

CITY OF WEST KELOWNA

BYLAW No. 0249

A BYLAW TO REQUIRE AND SET STANDARDS FOR THE PROVISION OF
MUNICIPAL WORKS AND SERVICES IN CONNECTION WITH THE DEVELOPMENT
AND SUBDIVISION OF LAND

CONSOLIDATED FOR CONVENIENCE TO INCLUDE

BYLAW 0249.01, 0249.02

WHEREAS the Council of the City of West Kelowna has the authority under Part 14 of the *Local Government Act* to regulate and require the provision of works and services in respect of the subdivision and development of land within the City's boundaries;

THEREFORE BE IT RESOLVED that the Council of the City of West Kelowna in open meeting assembled, HEREBY ENACTS AS FOLLOWS:

1.0 Part 1: GENERAL PROVISIONS

1.1 TITLE

This Bylaw may be cited as the "CITY OF WEST KELOWNA WORKS AND SERVICES BYLAW No. 0249, 2018".

1.2 DEFINITIONS

1.2.1 In this Bylaw, unless the context otherwise requires:

CERTIFICATE OF SUBSTANTIAL COMPLETION means a certificate issued by the Owner's Engineer certifying that the stage of completion of the work has been reached when the work is ready for use or is being used for its intended purpose, or the total of the incomplete, defective and deficient work can be completed at an estimated cost of no more than 3% of the total value of the work.

CITY means the City of West Kelowna.

DEVELOPMENT means any work, including the construction, alteration or repair of a building that requires a building permit under the Building Bylaw.

ENGINEER means a person who is registered or licensed as an Engineer in good standing under the *Engineers and Geoscientists Act* and for the purposes of this Bylaw may include the Owner's Engineer(s).

GENERAL MANAGER means the General Manager of Development Services or the General Manager of Engineering and Public Works.

GENERAL MANAGER OF DEVELOPMENT SERVICES means the person appointed by the Chief Administrative Officer as the City's General Manager of Development Services and includes that person's delegate.

GENERAL MANAGER OF ENGINEERING AND PUBLIC WORKS means the person duly appointed by the Chief Administrative Officer as the City's General Manager of Engineering and Public Works and includes that person's delegate.

HIGHWAY includes a street, road, lane, bridge, thoroughfare, walkway and any other way open to public traffic, but does not include rights-of-way on private property.

LANDSCAPE PROFESSIONAL means a member of the British Columbia Society of Landscape Architects or other suitably qualified landscape designer as approved by the City.

OWNER means the registered owner of land proposed to be developed or subdivided, and for the purposes of this Bylaw may include the owner's authorized agent.

PANHANDLE PARCEL means a parcel that abuts a highway by means of a narrow strip of land providing sufficient width for vehicular access.

PARCEL means any lot, block, or other area in which real property is held or into which real property is subdivided but does not include a highway.

Unless otherwise defined herein, all words or expressions in this Bylaw shall have the same meaning as any similar words or expressions contained in the *Land Title Act*, the *Community Charter*, the *Local Government Act* and the *Strata Property Act*.

1.3 INTERPRETATION

A reference in this Bylaw to any bylaw, policy or form of the City is a reference to the bylaw, policy or form as amended, revised, consolidated or replaced from time to time.

1.4 PURPOSE

This Bylaw regulates and requires the provision of works and services to service any subdivision or development of lands within the City.

1.5 APPLICABILITY

This Bylaw shall apply to all subdivision or development of land within the City.

1.6 WORKS AND SERVICES REQUIREMENTS AT SUBDIVISION

Any Owner making application for subdivision is required to provide works and services within the subdivision in accordance with the standards established under Part 3.0 (WORKS AND SERVICES STANDARDS) of this Bylaw.

Where the subdivision abuts a highway, the Owner is required to provide works and services within the highway in accordance with Part 3.0 (WORKS AND SERVICES STANDARDS) of this Bylaw.

1.7 WORKS AND SERVICES REQUIREMENTS AT BUILDING PERMIT

Any Owner making application for a building permit is required to provide works and services within any abutting highway in accordance with Part 3.0 (WORKS AND SERVICES STANDARDS) of this Bylaw.

1.8 INCORPORATION OF APPENDICES

The following appendices form part of this Bylaw:

APPENDIX A – DESIGN AND CONSTRUCTION STANDARDS FOR WORKS AND SERVICES

APPENDIX B – WORKS AND SERVICES CONSTRUCTION AGREEMENT

APPENDIX C – WARRANTY SECURITY AGREEMENT

APPENDIX D – COMMITMENT TO DESIGN AND FIELD REVIEW BY OWNER'S ENGINEER

APPENDIX E – CERTIFICATION OF BYLAW COMPLIANCE BY OWNER'S ENGINEER

APPENDIX F – COMMITMENT BY OWNER AND ENGINEER

Bylaw No. 0249.01 adopted August 24, 2021, deleted Section 1.9 in its entirety and replaced it with the following Section 1.9:

1.9 DELEGATED AUTHORITY

1.9.1 The General Manager is authorized by Council to administer and enforce the provisions of this bylaw.

1.9.2 The Approving Officer is delegated the authority to exempt a parcel from the applicable minimum parcel frontage on a highway specified in s. 512(1)(a) of the Local Government Act.

Bylaw No. 0249.02 adopted September 20, 2022, deleted "Zoning Bylaw 0154" and replaced it with "the City's Zoning Bylaw"

1.9.3 The Approving Officer is delegated the authority to exempt a parcel from the applicable minimum parcel frontage on a highway specified in the City's Zoning

Bylaw, provided that the minimum frontage is not reduced by more than 10 percent. In the case of a panhandle Parcel, the Approving Officer may permit a parcel frontage exemption of more than 10 percent if the panhandle is at least 6.0 m wide.

Bylaw No. 0249.02 adopted September 20, 2022, deleted "Zoning Bylaw 0154" and replaced it with "the City's Zoning Bylaw"

- 1.9.4 Where the Owner wishes to exempt a parcel from the applicable minimum parcel frontage on a highway specified in the City's Zoning Bylaw that exceeds 10 percent of the minimum frontage, a frontage exemption must be obtained from Council.
- 1.9.5 The Approving Officer is delegated the authority to execute Works and Services Construction Agreements, Warranty Security Agreements and Maintenance Agreement documents.

2.0 PART 2: ADMINISTRATIVE MATTERS

2.1 DESIGNS, PLANS AND SUPPORTING DOCUMENTS

- 2.1.1 The Owner shall submit design plans, drawings and specifications for works and services required by this Bylaw in respect of the Owner's subdivision or development, including any required studies such as, but not limited to, a Functional Servicing Report prepared by the Owner's Engineer, all in accordance with Appendix A. These shall be submitted to the Approving Officer in the case of applications to subdivide land and to the Building Inspector in the case of building permit applications. The Approving Officer and Building Inspector shall refer such plans, drawings, and specifications to the General Manager for confirmation of compliance with this Bylaw and approval.
- 2.1.2 The General Manager may require the Owner to direct the Owner's Engineer or Landscape Professional to provide supplementary designs, plans and supporting documents to the extent that they are, in the General Manager opinion, reasonably required to determine whether proposed works and services comply with this Bylaw and will function as intended.
- 2.1.3 In the event that works and services required by this Bylaw will serve lands other than the land being subdivided or developed, the General Manager may require that the works and services be designed on the basis of the actual service area and, for the purposes of Section 3.1.7, may request that the Owner's Engineer identify for the City's consideration the portion of the works and services that in the Engineer's opinion constitute excess or extended services as defined in s. 507 of the *Local Government Act*; the lands that in the Engineer's opinion benefit from the excess or extended services; and a proposed formula that in the Engineer's opinion allocates the cost of excess or extended services among the benefiting lands in proportion to the benefit.

2.2 COST OF WORKS AND SERVICES BORNE BY OWNER

The Owner shall, subject to Section 3.1.7, bear sole responsibility for all costs related to the design and provision of works and services required under this bylaw.

2.3 PROFESSIONAL CERTIFICATION

- 2.3.1 The Owner shall retain at their sole expense, an Engineer to design and inspect the construction of the works and services required by this Bylaw, and to certify that the works and services have been designed, constructed and installed in accordance with this Bylaw and the design drawings approved by the General Manager.

- 2.3.2 The Owner shall provide to the General Manager the Commitment by the Owner and Owner's Engineer set out in Appendix F.
- 2.3.3 The Owner's Engineer shall provide to the General Manager:
- (a) The Commitment to Design and Field Review by the Owner's Engineer set out in Appendix D prior to the approval of the subdivision or issuance of the building permit in respect of which works and services are required; and
 - (b) The Certification of Bylaw Compliance by the Owner's Engineer set out in Appendix E upon substantial completion pursuant to a Works and Services Construction Agreement or Warranty Security Agreement.
- 2.3.4 The Owner shall retain a Landscape Professional to design and inspect the installation of landscape works required by this Bylaw and to certify that the works have been designed, constructed and installed in accordance with this Bylaw and the design drawings approved by the General Manager.

2.4 TERMINATION OF CONSULTING SERVICES

The Owner must advise the General Manager of any change in the engagement of the Owner's Engineer or Landscape Professional during the course of the design and construction of the works and services whether resulting from the Owner's termination of the Engineer or Landscape Professional or from their resignation. The Engineer or Landscape Professional who is retained in their place must provide to the General Manager a Commitment to Design and Field Review by Owner's Engineer in the form set out in Appendix D, and a Commitment by Owner and Engineer set out in Appendix F, confirming the scope of that professional's engagement.

