m to 3.0m along a property frontage, but not more than 1.5m elsewhere.

The Pine Rivers Shire Council may require sewer lines to be located on alternative alignments where significant environmental features are to be retained.

Generally sewers shall be constructed at right angles or parallel to allotment boundaries, and not across boundaries at acute angles.

Where sewers are constructed through filled allotments, compaction tests confirming adequate compaction of the allotment filling must be provided to the Pine Rivers Shire Council prior to commencement of sewerage construction.

Where roof water lines are constructed in the property, the sewer shall be located between the property boundary and the roof water line. The house connection branch shall extend across the roof water line for a distance of at least 1 m.

All the Pine Rivers Shire Council parks or reserves shall be provided with a connection to the sewer at a location approved by a Pine Rivers Shire Council engineer.

Where areas external to the subdivision gravitate into the subdivision, sewers shall be extended to the boundaries of the subdivision to control these external areas.

Sewers in industrial estates shall not be located in the rear of the allotments, if practicable and shall have 150 mm diameter allotment connections. In areas which are zoned Industrial, Commercial or similar in nature, sewers shall not be located under possible building areas.

2.8.2 LOCATION OF MANHOLES

Manholes shall be located 1.0 m upstream of allotment boundaries. At the truncated section of a corner allotment, manholes shall be wholly in the allotment or wholly on the footpath, but not across the alignment.

In steep terrain, and where significant features prevent the installation of manholes and sewers on the standard alignments, a Pine Rivers Shire Council engineer may approve the location of the sewer manhole in the downstream property on a 1.0 m alignment outside of a property boundary. This shall be reliant on an alignment being available on the verge that is not in conflict with service the allocations shown on Pine Rivers Shire Council's standard drawings.

Where manholes are to be located in the footpath, prior approval from a Pine Rivers Shire Council engineer will be required.

Manholes shall be located at all changes in sewer grade, changes in sewer direction and intersections of sewers in accordance with Section 2.6.0 of the Design Standards for Sewerage Works. The manhole shall be positioned centrally over the sewer channels and not necessarily on the projected sewer centrelines, in accordance with the Pine Rivers Shire Council standard drawings.

Inlet sewers shall not be at an overly acute angle to the outlet sewer. The angle between the incoming sewer and outlet sewer centrelines shall not be less the 80^{o} to allow for channel construction. A Type C sewer inlet may be permitted with an angle no less than 60^{o} between inlet and outlet sewers.

A maximum of three inlet sewers or house connection inlets are permissible at any manhole.

2.8.3 LOCATION OF HOUSE CONNECTIONS

House connection branches adjacent to manholes shall be constructed as inlet entries to the manhole where practicable.

House connections shall not be constructed on sewers where the depth to invert exceeds 3 m or where the diameter of the sewer is 300 mm or greater. Where this is unavoidable, connections shall be constructed as inlets to manholes.

House connection branches shall be located generally 1.0 to 1.2 m upstream of the allotment boundary, at the lowest part of the allotment and at sufficient depth to serve the whole allotment. Generally, the desirable maximum depth to invert of the connection shall be 1.4 m except that in special circumstances a Pine Rivers Shire Council engineer may approve of a greater depth where this is necessary to control the whole allotment.

Under no circumstances should a design or construction include house connection depths in excess of 1.5 m without prior approval from a Pine Rivers Shire Council engineer.

Where a sewer is located in an adjoining property, the maximum length of the house connection branch from a sewer in the adjoining property shall be 5.0 m. The house connection branch shall extend a minimum of 1.0 m into the allotment being sewered.

House connections shall not be constructed across streets or reserves to enter sewer lines. Connections to a sewer located in the verge on the same side of the street or road may be accepted subject to approval from a Pine Rivers Shire Council engineer.

2.9.0 SPECIAL DEVELOPMENTS

2.9.1 GENERAL

Special developments are typically commercial and industrial building developments or group title, strata title and building unit plan developments of residential, commercial or industrial nature.

The designer should note that the provision of sewerage services including house drains to these developments is subject to the requirements of the Sewerage and Water Supply Act, in the same manner as a “normal” subdivisional development.

All sewerage works whether internal or external to the site, or both as the case may be, relevant or reasonably required in respect of the proposed development shall be provided at the developer’s cost.

In particular, the developer is required to meet the full cost of providing an appropriate sewerage system, with capacity sufficient to pass though his or her land, the design flow from all upstream catchments, as determined by a Pine Rivers Shire Council engineer, when such catchments are fully developed in accordance with the Pine Rivers Shire Council Planning Scheme.