2.5 COST ESTIMATES

- 2.5.1 The Owner's Engineer and Landscape Professional shall prepare detailed cost estimates for the construction of all required works or services, including their respective design, construction, inspection, monitoring and contract administration services related thereto, for the purposes of Section 2.9.1.
- 2.5.2 The cost estimate shall be representative of current engineering design, construction services and construction costs for the works and services, and shall be subject to the approval of the General Manager.
- 2.5.3 For certainty, the cost estimates shall not include the cost of works to be provided by third parties including, without limitation, the cost of providing electricity, natural gas, community mailbox, telephone, cablevision or other telecommunications facilities, but shall include the cost of installing all civil works including ducts and conduits for any such services in City highways.

2.5.4 The General Manager may require the Owner's Engineer or Landscape Professional to update an estimate provided under Section 2.5.1 during the course of construction of the works and services to which the estimate pertains, to ensure that the estimate accurately reflects their cost. The updated estimate shall be subject to the approval of the General Manager.

2.6 CHANGE OF OWNERSHIP

If there is a change of ownership of land that is the subject of an application for subdivision or building permit that requires works or services under this Bylaw, the City may require written authorization from the new owner prior to proceeding with the application.

2.7 STATUTORY RIGHTS-OF-WAY, COVENANTS, AND EASEMENTS

2.7.1 Where the Engineer demonstrates that the proposed works or services cannot reasonably be accommodated within existing highways or rights-of-way, and establishes an alternative and satisfactory servicing design that is approved by the General Manager, the Owner shall obtain in favour of the City, at the Owner's sole expense and effort, a statutory right-of-way for the works and services and register it in the Land Title Office in priority to all financial encumbrances.

2.7.2 All legal documents for statutory rights-of-way, covenants, and easements shall be substantially in the City's standard form for such instruments or in another form satisfactory to the General Manager.

2.7.3 The Owner shall provide the City with copies of any statutory rights-of-way, covenants and easement documents and plans immediately upon registration.

2.8 PERMIT FOR WORK ON MUNICIPAL LAND

A Municipal Highway Permit is required for any proposed works undertaken within existing Municipal highways and rights-of-way.

2.9 WORKS AND SERVICES AGREEMENT AND WARRANTY SECURITY AGREEMENT

2.9.1 Where an Owner is required by this Bylaw to provide works and services in connection with a subdivision or development, and wishes to obtain a building permit or approval of a subdivision in advance of completing construction of the works and services, the Owner shall enter into a Works and Services Construction Agreement in the general form set out in Appendix B.

2.9.2 Where works and services are to be installed on City lands, the Owner shall enter into a Works and Services Construction Agreement in the general form set out in Appendix B.

2.9.3 Where an Owner has provided works and services in connection with a proposed subdivision or development prior to receiving a Certificate to Commence Construction or building permit, no subdivision shall be approved or building permit issued unless:

- (a) The General Manager has issued a Certificate to Commence Construction and receives a Certificate of Substantial Completion of the works and services, indicating that the works and services are complete and the Owner has satisfactorily maintained, repaired and corrected all defects and deficiencies in the works and services becoming apparent within 12 months of the date of substantial completion of the works and services or such further period as the General Manager may require in relation to portions or components of the works and services; or
- (b) The General Manager has received and approved a Certificate of Substantial Completion of the works and services indicating that the works and services are complete subject to the correction of any defects or deficiencies specified in the Certificate and the repairs and the correction of defects and deficiencies required during the term of a Warranty Security Agreement, and the Owner has entered into such an agreement in the general form set out in Appendix C.

2.10 INSURANCE

2.10.1 The owner must provide and maintain, at their expense, and at all times until the Certificate of Bylaw Compliance is issued, Comprehensive General Liability Insurance coverage in respect of the insured's activities on City highways and statutory right-of-way, covering premises and operations liability, contingent liability with respect to contractual liability and automobile liability for owned, non-owned and hired units. The limits of liability must be not less than \$5,000,000.00 for each occurrence for bodily injury, death and damage to property.

2.10.2 The policy or policies must be with a company or companies, and on such terms, as are acceptable to the City. Each policy must provide that it cannot be cancelled, lapsed, or materially altered without at least thirty (30) days' notice in writing to the City by registered mail, must name the City and its officials and employees as an additional insured, and must contain a cross-liability clause.

2.10.3 The Owner must deliver a copy of each insurance policy with a letter from the insurance provider confirming the policies meet or exceed these requirements, to the City prior to the commencement of construction of the works and services.

3.0 PART 3: WORKS AND SERVICES STANDARDS

3.1 GENERAL MATTERS

3.1.1 All works and services required in connection with the development or subdivision of land under this Bylaw shall be designed and constructed in accordance with the following standards and specifications:

- (a) Appendix A;
- (b) Transportation Association of Canada “Geometric Design Guide for Canadian Roads” (TAC);
- (c) Manual of Uniform Traffic Control Devices for Canada (MUTCD);
- (d) BC Ministry of Transportation and Infrastructure’s “Manual of Standard Traffic Signs & Pavement Markings”;
- (e) Street Sign Road Marking Manual for the City of West Kelowna (2014);
- (f) Fire Underwriters Survey “Water Supply for Public Fire Protection (FUS);
- (g) Canadian Electrical Code (CEC);
- (h) American National Standards Institute/Illuminating Engineering Society RP-8-14 Roadway Lighting Manual (ANSI/IES RP-8-14);
- (i) Master Municipal Contract Documents (MMCD), which is incorporated into this Bylaw; and
- (j) MMCD Supplementary Irrigation System Specifications of West Kelowna.

3.1.2 A reference in this Bylaw to the MMCD is a reference to the Municipal Infrastructure Design Guideline Manual and the Master Municipal Specifications and Standard Detail Drawings in Volume II of the Platinum Edition of the Master Municipal Construction Documents (2009) published by the Master Municipal Construction Documents Association, and includes:

- (a) The definitions of such terms used in the Master Municipal Specifications and Standard Detail Drawings as are set out in the General Conditions in Volume II; and
- (b) All documents supplemental to the Master Municipal Specifications, the Standard Detail Drawings and the relevant definitions set out in the General Conditions that are issued from time to time by the Association, but

excludes all references to measurement and payment in the Master Municipal Specifications.

- 3.1.3 Where Appendix A sets out City specifications or standard detail drawings that are identified as replacing specifications or drawings contained in the MMCD, the Appendix and not the MMCD shall govern the matter.
- 3.1.4 As a condition of the approval of a subdivision, the Owner shall provide within the subdivision all of the works and services required by this Bylaw, including service connections to any park being dedicated within the subdivision.
- 3.1.5 The City will advise the Owner of the classification of each road within or adjacent to any particular development, generally in accordance with the City of West Kelowna Master Transportation Plan. For each road classification, the works and services requirements and the cross-section of these highways will be in accordance with the typical road cross sections in the Standard Detail Drawings shown in Schedule 9 of Appendix A.
- 3.1.6 The Owner shall provide the works and services required by this Bylaw on every highway immediately adjacent to land being subdivided or developed, up to the centreline of such highway. Where the works and services on the adjacent highway have been constructed to an alternate standard than those required by this Bylaw, the Owner shall reconstruct the works and services to the Bylaw standard. If the General Manager determines that it would not be in accordance with good engineering practice to do so, the works and services may be constructed to the existing standard or to an intermediate standard determined by the General Manager.
- 3.1.7 Where the intended use of a proposed subdivision or development places a demand on off-site municipal works or services that in the opinion of the General Manager cannot be accommodated without improvements, the Owner shall provide appropriately designed and implemented improvements to mitigate these impacts in their entirety. These services shall include, but are not limited to, water treatment, storage or pumping facilities, sewage pumping or treatment facilities, highways or highway intersections, or drainage works.
- 3.1.8 If works or services required by this Bylaw constitute excess or extended services under s. 507 of the *Local Government Act*, the City and the Owner shall enter into an agreement that identifies the extent of the excess or extended services, the benefiting lands, and the latecomer charges to be levied in respect of the benefiting lands. Alternatively the parties may provide for those matters in a works and services agreement entered into pursuant to s. 509 of the *Local Government Act*.

3.2 HIGHWAYS

- 3.2.1 The Owner of land being subdivided must construct all highways within the subdivision in accordance with the Road Classification Plan, Standard Detail Drawings and construction standards in Appendix A.
- 3.2.2 The Owner shall construct or reconstruct all highways that are immediately adjacent to the land being subdivided or developed, up to the centreline of the highway.
- 3.2.3 In addition to the works and services required in accordance with the Road Classification Plan and road Standard Detail Drawings outlined in Appendix A, all highway works, and services required under this bylaw shall include:
- (a) Landscaping of all portions of the highway not improved with paved road, curb, and gutter, walkway, trail or sidewalk, including planting of street trees, in accordance with Appendix A, Section 2.7.4;
 - (b) Underground irrigation of all landscaped areas, in accordance with Appendix A Section 2.7.5 to ensure the viability of street trees or other landscaping;
 - (c) Transit bays where required by the General Manager to service existing or potential public transit services;
 - (d) Overhead or underground electrical and telecommunications wiring and street lighting;
 - (e) Traffic control devices and equipment;
 - (f) Street name signage; and
 - (g) Standard traffic signs and pavement markings.

3.3 DRIVEWAYS AND ENTRANCEWAYS

The Owner shall construct all necessary driveways and entranceways in accordance with the Traffic Bylaw and Appendix A of this Bylaw.

3.4 WALKWAYS AND TRAILS

Where required as a condition of subdivision, the Owner shall construct all required pedestrian walkways or trails, including extensions or existing walkways or trails and improvements to existing walkways or trails, in accordance with Appendix A.

3.5 GRADING AND DRAINAGE CONTROL

- 3.5.1 The Owner shall provide a stormwater management plan prepared by the Owner's Engineer, to be designed and constructed in accordance with Appendix A for all storm drainage works. All proposed subdivision or development shall be provided with an onsite storm drainage system or a system of drainage works that collect and convey stormwater runoff from the proposed subdivision or development to City drainage works, receiving watercourse or groundwater recharge.
- 3.5.2 As a condition of the approval of subdivision or the issuance of a building permit, the Owner shall provide an extension of, or improvements to, the City's storm drainage system within that portion of the highway immediately adjacent to the lands being subdivided or developed across the entire frontage of the parcel, in accordance with Appendix A.
- 3.5.3 The Owner's Engineer will be required to show to the General Manager that the receiving watercourse or municipal storm system will be satisfactorily sized to accept the flows and that the environmental impact will be minimized.
- 3.5.4 The Owner shall provide grading, and erosion & sediment control plans, prepared by the Owner's Engineer in accordance with Appendix A. These plans will specify how the land will be graded, drained and protected from erosion. The stormwater management plan and erosion & sediment control plans will need to ensure that flooding and erosion impacts to abutting properties will be minimized.

3.6 WATER SUPPLY AND DISTRIBUTION

- 3.6.1 The Owner of land being subdivided must provide within the subdivision, a water supply, and distribution system designed and constructed in accordance with Appendix A and the "Water Supply for Public Fire Protection – A Guide to Recommended Practice" published by Fire Underwriters Survey, including connection to the municipal water supply and distribution system.
- 3.6.2 As a condition of the approval of subdivision or the issuance of a building permit, the Owner shall provide an extension of, or improvement to, the City's water supply and distribution system within that portion of the highway immediately adjacent to the lands being subdivided or developed across the entire frontage of the parcel, in accordance with Appendix A.
- 3.6.3 All parcels being created by a subdivision shall be connected to the City's water supply and distribution system by means of a suitably sized connection that is designed and constructed in accordance with Appendix A.

- 3.6.4 Connection of all strata developments to the City's water supply and distribution system must be by means of a single, metered service connection for domestic flow with backflow prevention that supplies water and hydrants in the strata plan by means of private water supply and distribution works.
- 3.6.5 Despite subsections 3.6.1 through 3.6.3, for land that is zoned RU4, A1, F1, I4, I5, and P1, each parcel is to be provided with an onsite water supply when a community water system is not available. In these zones, if no part of the land being subdivided has an available watermain with adequate capacity, the Owner shall provide an onsite potable water supply system that complies with Appendix A and the *Drinking Water Protection Act*.
- 3.6.6 Where City park space is required as a condition of development a fully automatic underground irrigation system may be required including all necessary preparatory work, electrical wiring, and plumbing connections.

3.7 SANITARY SEWER

- 3.7.1 The Owner of land being subdivided must provide within the subdivision a sanitary sewer system that is designed and constructed in accordance with Appendix A.
- 3.7.2 The Owner shall, as a condition of the approval of subdivision or the issuance of a building permit, provide an extension of, or improvements to, the City's sanitary sewer system within that portion of the highway immediately adjacent to the lands being subdivided or developed across the entire frontage of the parcel, in accordance with Appendix A.
- 3.7.3 All parcels being created by a subdivision shall be connected to the City's sanitary sewer system by means of a suitably sized, single service connection that is designed and constructed in accordance with Appendix A.
- 3.7.4 Connection of bare land strata subdivisions to the City's sanitary sewer system must be by means of a single service connection that provides service to the individual strata parcels by means of private sewage collection works.
- 3.7.5 Despite subsections 3.7.1 through 3.7.3, for subdivision or development of land that is designated zone A1, F1, I2, I3, I4, I5, I6, P1, RU2, RU3, RU4 and RU5, or for parcels greater than 1 ha, each parcel is to be provided with an onsite sewage disposal system when a community sewer system is not available. In these cases, if no part of the land being subdivided or developed has an available sewer main with adequate capacity, the Owner shall provide an onsite sewage disposal system that complies with Appendix A and the Sewerage System Regulation under the *Public Health Act*.

- 3.7.6 Notwithstanding section 3.7.5, in no case shall a parcel be serviced by onsite sewage disposal if a community sewer system is available to service the parcel.
- 3.7.7 For parcels within the Agricultural Land Reserve, onsite sewage disposal may be permitted under the LRC Homesite Severance Policy for parcels less than 1 hectare if approved by the Agricultural Land Commission.

3.8 WORKS AND SERVICES EXEMPTIONS

- 3.8.1 Servicing requirements prescribed in this Bylaw shall not apply in the case of subdivision where the parcel created or developed is to be used solely for the unattended equipment necessary for the operation of:
- (a) A community water or sewer system; and
 - (b) Any other similar public service facility or utility.
- 3.8.2 Works and services requirements of this Bylaw shall not apply in the case of building permit applications for:
- (a) Parks buildings or structures;
 - (b) Residential accessory buildings;
 - (c) Additions to single detached dwellings or duplexes.; and
 - (d) New construction of single detached dwellings or duplexes.
- 3.8.3 Works and services requirements of this Bylaw shall not apply in the case of parcel boundary adjustments that do not create additional parcels.
- 3.8.4 Where A1 zoned land or land located within the Agricultural Land Reserve is proposed to be subdivided, the applicant shall upgrade the fronting road(s) to a rural standard.

3.9 PAYMENT IN LIEU OF PROVIDING WORKS AND SERVICES

The General Manager may require an Owner to pay to the City, in lieu of constructing or altering all or a portion of the works and services required by this Bylaw, cash in the amount not to exceed 110% of the cost of designing and constructing or altering the works and services as of the time of approval of the subdivision or issuance of the building permit including any land acquisition costs. If the General Manager determines on the basis of sound civil engineering practice or cost considerations that the works or services should be constructed or altered at a later time or concurrently with the construction or alteration of works and services serving adjacent or nearby parcels of land, the City shall deposit the funds

into a reserve fund established for the construction or alteration of the works and services.

3.10 WORKS REQUIREMENTS FOR PHASED AND PARTIAL DEVELOPMENTS

Where a building permit is for partial or phased development of the parcel, the General Manager may require the applicant to:

- (a) Construct a percentage of the offsite work proportional to the percentage of the site being developed; OR
- (b) Provide cash-in-lieu for a proportion of the offsite work in accordance with section 3.9.

4.0 PART 4: COMPLIANCE AND ENFORCEMENT

4.1 OFFENCES AND PENALTIES FOR NON-COMPLIANCE

4.1.1 Any Owner determined to be in non-compliance with this Bylaw is, on summary conviction, liable to a maximum fine of \$10,000, plus the cost of prosecution, for each offence, in addition to any other remedy for an infraction of this Bylaw.

4.1.2 Each day that a condition of non-compliance remains in existence or is permitted to exist shall constitute a separate offence.

4.2 COMPLIANCE ORDERS

4.2.1 The General Manager may issue a Compliance Order to the Owner or any other person who is found to be in contravention of this Bylaw, which order may:

- (a) Include an order to Stop Work or otherwise cease construction or development of works or services on City highways or within City rights-of-way;
- (b) Require compliance with the provisions of this Bylaw within a period of time set out in the Compliance Order; and/ or
- (c) Include an order to complete unfinished work or rectify deficient works or services within a period of time set out in the Compliance Order.

4.2.2 If a Compliance Order is issued, no approval to proceed with any aspect of the works or services shall be granted until:

- (a) The General Manager is satisfied that the remedial action taken or proposed will comply with the requirements of this Bylaw; and,
- (b) All fees or charges imposed in connection with the Compliance Order, including but not limited to fees or charges for inspection and testing, and for reconnection to or reinstating of any works or services, have been paid by the Owner.

4.2.3 All costs associated with rectifying Bylaw non-compliance shall be the sole responsibility of the Owner.

4.3 PROHIBITIONS

4.3.1 No person shall:

- (a) Subdivide or undertake development of land within the City except in accordance with this Bylaw and all other applicable City bylaws;

- (b) Undertake the construction of works or services on a highway or right-of-way unless authorized by the General Manager; or
- (c) Construct any works and services required under this Bylaw for a subdivision or a development except under the supervision of the Owner's Engineer, or under the supervision of a Landscape Professional in respect of any landscaping work.

4.4 COMMENCEMENT OF WORK WITHOUT AUTHORIZATION

- 4.4.1 No person shall commence any construction or installation of works or services related to a subdivision or development until the General Manager has issued a Certificate to Commence Construction and the City has issued any required development or building permit.
- 4.4.2 Section 4.4.1 does not apply to the construction or installation of erosion or sediment control works required on an emergency basis to prevent erosion or prevent the siltation of a watercourse.
- 4.4.3 If Works and Services are installed without approvals required under this Bylaw, they shall not be connected to the City's systems until:
 - (a) The Works and Services have been certified by the Owner's Engineer as having been designed and constructed in compliance with this Bylaw;
 - (b) Certified as-constructed drawings have been accepted by the City;
 - (c) The Owner has paid to the City the works and services administration and inspection charges that would have been imposed under the Fees and Charges Bylaw if the Owner had obtained the City's approval of the Works and Services prior to their installation;
 - (d) The City has inspected the Works and Services and notified the Owner in writing that no construction deficiencies have been identified;
 - (e) The Owner has granted to the City and deposited in the Land Title Office in priority to all financial charges a statutory right-of-way in the City's standard form for any portions of the Works and Services that are not located in City highways or existing statutory rights-of-way; and
 - (f) The Owner has made an application for connections to the City's systems.
- 4.4.4 Where the General Manager inspects the Works or Services pursuant to this Bylaw and the Works or Services are found to be incomplete, deficient or otherwise not

in compliance with this Bylaw, the Owner shall pay to the City the re-inspection fee imposed by the Fees and Charges Bylaw.