2.9.2 EXTENT OF WORKS

The sewerage works shall extend from an approved discharge point to the upstream boundary of the development site unless otherwise approved by a Pine Rivers Shire Council engineer.

Where a sewer serves an upstream property, such sewer may be accepted by the Pine Rivers Shire Council as “Pine Rivers Shire Council sewer” subject to such sewer fully complying with the design and construction requirements of the Pine Rivers Shire Council design standards.

The balance of the sewerage system serving a particular development shall be “private sewer”, designed, constructed and maintained at the developer’s and or future property owner’s expense.

Private sewer, as distinct from house drain, shall comply with the design and construction requirements for sewers in accordance with the Pine Rivers Shire Council design standards.

House drains shall comply with the standard sewerage by-laws and the Sewerage and Water Supply Act.

2.9.3 DESIGN CONSIDERATIONS

Due to the relatively high proportion of building site coverage in special developments, particular care needs to be taken in the location of the sewerage system such that satisfactory access for maintenance or repairs is available at all times.

Building of structures or retaining walls over sewers should be avoided. The designers attention is drawn to relevant Pine Rivers Shire Council Policies dealing with this matter.

Where a development includes security measures, such as electronic gates, which may prevent or limit access to the Pine Rivers Shire Council sewer for maintenance or repair, arrangements are to be made for emergency access to the development by the Pine Rivers Shire Council staff. Such arrangements shall be to the satisfaction of the Pine Rivers Shire Council's General Manager Pine Water.

2.10.0 EXISTING SEWERS

Any connection or alteration of existing sewers is subject to the approval of Pine rivers Shire Council's engineer. Work shall not be performed on Council's sewers without prior written approval from Council's engineer.

Application for connection or alteration of Councils sewers shall be made in writing to Pine Rivers Shire Council, and shall include a site plan, detailed plan or sketch showing the location of the works, and the nature of the connection or alteration.

Where connection to an existing sewer is made as part of development works, full details of such connection, whether made by the Pine Rivers Shire Council or others, are to be designed and following construction, recorded on the "as constructed" drawings for the development.

2.11.0 SEWAGE PUMPING STATIONS

2.11.1 GENERAL

When gravity sewers can not serve a development, sewage pumping stations shall be designed in accordance with the Pine Rivers Shire Council standard drawing and specifications and shall comply with the Department of Natural Resources (Water Resources) Sewerage Guidelines.

A submersible sewage pumping station built to the Pine Rivers Shire Council standard drawings and incorporating two submersible sewage pumps, with motor size up to 22 kW each will be regarded as a “standard” installation. Any station with larger than 22 kW pumps will be regarded as a “non-standard” installation.

The Pine Rivers Shire Council has prepared a set of standard and computer aided drawings showing its requirements for submersible sewage pump stations. The consulting engineer shall prepare site specific drawings based on these requirements.

The CAD drawings show:-

- general arrangement
- design information (to be completed and issued to the Pine Rivers Shire Council prior to final pumping station design drawings being submitted)
- “as constructed” details (to be completed and forwarded with final “as constructed” drawings)

Pumping stations shall be located as far as possible from existing or proposed habitable dwellings. In no case shall a new pumping station be sited closer than 100 m from residential allotments unless otherwise approved by the Pine Rivers Shire Council General Manager Pine Water.

Pumping stations shall be located such that the top of the pumping station is 100 mm above the 1 in 20 year ARI flood event, unless otherwise approved by a Pine Rivers Shire Council engineer. The switchboard shall be located such that the bottom of the switchboard is 300 mm above the 1 in 100 year ARI flood event.

Where required by a Pine Rivers Shire Council engineer, an approved security fence is to be provided around the pumping station site.

2.11.2 SEWER PUMPING STATION DESIGN CRITERIA

Sewer pumping stations shall be designed in accordance with the requirements shown in Table 2.11.0, and the Department of Natural Resources and Mines Guidelines for the Design of Sewerage Systems.