5.0 PART 5: ENACTMENT

5.1 REPEAL AND TRANSITION

5.1.1 District of West Kelowna Works and Services Bylaw No. 120, 2012 is repealed.

5.1.2 The works and services requirements and standards in Bylaw No. 120 shall apply in respect of applications for subdivision or building permit that were made in complete form prior to the date of adoption of this Bylaw, unless the applicant requests in writing to have the application dealt with in accordance with this Bylaw.

5.2 SEVERABILITY

If any section, subsection, clause, sub-clause or phrase of this Bylaw is for any reason held to be invalid by the decision of any Court of competent jurisdiction, that section, subsection, clause, sub-clause or phrase shall be struck from the Bylaw and any such decision shall not affect the validity of the remaining portions of this Bylaw.

READ A FIRST, SECOND AND THIRD TIME THIS 10TH DAY OF JULY, 2018
ADOPTED THIS 24TH DAY OF JULY, 2018

MAYOR

CITY CLERK



Engineering Services
2760 Cameron Road
West Kelowna, BC V1Z 2T6
Tel (778) 797-8840
Fax (778) 797-1001

**WORKS AND SERVICES
BYLAW NO. 0249**

APPENDIX A

**DESIGN AND CONSTRUCTION STANDARDS FOR WORKS AND
SERVICES**

SCHEDULES 1 – 9



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FOREWORD/INTRODUCTION

The Design and Construction Standards component of City Bylaw No. 0249 shall govern the design, construction and installation of works or servicing.

Where any conflict occurs between the specifications/standard detail drawings identified in this document and/or another code or regulation enforceable in the City, the General Manager shall determine the applicable standard to be implemented.

Throughout this document the words "shall", "must", and "is required" indicate the imperative. The word "should" indicates the desired or intended result without being mandatory. The word "may", and like expressions, indicate a choice, an election, or a permitted procedure according to the context.

Scope:

These design standards shall apply to the construction of works and servicing required as a condition of subdivision or development, including but not limited to:

1. Drawing Standards
 - Highways
 - Asphalt Surfaces
 - Curb/Gutter
 - Sidewalk
 - Boulevard
2. Water Supply and Distribution Systems
 - System
 - Water Main and Appurtenances
 - Water Facility
3. Sanitary Sewer Systems
 - System
 - Facilities
 - Septic System
4. Storm Water Management
 - System
 - Facilities
 - Erosion
 - Grading
5. Utilities
 - Electrical/Communications
 - Natural Gas
 - Street Lighting

1.0 SCHEDULE 1 – DRAWING STANDARDS

1.1 GENERAL

These requirements pertain to the preparation of design drawings for all works required to be constructed and installed under the provisions of this bylaw. This section outlines the minimum Standards and requirements that the City of West Kelowna will accept for Design and "Record" submissions for engineering work(s).

All drawings provided must be consistent and clear. Drawings must provide all additional information necessary to indicate current features of the site, proposed works and completed development. Drawings must illustrate the proposed design and installation techniques to address any non-typical situations. Drawings shall clearly show the existing and proposed locations of all utilities using offsets from parcel boundaries of rights-of-way. Limits of construction must be shown with future extension works to be provided at a lesser line weight.

1.2 STANDARD DETAIL DRAWINGS

Where a standard drawing exists as part of this Bylaw, it shall be sufficient to refer to the appropriate drawing by referencing the drawing number and date of issue. Where a standard drawing does not exist, or is unsuitable for a particular case, detail drawings shall be prepared to accurately portray the various elements of the installation. Where no standard is defined in this Bylaw for the preparation of a drawing to portray a particular service, structure, or other item, instructions and requirements may be obtained by discussion with the General Manager.

1.3 DRAWING STANDARDS

1.3.1 SHEET SIZE

Drawings shall be submitted using the following standard sheet sizes (outside dimensions):

- A1 – 841 mm x 594 mm (border to be no more than 810 mm x 540 mm)

1.3.2 TITLE BLOCK

The title shall describe the contents of the drawing (e.g. key plan, road, etc.) and shall clearly indicate the location of the works by road name and civic addresses.

1.3.3 SCALES

The following scales shall be used:

- Location Plans 1:2500; 1:5000; 1:10000
- Composite / Legend Plans 1:500
- Details 1:5 to 1:250

- Plan/Profile
- Horizontal 1:250 or 1:500
- Vertical Exaggeration 1:5 or 1:10
- Cross-Sections
- Horizontal 1:100 or 1:50
- Vertical Exaggeration 1:1, 1:2 or 1:4

Alternate scales which provide increased clarity that are specific to project parameters may be permitted for use upon approval by the General Manager.

1.3.4 DIMENSIONS AND UNITS

The following conventions must be used:

- Dimensions and units must be shown in metric.
- All distances, elevations and coordinates shall be given in metres to accuracy of three (3) decimal places for design drawings and two (2) decimal places for record drawings.
- Grades shall be given as a percentage to accuracy of two (2) decimal places.
- Areas shall be in square metres rounded to the nearest square metre.
- All pipe sizes shall be given in millimetres as per ASTM specifications using:
 - 1" = 25.0 mm
- Existing imperial dimensions, except for pipe sizes, are to be soft converted using the factors:
 - 1" = 25.4 mm
 - 1' = 0.3048 m

1.3.5 TEXT

Lettering is to be an open style of Vertical Gothic (e.g. Leroy or AutoCAD – 'Romans'). All lettering is to maintain a 1:10 ratio between plotted text height and plotted pen thickness. The following standards must also apply:

- The minimum plotted text height shall be 1.5 mm.
- The maximum plotted text height shall be 5 mm.
- The standard lettering height is 2 mm.

1.3.6 DRAWING REQUIREMENTS

- Existing works refers to the works which were constructed and installed prior to the current subdivision or development.
- Proposed works refers to the works which are to be constructed and installed during the current subdivision or development phase.
- Future works refers to any works that will be constructed or installed in future phases of subdivision or development.

- All drawings shall provide Registered Plan numbers (if applicable).
- All drawings shall show a corresponding legend.
- All drawings shall incorporate reference to official geodetic control monuments (where available).
- A local benchmark note shall appear in each drawing.
- Existing information shall be shown in background.
- Proposed information shall be bolded or foreground line weight.
- North arrow shall be referenced on all drawings on the top right corner.
- Match lines to be shown on details as required.
- Chainage on a plan-profile shall increase from left to right.

1.3.7 All drawings are to be stamped and signed by an Engineer

1.4 DIGITAL ENGINEERING SUBMISSIONS (.PDF)

Digital files shall be provided with the drawing submission (.pdf), and be completed in accordance with the current requirements of the City. The Owner's Engineer shall ensure compatibility with City application software prior to initiating any detailed design.

The Owner's Engineer shall use the most recent version of the City's drawing standards and conventions.

The following drawings must be included in the submission:

- Cover Sheet
- Key Plan
- Storm Water Management Plan
- Lot Grading Plan
- Composite Utility Plan (including all SRWs and Easements)
- Plan/Profile Drawings for all City Rights-of-Way
- Street Lighting Plan
- Erosion and Sediment Control Plan
- Pavement Marking and Signage Plan
- Traffic Control Plan
- Curb Return Geometry

All drawings must be signed and sealed by an Engineer.

1.5 GEODETIC CONTROL

Where available monuments exist, a digital drawing file with the following spatial characteristics shall accompany development applications:

Map Projection:	Universal Transverse Mercator
Horizontal Datum:	NAD83 - 1983 North American Datum
Horizontal Units:	Metres

The graphical representation of each geodetic control point in the drawing must be geographically positioned to third order accuracy, and shall include the following information for each control point:

- UTM Northing (e.g. 4759528.620 m)
- UTM Easting (e.g. 643968.440 m)
- Marker Type (e.g. GPM, SCP, BM)
- Marker ID (e.g. SCP-517)
- Elevation (e.g. 579.812)
- Description (e.g. North West corner of Lot 32 at parcel boundary)

1.6 RECORD DRAWINGS (.DWG/ .PDF)

Digital files shall be provided with the record drawing submission (both .dwg and .pdf), and be completed in accordance with the current requirements of the City. All .dwg files shall include all XREF files and be georeferenced where applicable (UTM Zone 11 NAD 83). The Owner's Engineer shall ensure compatibility with City application software prior to initiating any detailed design.

The following drawings must be included in the record submission:

- Cover Sheet
- Key Plan
- Storm Water Management Plan
- Lot Grading Plan
- Composite Utility Plan (including all SRWs and Easements)
- Plan/Profile Drawings for all City Rights-of-Way
- Street Lighting Plan
- Erosion and Sediment Control Plan
- Pavement Marking and Signage Plan
- Curb Return Geometry

2.0 SCHEDULE 2 – HIGHWAYS

2.1 GENERAL

The geometric design of highways shall conform with standards set out in the latest edition of the “Geometric Design Guide for Canadian Roads” issued by the Transportation Association of Canada (TAC), Master Municipal Construction Documents MMCD (referenced herein), the TAC “Manual of Uniform Traffic Control Devices for Canada” (MUTCD), BC Ministry of Transportation and Infrastructure’s “Manual of Standard Traffic Signs and Pavement Markings”, Street Sign Road Marking Manual for the City of West Kelowna (2014).

Where applicable, specific standards or standard detail drawings shall be used for design as supplied in this bylaw.

Where the General Manager determines that technical factors may require additional highway width to construct any proposed highway, the Owner may be required to provide or otherwise secure land of sufficient size to permit the construction of said highway in accordance with Section 513(3) of the *Local Government Act*.

2.2 ROAD CLASSIFICATIONS

For the purposes of the design standards for works and services established under this Bylaw, highways within the City are classified in accordance with the City of West Kelowna Master Transportation Plan.

2.2.1 ARTERIAL ROADWAYS

Arterial Roads are intended to provide mobility and to restrict access. The primary purpose of Arterial Roads is to carry through traffic within, and between, jurisdictions.

2.2.2 COLLECTOR ROADWAYS

Collector Roads provide a mix of accessibility and mobility. The primary traffic service function is to carry traffic between Local Roads, other Collector Roads and the Arterial Road system.

2.2.3 MINOR COLLECTOR ROADWAYS

Minor Collector Roads feature curb and gutter, two-sided sidewalks, roadway for shared vehicle and bicycle use, and on-street parking. This cross-section is to be applied on major reconstruction of existing roads and with new development.

2.2.4 LOCAL ROADS

Local Roads generally serve only the abutting properties and are intended for lower volumes. Local Roads include lanes and cul-de-sac streets.

2.2.5 LANES

Lanes are permitted for residential and commercial developments where the implementation of a wider right-of-way is impractical due to topographical or environmental constraints. Lanes are intended to provide secondary access to subdivisions or development.

Private lanes that provide primary access to parcels shall be designed to good engineering practices and located on statutory rights-of-way and/or an easement agreement to provide public access, and must include an approved turn around for vehicles.

2.2.6 CUL-DE-SACS

The proposed road network should be designed to minimize the number of cul-de-sacs, so as to maximize network redundancy and provide additional means of ingress/egress. Cul-de-sacs should generally be limited to single detached residential development areas.

Temporary cul-de-sacs, allowed when approved by the General Manager, that are greater than 90 m in length and are intended to be extended in the future shall be designed with a temporary asphalt apron and shall be constructed entirely on the applicant's lands. A statutory right-of-way is required for turning radiuses.

- Dead-end barricades and appropriate "Checker board" signage must be located at the ends of any temporary cul-de-sacs (for safety and to restrict access to adjacent lands).
- Where there is no other access to the subdivision, a "No Exit" sign shall be placed at the entrance.
- Roads ending with cul-de-sacs should feature an "Cul-de-sac" sign posted conspicuously on the entry to the roadway.
- When cul-de-sacs are proposed, a plan showing gutter line and pavement spot elevations must be submitted for approval. The grade around the gutter line of a cul-de-sac bulb shall not be less than 0.5% nor greater than 5%.
- Cul-de-sacs shall be designed so that the grade between the bulb center-point and the end of the bulb, at any point of the radius, shall not exceed 8%.
- Preference shall be given to cul-de-sac grading that drains the cul-de-sac towards the intersecting roadway. If the cul-de-sac must be graded with drainage towards the bulb, the subdivision design must provide for overland flow of the major flood routing. The grade of a downhill cul-de-

sac shall not exceed 8%. Sidewalks are to be included in cases where there is a connecting trail or, pathway.

- Pedestrian connections are to be included between abutting cul-de-sacs.
 - Cul-de-sacs shall not exceed the fire-fighting capability of the fire department including but not limited to: cul-de-sac length;
 - Turning radius; and
 - Proximity and access of hydrant(s).

2.3 GEOMETRIC DESIGN

Unless otherwise specified in these standards, the geometric design of roadways shall be in accordance with the "Geometric Design Guide for Canadian Roads" (TAC). Safety, operation, and overall design philosophy must be respected and are deemed to be of higher priority than meeting the minimum and maximum values presented in the table.

2.3.1 MINIMUM AND MAXIMUM LONGITUDINAL ROAD GRADIENT

The minimum longitudinal road gradient is 0.5%, while maximum road grades are established for each road classification and are further defined in Table A-1.

2.3.2 HORIZONTAL CURVES

Horizontal road curves shall be designed in accordance with the provisions of Table A-1.

2.3.3 VERTICAL CURVES

Vertical road curves shall be designed in accordance with the provisions of Table A-1.

2.3.4 VEHICLE TURNING MOVEMENTS

Geometric design should be evaluated with CAD-based vehicular turning software (e.g. AutoTURN, Vehicle Tracking, or other equivalent) to ensure design vehicles can operate within the roadway. Analysis should be done for all new and major changes to accesses, intersection alignments and lanings, and turnarounds.

TABLE A-1 – GEOMETRIC DESIGN PARAMETERS				
*Refer to TAC Guidelines for Design of all Arterial and Collector Roads				
DESIGN CRITERIA	ROAD CLASSIFICATION			
	LANE	LOCAL	COLLECTOR	ARTERIAL
Minimum Grade	0.5%	0.5%	0.5%	0.5%
Maximum Grade	12%	12%	10%	8%
Maximum Grade for Through Roads at Intersection	In accordance with TAC Geometric Design Guide for Canadian Roads			
Vertical Alignment / Cross Slope at Intersection	In accordance with TAC Geometric Design Guide for Canadian Roads			
Maximum Grade for Stop Roads at Intersection	4%	4%	4%	4%
Minimum Curb Radius at Intersection with Arterial Road	9.0 m	9.0 m	9.0 m	12 m
Minimum Curb Radius at Intersection with Collector Road	9.0 m	9.0 m	9.0 m	12 m
Minimum Curb Grade	0.5%	0.5%	0.5%	0.5%
Minimum Curb Grade at Radius of Intersections	0.8%	0.8%	0.8%	0.8%
Cul-de-Sac Minimum Outside Curb Radius (distance from center of cul-de-sac bulb to back of curb outside circumference of cul-de-sac)	N/A	13 m	N/A	N/A
Minimum Centerline Horizontal Curve Radius	60 m**	80 m**	115 m	185 – 300 m
Design Speed	30 km/h	50 km/h	50 km/h	60 – 70
Vertical Curve				
Min. sight stopping distance	45 m	65 m	65 m	110 m
L = KA (TAC)				
K. for Sag (Illuminated Roadways)	4	6	8	15
K. for Crest	4	7	10	20
Maximum Super Elevation	N/A	N/A	As Required	As Required
Intersection Angle	70-110° at Local 80-100° at Collector and Arterial***	70-110° at Local 80-100° at Collector and Arterial***	80-100° ***	90°
Minimum Intersection Spacing (distance between adjacent intersections, measured from centerline to centerline of intersections)	60 m	60 m	60 m	200 m

Notes:

** Except at 90° corners for crescents and courts.

*** All streets are to intersect at 90°, unless existing road alignments or parcel restrictions require otherwise.

2.4 STRUCTURAL DESIGN (ROAD PAVEMENTS)

All highways must have a structural design submitted with the design drawings. Pavement design shall include consideration of the traffic loading, subgrade soil type, moisture conditions and subgrade drainage provisions. Design life of asphalt road pavement shall be for a minimum of 20 years.

In-situ granular materials may be used in lieu of imported pit-run gravel, when such material complies with the MMCD.

The pavement design for highways will be considered on an individual basis. The composition and construction thickness of the road pavement shall be designed based upon the following factors, as outlined in the geotechnical soils report:

- Mechanical analysis of the subgrade soil
- Drainage
- Frost susceptibility
- The future volume and class of traffic expected to use the pavement

An Engineer with experience in pavement design shall confirm the structural road design based on the results of a geotechnical investigation.

On Arterial Roads and highways designated as transit routes, the base course asphalt thickness shall be a minimum 100 mm. All bus routes shall have a minimum 9.0 m curb radius, regardless of road classification.

2.5 CURB AND GUTTER

The type and extent of Curb and Gutter on City roadways shall be established by the applicable road classification abutting the proposed subdivision or development.

Barrier curb with standard gutter shall be used on all Arterial roadways and for parcels with no fronting developments. Saw cutting of curb or entrance depressions is permissible.

Rollover curbs with standard gutter shall be used on all Urban Local, Minor Collector and Collector roadways, and parcels with fronting developments. Barrier curbs may be also be used for Collector roadways in specific situations and/or areas with the approval of the General Manager.

2.6 BICYCLE FACILITIES & MULTI-USE PATHWAYS

Bicycle lanes and multi-use pathway designs require signage and pavement marking plans.

Bicycle lanes on upgrades at 8% or more should be 2.0 m wide (to lip-of-gutter) to allow for increased sway of cyclists climbing upgrades. Where bicycle lanes are

shared consideration should be made to provide a 1.5 m bike lane for uphill portions exceeding 5% and 2.0 m where they exceed 8%.

2.7 STREETSCLAPING

2.7.1 BOULEVARDS

Boulevards shall be designed in accordance with the standard detail drawings, including any appurtenant landscape features. The boulevard area shall be filled with topsoil to a minimum depth of 300 mm and surfaced with nursery sod or approved Hydroseed mix.