Table 2.11.0

SEWER PUMP STATION DESIGN

Item	Description	Adopted Design Parameter	Comments
1	Pump Motor Drives	Variable Speed drives may only be utilised when approved by the Manager Electrical and Mechanical Services, Pine Water	Generally variable speed drives will only be required when the pump station discharges directly to a wastewater treatment plant or in the case of pump stations where duty points are outside the range of the curves shown on Pine Rivers Shire Council's pump selection criteria.
2	Number of Pumps	Two pumps preferred unless approved otherwise by the Manager Electrical and Mechanical Services, Pine Water	Pumps are operated on a duty, standby cycle. This cycle is not automatic; the duty pump is alternated manually. Accordingly the number of pump starts per hour may not be varied from that specified in Items 3 and 4 of this Table
3	Fixed Speed Pumps Wet Well Operating Volume (kl)	$\frac{0.9 \times Q}{N}$	Where Q is the flow rate (l/s) of a single pump operating and N is the allowable number of pump starts (as per QDNRM Guidelines).The number of pump starts (N) should be not more than 10 for pumps less than 50kW rating. For pumps greater than 50kW rating, according to manufacturers recommendations
4	Variable speed Pumps Wet Well operating Volume (kl)	$\frac{0.9 \times Q}{N}$	Q = discharge of a single pump (l/s) at 50Hz. N = maximum number of starts per hour recommended by the motor manufacturer

Item	Description	Adopted Design Parameter	Comments
5	Bottom Water Level (BWL)	a) For fixed speed pumps; in accordance with Pine Rivers shire Council standard drawings b) For variable speed pumps; minimum of 100mm above top of motor casing	In the case of variable speed drives a permanent water level must be maintained above the motor casing to ensure continuous cooling of the motor.
6	Well Diameter	Minimum internal well diameter – 2000mm Internal well diameter may be increased in increments of 500mm depending upon considerations such as: a) Clearance around pumps and pipework b) Depth of pump station, and c) Geotechnical conditions	
7	Top Water Level (TWL)	Must be set 300mm below invert level of inlet sewer	
8	Operating Range (TWL – BWL)	Generally this range should be between 600mm and 2800mm subject to maximum and minimum depths shown on Pine Rivers Shire Council standard drawings	
9	Duty Point	With static head corresponding to top water level and pipe friction factors as follows determine Duty Points 1 and 2: • Hazen Williams C = 100 (dia. $\leq$ 300mm) • Hazen Williams C = 120 (dia. $>$ 300mm) **Duty Point 1 – Single Pump Operation:** C_1 x ADWF (l/s) vs. Static Head + Friction Head (m) **Duty Point 2 – Duty Pump operating in parallel with Standby Pump:** 5 x ADWF (l/s) vs. Static Head + Friction Head (m)	where: • Static Head = Highest Point in Rising Main – Water Level in Wet Well • Friction Head is derived form the Hazen Williams formula • C_1 = Peaking Factor shown in Drawing Number A3-99480 of the QDNRM Guidelines

Item	Description	Adopted Design Parameter	Comments
10	Pump Selection	Select a pump that is capable of operating at both duty points and which operates within the range of the system resistance curves that are determined by the Conditions detailed below: **Condition 1 – Normal Operating Condition lower limit system resistance curve:** Static head corresponding to Top Water Level with rising main friction factors as follows: C = 120 (dia. $\leq$ 300mm) C = 140 (dia. $>$ 300mm) **Condition 2 – Normal Operating Condition Upper limit system resistance curve:** Static Head corresponding to Bottom Water Level with rising main friction factors as follows: C = 100 (dia. $\leq$ 300mm)	The friction factors used in pump selection depend on Top and Bottom Water Level so as to ensure the fullest possible range of heads are taken into account in the selection of the pumps
11	Emergency Storage	6 hours ADWF	May vary dependent on location of overflow. Emergency storage may include gravity sewers, manholes and pump station wet well volume above TWL
12	Duty Pump Capacity	Not less than C_1 x ADWF	C_1 is interpreted from Drawing 99480 of the QDNRM Guidelines where the contributing population is the sum of the population contributing to all upstream pump stations plus the population of subject pump station's catchment
13	Standby Pump Capacity	Equivalent to capacity of the duty pump	
14	Total Pump Station Capacity	Not less than 5 x ADWF	As per QDNRM Guidelines

2.11.3 VENTILATION

The pumping station shall be provided with a properly designed ventilation system incorporating vent pole of appropriate height (depending on topography) and airtight access openings. If directed by the Pine Rivers Shire Council General Manager Pine Water, a mechanical ventilation system shall be installed whereby the air space in the pumping station shall be exchanged not less that 12 times per hour on a continuous basis.

Typical ventilation details are shown on the Pine Rivers Shire Council standard drawings.

The fan, if required, shall be protected against corrosion both internally and externally and shall be protected against vandalism. The fan shall be appropriately sized to suit the standard ducting and vent pole arrangements, while meeting the performance requirements.

If required by a Pine Rivers Shire Council engineer, the pumping station shall be smoke tested before it is commissioned, to determine the likely path of exhausted gases. If, in the opinion of a Pine Rivers Shire Council engineer, the direction of travel of gases is likely to cause a nuisance to existing or proposed habitable dwellings, an odour control unit shall be installed. This shall take the form of an activated carbon filter or any other approved device, suitable for the purpose.

The height of the pump station vent pole shall be determined to the satisfaction of a Pine Rivers Shire Council engineer. The 7.2 m vent pole shall only be used on “standard” installations remote from adjacent dwellings or structures.

Where a larger “non-standard” or “major” installation is proposed or where odour nuisance is likely, a larger vent pole shall be provided.

2.11.4 CALCULATIONS

The consulting engineer shall submit calculations showing the basis for pump and pressure main sizing and for the thickness of the pumping station floor (or plug if constructed by the caisson method), necessary to prevent flotation of the station. The sizing of pump and pressure main shall take account of capital, operating and whole of life costs and shall be to the satisfaction of a Pine Rivers Shire Council engineer.

2.11.5 APPROVALS AND LICENCES

The consulting engineer shall be responsible for obtaining any necessary approvals or licences associated with the construction and operation of a sewage pumping station or overflow. Evidence of such approvals or licence shall be provided prior to approval of engineering drawings for the sewerage works.

All costs associated with the obtaining of any approval or licence shall be borne by the developer.

2.11.6 WATER SERVICE

A water service incorporating an approved reduced pressure zone (RPZ) valve shall be provided in accordance with the Pine Rivers Shire Council standard drawing. Where required by a Pine Rivers Shire Council engineer the standard 25 mm diameter water service shall be upgraded to a 40 mm diameter service.

2.11.7 MAJOR SEWAGE PUMPING STATIONS

Major sewage pumping stations are typically dual well type housing pumps with motors in excess of 50 kW.

These stations by nature will need to be specifically designed to suit the design flow requirements and location with consideration given to the impact of the station on the amenity of the adjacent area.

Switchboards shall be pad mounted and housed in a suitable brick structure designed to the satisfaction of the Pine Rivers Shire Council Manager Sewerage Services. Provision shall be made within the structure for toilet facilities consisting, as a minimum, of one pan and hand basin.

The Pine Rivers Shire Council may determine that a pumping station housing pumps of less than 50 kW is a “major station” due to its location, strategic importance or other condition, and accordingly the requirements of this section shall apply.

Where required by a Pine Rivers Shire Council engineer an approved security fence is to be provided around the pumping station site.

2.11.8 FLOW METERS

Where required by the General Manager Pine Water, flow meters shall be provided on the discharge line from the sewage pumping station.

Detailed design including nature, size and location of pit together with size and type of meter and associated fittings shall be to the satisfaction of the General Manager Pine Water.

2.11.9 CONTROL OF SEPTIC SEWAGE

Extended detention times within a sewerage system gives rise to the potential for sewage to become septic and create odour and corrosion problems.

Where the total detention time exceeds six hours, appropriate methods to prevent the sewage from becoming septic will be required by the General Manager Pine Water.

The issues of odour and corrosion control within sewerage pressure mains is discussed in Section 2.14.3 of the Design Standards for Sewerage Works. Consideration is also to be given to the potential for sewage to become septic due to low flow volume during the early period of operation of a new pumping station.

Appropriate treatments shall be used to control septicity of the sewage to the satisfaction of the General Manager Pine Water. Treatments which may be considered for the control of septicity within the pumping station include:-

- oxygen injection
- chemical injection
- organic concentrate dosing (“Pro-Bac” or approved equivalent)
- other methods approved by the General Manager Pine Water

The merits of a particular proposed treatment method are to be subject to cost/benefit analysis and final acceptance of a particular treatment method is to be subject to approval from the Pine Rivers Shire Council General Manager, Pine Water.

Preference should be given to systems or treatment processes which will function for the long term control of odour and corrosion within the pumping station and rising main.

2.12.0 SEWAGE PUMPS AND ANCILLARY EQUIPMENT

2.12.1 SEWAGE PUMPS

Sewage pumps shall be of the non-clogging submersible type unless otherwise specified by the General Manager Pine Water. The Pine Rivers Shire Council standard drawings for sewage pumping stations have been prepared on the basis of the use of submersible sewage pump sets.

The Pine Rivers Shire Council has implemented a pump rationalisation programme which is based on the KSB Ajax (Australis) range of submersible sewage pumps. Curves for these pumps are given on the standard pump selection chart included with the standard drawings.

The general requirements of Sections 4.6 of the Department of Natural Resources (Water Resources) Sewerage Guidelines discussing the selection of Pumping Plant and Sewage Pumping Equipment shall be applied to the design and selection of sewage pumping equipment.