Where the boulevard cross-section requires installation of a sidewalk(s), all boulevard areas shall be graded so that runoff from the sidewalk transitions across the boulevard and into the curb and gutter (positive grade of 2 – 4% across the boulevard).

There shall be no slope transitions greater than 4% in any boulevard areas, unless prior written approval by the General Manager.

2.7.2 STREET FURNITURE

Street furniture includes any and all surface design elements that form part of the road right-of-way, including but not limited to:

- Benches
- Shelters
- Bollards
- Bike racks
- Art
- Light standards
- Waste receptacles
- Utility pedestals
- Kiosks
- Planter beds
- Below-ground and above-ground electrical vaults
- Utility poles/anchors
- Informational signage

Street furniture shall be shown on all plans, and located such as to avoid conflict with any above-ground or underground (shallow) utilities. The placement of street furniture shall also have due regard for the form and function of the general streetscape, to avoid functional and/or operation concerns with other works, sightlines to other road users, or servicing in the general plan area.

2.7.3 STREET TREES

All Arterial Roads shall be provided with street trees as follows:

Street tree spacing is 11 m and is to be located as per the standard detail drawings. There is to be no interference with sightlines to other road users, power poles, street lights, signal lights, signage, or other infrastructure within the right-of-way. The tree species is to be approved by the General Manager.

2.7.4 LANDSCAPING

Landscaping shall be provide to ensure the streetscape meets adequate aesthetic and operational functions. Landscaping is required for all portions of the highway not improved with paved road, curb and gutter, walkway, trail or sidewalk, including planting of street trees unless otherwise authorized by the General Manager.

2.7.5 IRRIGATION

Underground irrigation shall be provided for all landscaped areas within the highway to ensure the viability of street trees and other landscaping unless otherwise authorized by the General Manager.

2.8 INTERSECTIONS

All proposed road rights-of-way shall be designed in accordance with Table A-1; this table establishes all applicable design parameters and requirements for each roadway classification. In addition, the following criteria shall apply:

- The minimum spacing between "T" intersections shall be 60 m, measured from the intersection center lines. Where no other alternative exists due to site characteristics and when it has been demonstrated that road safety has not been compromised, a shorter distance may be approved by the General Manager.
- The approach grade of a minor roadway within 15 m of an intersection (measured from the gutter line of the major roadway) shall not exceed 4%.
- Vertical curves at intersections shall terminate prior to the gutter line of the major roadway, thereby insuring that the crown on the major roadway is maintained.
- When cross-fall occurs at an intersection, the variation in the crown of the major roadway shall be made by smooth transition over a minimum of 15 m on each side of the intersection. The crown of the minor roadway shall be varied to suit the profile of the major road. The maximum rate of cross-fall variation shall be 1% per 10 m on a collector and 2% per 10 m on a local. Extra care and consideration must be given to the pavement drainage when selecting the length of transition.
- Intersections should be avoided near the crests of hills. If this cannot be avoided, sightlines must be proven through TAC requirements.

- All intersection center lines shall be referenced to the center line station chainage.
- All curb returns at intersections shall be no less than 5.0 m for Local Roads and Lanes.

2.8.1 TRAFFIC SIGNALS

All traffic signal systems are to be designed using the BC Ministry of Transportation and Infrastructure’s “Electrical and Traffic Engineering Manual; Guidelines for the Design of Lighting, Signal and Sign Installations” (2004).

All traffic signal systems are required to include an emergency vehicle pre-emption system.

2.8.2 ROUNDABOUTS

At intersections where traffic signals are warranted, consideration of roundabouts is required.

All roundabouts are to be designed by a qualified Engineer competent in the design principles of urban roundabouts.

Roundabout design should follow the TAC Roundabout Design Guide. Additional design support is available from the National Cooperative Highway Research Program (NCHRP) Report 672 Roundabouts: An Informational Guide.

Roundabout designs shall include a fastest path analysis and design vehicle turning templates.

Roundabouts at arterial intersections should include bike ramps for transitioning to and from dedicated cycling facilities for both major and minor road approaches.

2.8.3 CORNER CUTS

Corner cuts should provide a minimum distance between curb face and parcel boundary of 4.0 m measured from approach land to departure lane. Intersection corner cuts are summarized in Table A-2.

Table A-2 – Intersection Corner Cuts	
Intersection Type	Corner Cut
Arterial to Arterial	14.5 m x 38 m
Arterial to Collector	
Collector to Arterial	
Collector to Collector	
All other roadway intersections	3.0 m x 3.0 m
Lane to Lane	5.5 m x 5.5 m

Note: Corner cut measured from approach lane to departure lane.

2.9 PAVEMENT MARKINGS

Directional dividing lines shall be painted on Collector and Arterial Roads only. Short sections (5 m) of directional dividing line may be used in conjunction with stop bars.

Parallel crosswalks shall be provided in instances where there is a crossing across a road with a stop condition. Zebra stripes shall be provided for all mid-block and non-stop controlled crossings.

Material specifications:

(a) Transverse Markings (crosswalks, stop bars, arrows etc).

- Thermoplastic Laftrenz system 300
- Wet thickness no less than 16 mils
- White: Minimum 150 millicandela after 120 days
- Yellow: Minimum 75 millicandela at after 120 days

(b) Long Lines

- Minimum of 100 mm width to max of 110 mm width for specified 100 mm lines.
- Minimum 200 mm to max 210 mm width for specified 200 mm lines.
- Yellow lines: retro reflectivity of 150 millicandela for at least 30 days from the time of installation and 70 millicandela after 120 days.
- White lines: retro reflectivity of 200 millicandela for at least 30 days from the time of installation and 150 millicandela after 120 days.
- Minimum wet thickness on 16 mils.
- Glass bead must be applied immediately following paint application.
- Pre-form symbols may be acceptable with written approval of the General Manager of Engineering and Public Works.

2.10 SIGNAGE

All signage installed is to conform to the latest edition of the Manual of Uniform Traffic Control Devices for Canada (MUTCD) or the BC Ministry of Transportation and Infrastructure’s “Manual of Standard Traffic Signs & Pavement Markings”.

Street name signs are to be white lettering on reflectorized green blades, except at signal-controlled intersections where street name signs shall be green blade with reflectorized white lettering.

All signage installed is to be diamond grade sheeting complete with 3M protective overlay film series 1160.

2.11 DRIVEWAYS AND ENTRANCES

Where sidewalks abut a proposed subdivision or development site, the sidewalk shall be carried through any entranceway, with a let-down transition provided. This shall apply to all multi-residential, commercial, institutional, or industrial entrances, such that sidewalks are continuous through the width of the entrance.

- The maximum driveway gradient for any street fronting residential unit shall be 12%.
- The maximum gradient for a multi-Residential site development entrance shall be 12%.
- The maximum gradient of an industrial, commercial, institutional or mixed-use entrance shall be 8%.

Grade changes in driveways shall be designed with adequate vertical curves so as to prevent vehicle bottom contact. Any proposed transition necessary shall be provided on the private property side of the proposed driveway (no grade transitions in the ROW).

2.12 SIDEWALKS

City sidewalks or multi-use pathways required as a condition of subdivision or development shall be located either within dedicated road rights-of-way or (with the approval of the General Manager) within easements or statutory rights-of-way.

2.12.1 LOCATION

Additional sidewalk width may be required in special circumstances. In these instances, the General Manager shall confirm the required sidewalk width to be constructed.

Sidewalks shall be located and constructed in accordance with the applicable road classification standard. Consideration for accessible connectivity to surrounding pedestrian facilities, transit stops, school bus stops, community post boxes, trails, and major destinations must be made.

2.12.2 BARRIER FREE ACCESSIBILITY

Pedestrian ramps shall be provided at all intersections, curb returns and crosswalks. Ramps shall not be located at catch basins.

2.12.3 HANDRAILS

Handrails shall be provided where the elevation between the proposed sidewalk and adjacent down-gradient lands, measured at a horizontal offset of 1.0 m from the back edge of sidewalk, exceeds 0.6 m. Conversely, retaining wall structures may also be required where the installation of sidewalk results in cuts or fills immediately adjacent to the sidewalk greater than 0.6 m.

2.13 WALKWAYS AND FENCING

Walkways required as a condition of subdivision or development shall be located either within dedicated road rights-of-way or (with the approval of the General Manager) statutory rights-of-way.

- Walkways shall be designed to provide barrier-free grade transitions to any connecting sidewalks or pathways.
- Walkways shall have a cross-slope of 2%.
- Fencing of all park boundaries that abut adjacent parcels shall be provided in accordance with the Zoning Bylaw.

2.14 TRAILS

Trails required as a condition of subdivision or development shall be located either within dedicated road rights-of-way or (with the approval of the General Manager) statutory rights-of-way. Further design guidelines are found in the Recreational Trails Master Plan.

2.14.1 MAJOR MULTI-USE TRAIL

Major Multi-Use Trails are for routes through the community, parks, or waterfront.

2.14.2 NARROW MULTI-USE TRAIL

Narrow Multi-Use Trails are community or neighborhood connectors, major creek corridors, or major routes through natural areas.

2.14.3 NATURE TRAIL

Nature Trails are for natural areas, or corridors through minor creeks.

2.15 PEDESTRIAN CROSSINGS

Pedestrian crossings shall be warranted and designed according to TAC *Pedestrian Crossing Control Guide*.

2.16 TRANSIT

Bus stops shall be designed in accordance to the BC Transit Infrastructure Design Guidelines.