The total installed pumping capacity of a station should be based on the Department of Natural Resources (Water Resources) Sewerage Guidelines or not less than the maximum design flow (refer to Section 2.3.2 of the Design Standards for Sewerage Works).

The selection of appropriate sewage pumping and ancillary equipment shall be to the satisfaction of the Pine Rivers Shire Council Manager Electrical Mechanical Services.

The consultant should plot the calculated duty point for the pumps on to the standard pump selection chart, and select the pump which is closest, but not inferior to, the required duty. Pumping units other that KSB Ajax (Australis) will be considered by the Pine Rivers Shire Council providing they are modified to suit the KSB Ajax (Australis) pedestal base.

For non standard installations the consultant should plot the required duty point on to the standard pump selection chart, select a pump and forward this information to the Pine Rivers Shire Council for checking against other non standard pumps currently in service. An opportunity to rationalise may exist if the proposed duty can be matched to a pump already in service.

If a non standard pump does not match any others because of size, capacity or manufacturer, the Pine Rivers Shire Council will reserve the right to request an additional complete pump to be supplied as a replacement pump.

2.12.2 SWITCHBOARDS AND ANCILLARY EQUIPMENT

Switchboards for standard installations will be manufactured to the Pine Rivers Shire Council standard drawings.

Non standard switchboards should be manufactured of the same materials and configured as near as possible to the Pine Rivers Shire Council standard switchboard to the satisfaction of the Pine Rivers Shire Council Manager Electrical Mechanical Services.

Flow meters, where required, shall be linked to the Pine Rivers Shire Council telemetry system. The flow meter and telemetry equipment shall be housed in a weatherproof enclosure or control building.

All pumping equipment, motors, switchboards, ventilation fans, flow meters, odour control and telemetry equipment, and testing of all equipment shall comply with the relevant Pine Rivers Shire Council Specification.

When tenders for supply of pumping equipment are called, details of the equipment offered shall be submitted to the Pine Rivers Shire Council Manager Electrical Mechanical Services for approval. The contract shall not be let for the supply of pumping equipment until Manager Electrical Mechanical Services approval in writing is received.

2.13.0 CONTROL OF SEWAGE OVERFLOWS

2.13.1 GENERAL

Every effort is to be made to minimize the potential for sewage overflows from sewage pumping stations and the sewerage system generally.

The section of the Department of Natural Resources Sewerage Guidelines dealing with the control of sewerage overflows shall apply to the control of sewage overflows.

2.13.2 OVERFLOW STORAGE

The following criteria detail the Pine Rivers Shire Council requirements for overflow storage at sewage pumping stations:-

- emergency overflow storage should be provided in accordance with the Department of Natural Resources (Water Resources) “Guidelines for Planning and Design of Sewerage Schemes”

- there shall be a minimum of six hours’ storage available before overflow at pump stations with telemetry

- emergency overflow storage in excess of six hours may be required at new pump stations at the discretion of the Pine Rivers Shire Council General Manager Pine Water.

- emergency overflow storage may be provided for within the reticulation network at the discretion of the Pine Rivers Shire Council General Manager Pine Water. That is, pump station, branch lines, manholes and larger than required sewers may be used toward storage containment. The design must ensure that scouring velocities of 0.9 m per second are obtained at the maximum daily flow (2 x ADWF)

- off-stream storage may be used if the required storage cannot be fully provided for within the reticulation or where required by the General Manager Pine Water. Drawings showing how this is to be achieved must be submitted to a Pine Rivers Shire Council engineer for approval.

- off-stream storage must be designed to keep sewage from developing an odour nuisance, and to ensure that all material is returned to the sewer when the peak flows in the sewer have abated

- switchboards shall include telemetry equipment, to be supplied and installed to the satisfaction of the Pine Rivers Shire Council Manager Electrical Mechanical Services

2.13.3 INSTALLATION OF TELEMETRY COMPONENTS

All necessary telemetry equipment is to be supplied and installed as part of development works.

The Pine Rivers Shire Council reserves the right to carry out the installation and commissioning of telemetry systems components. Such installation and commissioning shall be carried out at the developer’s cost under the relevant Pine Rivers Shire Council Policy.

Contractors may carry out work on components of the system if prior to the commencement of the work they are certified in writing by the General Manager, Pine Water as competent to carry out such work as authorised. Contractor's personnel will be issued certificates of competency in the following areas with respect to the telemetry system:-

- radio system (aerial cable less than 3 m)
- radio system (aerial cable greater than 3 m)
- input/output module installation
- input/output module configuration
- remote installation commissioning
- control system software configuration

2.14.0 PRESSURE MAINS

2.14.1 DESIGN

The need for a sewerage pumping station and associated pressure main shall be determined to the satisfaction of the Pine Rivers Shire Council General Manager Pine Water.