2.17 ON-STREET PARKING

Roads with cross-sections supporting on-street parking should feature curb bulbs at intersections and major accesses to bay parking areas.

2.18 AUXILIARY SHOULDERS

Paved shoulders on Rural Local Roads without pedestrian facilities shall be delineated with a line to accommodate pedestrians, as an alternative to a sidewalk. Paved shoulders on Rural Collector Roads without pedestrian facilities shall accommodate cyclists as an alternative to bicycle lanes and accommodate pedestrians. No parking signs shall be posted along auxiliary shoulders

3.0 SCHEDULE 3 – WATER SUPPLY AND DISTRIBUTION SYSTEMS

3.1 GENERAL

Water distribution systems shall be designed in accordance with the requirements of this Schedule; the Master Municipal Construction Documents; and the Fire Underwriters Survey, “Water Supply for Public Fire Protection”, MMCD Supplementary Irrigation System Specifications of West Kelowna. The City of West Kelowna standards and specifications shall take precedent over the MMCD and FUS documents. Standards and specifications contained in this Schedule shall apply to all water distribution system installations constructed in the City. All standards not specifically covered in these standards, MMCD, or FUS shall be as indicated by the General Manager.

3.2 SYSTEM DESIGN CRITERIA

The system must be designed to provide domestic requirements and must also provide adequate flows for fire protection.

3.2.1 WATER DISTRIBUTION SYSTEM

Where there is an existing hydraulic network in place, the City will provide any available information for assistance in designing the network.

Design computations for water distribution systems will be based on the Hazen-Williams formula, with the following 'C' values:

- PVC 130
- Ductile, Concrete Cylinder, Steel 120

$$V = 0.849C R^{0.633} S^{0.54}$$

The maximum allowable design velocity shall not exceed the following:

- Pump Supply
 - Reservoir and Trunk Mains 2 m/s
- Distribution Lines
 - At Peak Hour Flow 2 m/s
 - Fire Flow Conditions 4 m/s

3.2.2 DOMESTIC DEMAND

For residential areas, the daily domestic demand criteria for the purpose of designing water distribution systems shall be as follows:

Table B-1 – Domestic Demand	
Condition	L/cap/day
Average Daily Demand	900
Maximum Day Demand	2,400
Peak Hour Demand	4,000

Density for each parcel type is specified in the table below:

Table B-2 – Population Densities		
Coefficient	People/Hectare	People/Unit
Single Detached	24-30	3
Multi-Residential Low	85	2
Multi-Residential Medium	(3 storey) 120	2
Multi-Residential High	(4-12 storey)	2
Mobile Home	45	2
Industrial	50	-
Institutional	50	-
Commercial	75	-

Where, in the sole opinion of the General Manager of Engineering and Public Works, the characteristics of the Development’s population densities and water demand are substantially different, criteria may be modified.

3.2.3 FIRE FLOW DEMAND

For all new subdivisions or upgrades of the existing water mains, the minimum fire flows shown in Table B-3 must be met for each parcel type during maximum daily flow conditions. For existing parcels, the buildings must conform to the British Columbia Building Code’s Fire Protection Requirements.

Table B-3 – Fire Flow Demands Under Maximum Day Conditions		
Coefficient	Flow (L/sec)	Duration (Hrs)
Single and Dual Residential	60	2
Multi Residential	90	2
Institutional	150	2
Industrial/Downtown	225	3
Light Commercial & High	150	2

3.2.4 DESIGN PRESSURES

The water system must be designed to provide domestic water at the probable building main floor elevation on each parcel as follows:

- | | |
|--------------------------------|-------------------|
| • Maximum Static | 900 kPa (130 PSI) |
| • Minimum Dynamic at PHD | 275 kPa (40 PSI) |
| • Minimum Residual at MDD + FF | 140 kPa (20 PSI) |
| • Minimum Static | 275 kPa (40 PSI) |

3.2.5 HYDRAULIC NETWORK CONSIDERATIONS

- Depending on the complexity and extent of the proposed distribution system, the City may require a hydraulic analysis design showing flows and pressures.
- The maximum desirable length of any permanent non-interconnected water main is 150 m. All mains exceeding 150 m, unless it is a temporary situation, must be looped, except with the approval of the General Manager of Engineering and Public Works.
- Where the existing water system network is deficient, installation of supplementary mains may be required and may necessitate the provision of rights-of-way in favour of the City.
- Water mains must be a minimum 150 mm diameter or larger.
- In commercial, industrial and/or institutional areas, the minimum water main size allowed shall be 200 mm diameter.

3.3 WATERMAIN DESIGN CRITERIA

3.3.1 MINIMUM DEPTH OF COVER

The cover over any water main must not be less than 1.5 m. With approval from the City, special consideration for frost and mechanical protection may be permitted where minimum depth may not be achieved due to a conflict.

3.3.2 GRADE

Water mains must be designed to have a rising grade wherever possible to minimize high points in the main. Where a high point is unavoidable, either a hydrant, or air release valve should be installed at that point. The design must provide proper anchorage of the pipe; see MMCD drawing G8 for reference.

3.3.3 MINIMUM CLEARANCE

At all locations, there must be a minimum lineal horizontal clearance of 1.0 m between the water main and other existing or proposed underground services or open ditches, except sanitary sewers and storm drains. A minimum horizontal clearance of 3.0 m must be maintained between the water main and sanitary sewer

or storm drain. Where this is not possible, Interior Health Authority requirements must be met.

Where it is necessary for the water main to cross under other underground services, the crossing must be made at an angle greater than 20° horizontal. The vertical clearance between pipes at the crossing point must be in accordance with Interior Health Authority requirements. The drawings must indicate whether the water main passes over or under other underground services which it is crossing.

3.3.4 VALVING

Gate valves must be used up to, and including, 300 mm diameter. Butterfly valves with gear operators will be allowed in mains larger than 300 mm.

In general, valves must be located as follows:

- In intersections, in a cluster at the pipe intersection, or at the projected parcel boundaries, to avoid conflicts with curbs and sidewalks:
 - Three (3) valves at "X" intersection
 - Two (2) valves at "T" intersection
 - In-line valve at hydrant locations
 - Or as directed by the City, in order to allow for the isolation of specific sections of the main
- Not more than 200 m apart for single detached residential. All parcels zoned other than single detached residential require special designs.
- In locations and at a frequency so that not more than two hydrants are out of service when a section of the main is turned off.
- An exclusive isolation valve for each hydrant.

3.3.5 HYDRANTS

Maximum spacing is required in accordance with the Standard Hydrant Distribution section in the FUS Guidelines. Fire hydrants must be located so that the spacing is never greater than 180 m in single detached residential areas and 90 m in higher density residential, commercial, industrial, and institutional areas.

Hydrant leads must have inline valves with a minimum length of 6.0 m unless otherwise approved by the General Manager for a length of 8.0 m.

In mid-block locations, fire hydrants must be located at the parcel boundaries. The design and proposed locations of fire hydrants must not conflict with existing or proposed street lights, power poles, etc., and must have a minimum 1.0 m clearance from any objects. Attempts must be made to avoid locating hydrants on sidewalks. Consideration must also be given to satisfy minimum distance to main entrance or Siamese connection requirements per the British Columbia Building Code.

On Arterial Highways with, or designated to be constructed with, a raised median, fire hydrants shall be installed on both sides of the Highway with each side treated exclusively for spacing requirements.

3.3.6 AIR VALVES

Combination air valves are required on water mains 200 mm diameter and larger, except as follows:

- Where the difference in elevation between the summit and valley is less than 600 mm.

The general application of the three types of air valves must be:

- Air/vacuum valves for filling or discharging mains and preventing negative pressures.
- Air release valves for small air release during normal operation.
- Combination valves for combination of air/vacuum and air release valves.

3.3.7 BLOW-OFFS

Blow-offs are required at the terminal ends of all water mains. All water mains with a terminating end must have a blow-off assembly that can achieve a 0.8 m/s flushing velocity. All water mains larger than 250 mm with a terminating end must have a 100 mm blow-off assembly.

3.3.8 THRUST BLOCKING

Concrete thrust blocking and/or adequate joint restraining devices must be provided at bends, tees, wyes, reducers, plugs, caps, valves, hydrants and blow-offs. The restraining device system must take into account potential future excavations of the road in the vicinity of the water main. Engineered calculations for the thrust block design shall be based on fitting type, water pressure and soil conditions.

3.3.9 CHAMBERS

Chambers or manholes containing valves, blow-offs, meters, or other appurtenances are to allow adequate room for maintenance, including head room and side room. The access opening must be suitable for removing valves and equipment. The chamber is to be provided with a drain to a storm main or ditch (rock pits may be considered subject to adequate soil conditions) to prevent flooding of the chamber. Adequate venting is also to be provided.

The General Manager may require provision of forced ventilation, lighting, heating and dehumidification. Access and ventilation details shall comply with WorkSafe BC regulations.

3.3.10 SERVICE CONNECTIONS

The minimum service size is 19 mm diameter. 19 mm service connections may be tapped directly into mains 150 mm diameter and greater; 25 mm diameter service connections may be tapped directly into mains 200 mm diameter and greater, except in the use of PVC water mains where all service connections must be made with service saddles. 38 mm and 50 mm diameter service connections must be made using service saddles.

Multiple corporation stops must have a minimum spacing of 1.0 m. Where this cannot be met, the corporation stops must be staggered vertically and not less than 300 mm apart. No tappings must be made at an angle greater than 30°, or less than 10°, above the horizontal centerline plane of the pipe.