Every effort is to be made to minimise the number and length of pressure mains within the sewerage system.

Table 2.14.0

PRESSURE MAIN DESIGN

Item	Description	Adopted Design Parameter	Comments
1	Flow Equation	Hazen Williams	
2	Minimum Diameter	100mm – unless approved otherwise by the Manager Electrical and Mechanical Services, Pine Water	In accordance with Section 4.1 of the QDNRM Guidelines
3	Friction Factors	Refer Item 10 in Table 2.11.0	
4	Minimum Velocity (on a daily basis)	0.75 m / s	In accordance with Section 4.1 of the QDNRM Guidelines. To prevent the deposition of solid material such as grit
5	Preferred Minimum Velocity	1.5 m / s	To provide for slime stripping on a regular basis
6	Maximum Velocity	2.5 m / s	To prevent damage to pipe lining
7	Configuration	Rising Mains should be sized to optimise the balance between reduction of detention times and life cycle cost. Factors to be considered include but not be limited to: - • Population growth • Staging • Operational features to provide for maintenance and replacement activities • Minimisation of energy costs Detention times(9reduction of odours)	
8	Interconnection of Rising Mains from Different Pump Stations	Only with the approval of the General Manager Pine Water. Generally interconnection of rising mains from different pump stations will not be approved unless there are substantial economic and operational benefits	

Sewer pressure mains shall be designed generally in accordance with the requirements of Department of Natural Resources and Mines Guidelines and the criteria in Table 2.14.0, and the Pine Rivers Shire Council requirements as set out in these design standards and specifications.

Detailed analysis of the proposed pressure main shall be carried out by the consultant to determine the effect of "water hammer" and any necessary remedial works shall be incorporated in the design to the satisfaction of the Pine Rivers Shire Council General Manager Pine Water.

Where the impact of a possible failure of a sewerage pressure main is significant, e.g. where system storage is limited or repair response times can not be guaranteed, the General Manager Pine Water may require that a pressure main be constructed using twin pipes with a combined design capacity equivalent to a single larger pipe.

Pipe materials acceptable for pressure sewer main construction are as follows:-

- Unplasticised polyvinyl chloride (uPVC) Class PN12 minimum ductile iron compatible. (colour to be sewer grey unless otherwise approved by a Pine Rivers Shire Council engineer)
- Modified Polyvinyl Chloride (MPVC) Class PN12
- Optimised Polyvinyl Chloride (OPVC) Class PN12
- Ductile iron cement lined pipes, Class PN20, PN35, K9, and K12 – sulphate resistant or Calcium Aluminate mortar. Soil tests shall be carried out to determine the coating type required. A tar epoxy coating with the pipe installed in polythene sleeving is the minimum requirement.
- Glass filament reinforced thermosetting plastics (G.R.P.) - special approval required
- Mild steel cement lined - special approval required
- Cast iron or ductile iron fittings, coated internally and externally with fusion bonded nylon (FBN) or fusion bonded epoxy (FBE)

Pressure mains shall be located on an approved verge alignment excepting if a location is approved within private property, in which case they shall be laid centrally in a minimum 4.0 m wide approved easement.

Generally, sewer pressure mains less than 300 mm diameter shall be located on a 1.5 m alignment from the property boundary on the opposite side of the road reserve to any existing or proposed water reticulation mains.

For rising mains 300 mm diameter and larger a special alignment within the road reserve and or increased easement width may be required as determined by the Pine Rivers Shire Council General Manager Pine Water.

The minimum cover for pressure mains shall be 1.2 m under roadways and 1.0 m elsewhere.

Longitudinal sections shall be provided for all pressure mains showing all service crossings and hydraulic grade levels for the entire length of the main under static and dynamic operation.

Pressure mains shall not be laid within 1.5 m of parallel potable water lines. All crossings of such lines shall have a minimum clearance of 300 mm.

Where a sewer pressure main can not be laid 1.5 m from a parallel potable water line, the sewer shall be laid such that it's obvert is 500 mm below the potable water line.

2.14.2 VALVES, AIR RELEASES, AND SCOUR POINTS

Pressure mains shall have section valves every 500m unless required otherwise by a Pine Rivers Shire Council engineer.

Scour valves shall be located at low points in the longitudinal profile of the pressure main or as required by a Pine Rivers Shire Council engineer. These units shall be housed and marked in accordance with the relevant standard drawing.

The scour outlet shall be directed to an adjacent sewer manhole, pump out chamber or other point approved by a Pine Rivers Shire Council engineer.

Intermediate high points on the pressure main shall be vented by remote vent poles constructed in accordance with the Pine Rivers Shire Council standard drawings.

Where required by a Pine Rivers Shire Council engineer an isolating valve shall be provided on the vent line between the rising main and the vent pole.

All section valves, scour valves and isolating valves shall be resilient seated sluice valves manufactured in accordance with AS 2638.

When the hydraulic grade line, determined from hydraulic analysis of the rising main, is likely to result in discharge of sewage from the vent pole, an alternative approved air release is to be provided.

The configuration of the manual air release shall be constructed in accordance with the relevant Pine Rivers Shire Council standard drawings. The system shall be valved, and housed in a suitable chamber and marked to the satisfaction of a Pine Rivers Shire Council engineer.

2.14.3 CONTROL OF ODOUR AND CORROSION

Where required by the Pine Rivers Shire Council General Manager Pine Water, pressure mains shall be treated to minimize odour and corrosion.

Acceptable treatments which may be considered for the treatment of sewage within pressure mains include:-

- oxygen injection
- chemical injection
- organic concentrate dosing ("Pro-Bac" or approved equivalent)

- well washdown (sprinkler) system ("auto well washers" or similar products)
- other methods approved by the Pine Rivers Shire Council General Manager Pine Water.

The merits of a particular proposed treatment method are to be subject to cost / benefit analysis and final acceptance of a particular treatment method is to be subject to approval from the Pine Rivers Shire Council General Manager Pine Water.

2.14.4 PRESSURE MAIN DISCHARGE

Pressure mains shall discharge into an approved vented discharge manhole in accordance with the Pine Rivers Shire Council standard drawings.

Pressure mains shall not discharge immediately upstream of any line off which house connection branches are located. The location and design of a rising main discharge shall be to the satisfaction of a Pine Rivers Shire Council engineer.

Detailed calculations shall be provided which determine the point in the receiving sewer that the pumped flows have attenuated such that when combined with the average dry weather flow (ADWF) in the receiving sewer, the combined pumped flow plus the average dry weather flow do not exceed the maximum flow on a normal day (2 x ADWF) or where the receiving sewer carrying the combined flow will flow at less than 40% full (0.4 x depth). House connection branches shall not be located on the receiving sewer upstream of this point in the receiving sewer.

The above requirements may result in the need to provide a gravity sewer separate from the reticulation system between the rising main discharge point and the approved connection point to the general sewerage reticulation system.

2.15.0 VEHICULAR ACCESS TO SEWAGE PUMPING STATIONS

2.15.1 GENERAL

In preparation of the design plans for a sewage pumping station, the consultant shall provide detailed engineering drawings for vehicular access to the pumping station including vehicle turning areas.

2.15.2 GEOMETRIC DESIGN

Geometric design of the access shall be to the satisfaction of a Pine Rivers Shire Council engineer and take into account the following:-

- access by standard medium rigid vehicle (11 m radius turning template)
- access by "special" vehicles e.g. articulated tanker if oxygen injection is included at the station
- maximum grade of 1:10 for gravelled access, 1:6 for sealed access
- adequate vehicle manoeuvring areas for design vehicle (manoeuvring templates may be used)
- lifting of pumps by crane truck standing on level area adjacent to pump well
- position of vent pole, switchboard and other equipment clear of the lifting position for the crane truck
- minimum access width of 3.5 m (except for turning and manoeuvring areas)
- adequate visibility at intersection of the access and adjacent roadway
- suitable intersection / access design from the passing street or roadway in accordance with Pine Rivers Shire Council design standards.

2.15.3 DRAINAGE

Access to the pumping station shall include any necessary drainage or culverts such that the access is not inundated from the runoff resulting from a 1 in 5 year A.R.I design storm. The access shall remain trafficable in the 1 in 10 year ARI design storm.

A Pine Rivers Shire Council engineer may require that concrete kerbing and or channelling be provided, together with any necessary pipe drainage, where the access is likely to collect concentrated stormwater flows.

2.15.4 PAVING AND SEALING

The minimum requirement for other than major pumping stations is that an all weather gravel access is provided. The maximum grade for an unsealed gravel access is 1 in 10.

Accesses with grades in excess of 1 in 10 or serving "major pumping stations" or pumping stations adjacent to residential properties shall be sealed with a two coat bitumen or 25 mm asphaltic concrete surfacing.

Access pavements shall be designed for the following traffic loadings:-

- minor stations - 2.3×10^3 ESAs
- major stations - 4.5×10^3 ESAs

Access pavement design shall be generally in accordance with the relevant Pine Rivers Shire Guideline.

2.16.0 OPERATION AND MAINTENANCE MANUALS

At the time of commissioning and site testing of each pumping station, a draft manual in A4 format contained in a fully labelled heavy duty plastic folder shall be provided to the Pine Rivers Shire Council. Should the manual not be provided, then the pumping station will not be tested or accepted as having reached practical completion. The manual shall contain information for the operation and maintenance of each item of mechanical, electrical or other equipment installed under the contract and relevant performance test data, together with copies of all relevant "as constructed" drawings.

The information contained in the manual shall comply with the Pine Rivers Shire Council specification for "Submersible Sewage Pumping and Ancillary Equipment", and the relevant Pine Rivers Shire Design Guidelines.

2.17.0 ENVIRONMENTAL PROTECTION

It is the Pine Rivers Shire Council intention that the environmental aspects of any site or project are given close consideration.

The consultant and contractor's attention is drawn to the requirements of relevant Environmental Protection Legislation.

Where works are undertaken adjacent to watercourses or other environmentally significantly sites, priority is to be given to maintaining the existing vegetation and the environmental characteristics of the site.

All works are to be carried out, and reinstatement completed, to the satisfaction of a Pine Rivers Shire Council engineer.

Where sewerage works are carried out as part of a subdivision or other development, erosion and sediment control plans are to be prepared as part of the development plans.

Where sewerage works are carried out externally to or separately from development sites, separate erosion and sediment control plans are to be prepared to the satisfaction of a Pine Rivers Shire Council engineer.

The consultant's attention is drawn to Section 2.11.4 of the Design Standards for Sewerage Works regarding any necessary approvals or licenses dealing with environmental issues associated with sewerage works.

2.18.0 APPROVAL OF DRAWINGS

Construction shall not commence prior to approval of all drawings by a Pine Rivers Shire Council engineer.

The consulting engineer shall submit a full set of drawings covering all aspects of the works including sewers, pumping stations and pressures mains.

Engineering drawings shall comply with relevant Pine Rivers Shire Council Design Guidelines.

The Pine Rivers Shire Council reserves the right to recover any relevant costs from a consultant who, in the opinion of the Pine Rivers Shire Council's General Manager Pine Water, has not performed satisfactorily in the preparation of "design" or "as constructed" drawings.

Where a sewerage project includes the supply of pumping equipment, details of the equipment offered shall be submitted to the Pine Rivers Shire Council Manager Electrical Mechanical Services. The contract shall not be let until the Manager Electrical Mechanical Services approval in writing is received.

The contractor is required to submit drawings showing the general arrangement of pumps and pipework, switchboard construction and layout, power and control circuitry. Installation of telemetry equipment shall be shown.

A copy of these drawings shall be submitted to the Pine Rivers Shire Council Manager Electrical Mechanical Services for approval and authority to commence manufacture shall not be given to the contractor until this approval is received.

2.19.0 "AS CONSTRUCTED" INFORMATION

The supply of complete accurate "as constructed" information is considered as an essential element of any sewerage works.

Prior to the "on-maintenance" inspection of sewers, transparencies, certified by the consulting engineer, showing "as constructed" information as required by relevant Pine Rivers shire Council Design Guidelines shall be lodged with a Pine Rivers Shire Council engineer.

Additional information for pumping and associated equipment such as works and site tests, sites and switchboard wiring, shall be submitted in an approved format. The Pine Rivers Shire Council requirements for operation and maintenance manuals and for information for its maintenance management register shall be observed.

The works will not be regarded as "on-maintenance" until all of the above detailed information has been received and approved by a Pine Rivers Shire Council engineer.

2.20.0 INSPECTION AND MAINTENANCE

The requirements for inspection and maintenance of sewerage works shall be at the discretion of the Pine Rivers Shire Council General Manager Pine Water.

With respect to subdivisional sewerage works, these details are set out in the components of the Pine Rivers Shire Council Planning Scheme.

After the off maintenance inspection of sewers, the manhole lids shall be sealed in a manner approved by the Pine Rivers Shire Council General Manager Pine Water.

2.21.0 TESTING OF SEWERS, MANHOLES, PUMPING EQUIPMENT AND PRESSURE MAINS

All sewers, manholes, pumping equipment and pressure (rising) mains shall be tested to the satisfaction of a Pine Rivers Shire Council engineer prior to being accepted on maintenance.

The procedures for testing are set out in the relevant Pine Rivers Shire Council Specifications.