The curb stop must be located 2.0 m from the corner parcel pin and 0.5 m from the parcel boundary, on the road right-of-way. Services and curb stops must have a minimum cover of 1.5 m and curb stops must be no deeper than 2.0 m.

3.3.11 PIPE ALIGNMENT

Water mains must be designed to follow a straight alignment between intersections, at offsets parallel to the road centerline. Water mains must be located within the road right-of-way as indicated in the applicable standard detail drawings of the typical cross-section for that road. Water main shall be placed on the south or west side of the road except on side hill streets, where the main shall be located on the cut side of the centerline of the street. Tracer wire is required for all water mains.

Water mains must be located such that each parcel to be served has at least one side fronting thereon. The water main must be extended to the most convenient existing water main that will provide an adequate supply of water.

Curved alignments will be accepted by means of pipe joint deflection. Pipe alignment is to be at a parallel offset with an established road right-of-way or parcel boundary. The radius of curvature is to be no less than 300 times the outside diameter of the pipe barrel, or 1.5 times the minimum radius of curvature recommended by the pipe manufacturer, whichever is greater.

3.3.12 WATER SYSTEM LOCATION/CORRIDORS

When the utility is required to cross private land(s), the right-of-way must be sufficient to repair or replace the utility line without the use of caging or shoring, and be a minimum of 4.5 m wide.

When a utility is located within a statutory right-of-way, and manholes, valve chambers, or other appurtenances which require maintenance are located within the statutory rights-of-way, a constructed road access may be required. The

access road is to provide access and support for maintenance vehicles from a City road, and must be an appropriate road structure for City vehicles.

3.4 WATER FACILITY DESIGN CRITERIA

3.4.1 FACILITY ACCESS

Paved vehicular access must be provided to all reservoirs and pump stations. The minimum standard must be for emergency access road design, with drainage provisions as required.

3.4.2 RESERVOIRS

(a) Pre-Design Requirements

Prior to commencing detailed design, the Owner's Engineer must submit a predesign report that addresses the following criterion:

- Site Location
- Selection of Materials (concrete or steel)
- Operational Schematic
- Design Standards
- Volume
- Shape
- Number of Cells
- Geotechnical Report
- Aesthetics
- Water Quality

Approval of this pre-design concept must be obtained prior to the Owner's Engineer commencing detailed design.

(b) Reservoir Capacity

Reservoir capacity must be not less than the sum of the following (A+B+C):

A = Balancing Storage (25% of MDD)

B = Fire Flow

C = Emergency Storage (25% of A + B)

Subject to the results of a detailed engineering analysis and approval from the General Manager of Engineering and Public Works, the requirement for emergency storage (C) may be eliminated based on consideration of the following:

- Dependability of the water source.
- Reliability of the supply system.

- Presence of more than one supply source.
- Whether the reservoir is part of a large system.
- Presence of other reservoir(s) in the system.
- Availability of standby power.
- The need for adequate circulation of the reservoir to maintain water quality.

(c) Reservoir Design

Reservoir design must incorporate the following features:

1. Designed in accordance with the American Concrete Institute's Manual on Environmental Engineering Concrete Structures - ACI 350R.
2. Contains two (2) cells, each containing one-half of the total required volume and capable of being drained and filled independently.
3. Reservoir is to be below ground, unless specifically approved by the General Manager of Engineering and Public Works.
4. Each cell is to have an access opening in the roof for cleaning and maintenance. This access opening must have a minimum dimension of 900 mm x 900 mm, to be located so that the overflow pipe is clearly visible inside the reservoir when viewed from the hatch.
5. A survey mark is to be inlaid inside all access hatches, showing the geodetic elevation.
6. Access hatches are to have the following:
 - Aluminum 1/4" tread plate
 - Perimeter drain
 - Perimeter sealing gasket
 - Slam lock with aluminum removable sealing plug and opening tool
 - Flush lift handle
 - Gas spring assist cylinder
 - 90° hard open arm
 - Flush fitting padlock tang
7. Hatch must be reinforced for 1,465 kg/m² (300 lbs/ft²).
8. All fasteners for the hatch to be made of 316 stainless steel.
9. Ventilation pipes or openings sized to handle appropriate intake and exhausting volumes of air or filling and drawing the reservoir.
10. Reservoir floor is to slope to the drain sump.
11. Drain sump to be a minimum of 1000 mm x 1000 mm x 400 mm, with invert of drain pipe to be flush with sump floor and grating to be installed over sump.
12. Sub-drain under floor to collect and drain any leakage (may be connected to overflow pipe, provided suitable measures are incorporated to prevent surcharging).
13. Overflow drain to be provided and sized to transmit the maximum pump discharge with all pumps running.

14. A stainless steel interior wall ladder is required from roof access to floor. All ladders are to meet WorkSafe BC regulations, and must supply attachment points for fall arrest equipment.
15. Where public access could be gained to reservoir, install appropriate fall prevention railings.
16. All pipework within the reservoir to be PVC or fiberglass, except overflow which may be steel or cast iron coated to AWWA standards;
17. All metal parts within the reservoir, including bolts, nuts, screws, anchors, ladders, etc., to be stainless steel.
18. Reservoir inlet pipe to terminate with a diffuser positioned opposite the reservoir outlet and a distance of $\frac{3}{4}$ the length of the reservoir from the outlet. Diffuser is to cover $\frac{3}{4}$ of the wall length.
19. Ports in diffuser pipe to be engineered to produce circulation within the reservoir during fill cycle.
20. Diffuser to incorporate removable end caps.
21. Backup high and low level control balls for each cell set at 40% and 95% levels (not to contain lead or mercury).
22. The reservoir must be cleaned and disinfected to AWWA and City requirements.
23. Gated black chain link perimeter fencing may be required to address safety issues.
24. Landscaping acceptable to the City is to be provided, including irrigation.
25. Manuals are to be supplied as per “Manuals” section.

(d) Reservoir Valve Chamber

Reservoir must incorporate a valve chamber containing:

1. All valves associated with the reservoir.
2. Reservoir entrance is to be located at grade, large enough to permit safe removal of the largest single piece of equipment.
3. Install lifting beams and hoists, where necessary, to enable the removal of equipment or components.
4. Floor drains.
5. Separate inlet and outlet piping including check valves to separate inlet and outlet flows.
6. All inlet and outlet piping are to incorporate a $\frac{3}{4}$ ” sampling port with isolating ball valve.
7. $\frac{3}{4}$ ” Schedule 80 PVC sample line with an isolating ball valve for each cell, terminating in the middle of the cell wall at the 50% level and extending 25% towards the center of the reservoir.
8. 2” stainless steel Schedule 80 pipe with an isolating ball valve extending into each cell for the connection of cleaning hoses.
9. $\frac{3}{4}$ ” stainless steel pipe with isolating ball valve extending into each cell, connected to a pressure transmitter for level sensing.
10. Minimum 30 amp, 120 VAC electrical service.
11. Heat, light and ventilation to meet WorkSafe BC requirements.

12. All control wiring junction boxes.
13. A PLC control system to current Pump Operations standards.
14. Chlorine residual analyzer.
15. Interior and exterior of all steel piping to be coated to AWWA standards:
 - Inlet piping – mid blue
 - Outlet Piping – dark green
 - Drain Piping – gull grey
 - All Other Piping – mid blue
 - Check valves to show direction of flow with white painted arrows
16. PLC controlled modulating inlet valve where more than one reservoir serves a single zone. The modulating inlet valve shall include:
 - Non-contact 0 - 100% valve position indicator with 4-20 ma. output.
 - Hydraulically operated with pressure tank (minimum 40 psi), sized to operate valve for three (3) cycles during power failure.
 - Hydraulically operated diaphragm actuated globe or angle.
 - Pattern valve of 'powerrol type'.
 - Pilot system to be protected by single continuous flow 100 micron filter.

3.4.3 PUMP STATIONS

Pump stations, where required, must be designed to suit the particular circumstances and otherwise comply with this Bylaw. In general, pump stations must be designed to meet maximum daily demands, with the largest pump out of service and maintaining balanced storage on line.

(a) Pre-Design Requirements

The Owner's Engineer must obtain approval from the City that siting of the pump station is acceptable. Prior to commencing detailed design, the Owner's Engineer must submit a pre-design report that addresses the design considerations of this criterion. Approval of the pre-design concerns must be obtained prior to the Owner's Engineer commencing detailed design.

(b) Design Features

Pump station design must incorporate the following features:

1. Reinforced concrete, block work or brick construction must be aesthetically pleasing.
2. Access doorways sized so that the largest single piece of equipment may be safely removed and replaced; lifting hooks or rails with pulley blocks to be incorporated as required.
3. Adequate HVAC with filtered air inlet.
4. Stand By Power.
5. Housekeeping pads for MCCs.

6. Electric motors to be premium efficiency.
7. Variable speed drives for pump control.
8. Motors to have thermal protection.
9. Motors 100 hp and above to have analog vibration recording and protection.
10. All pilot and air relief discharge to be piped to floor drains to avoid standing water.
11. Air release valves with isolation valves.
12. Hydraulically operated pump control valves with isolation valves;
13. Flow meter.
14. Spring return check valves.
15. High pressure and surge relief valves with isolation valves.
16. Suction and discharge pressure gauges for each pump with isolation valves.
17. Stainless steel spools.
18. Drain with a 75 mm cleanout.
19. Mechanical pump seals.
20. Lockable roof hatches for motor and pump removal.
21. Water quality sampling ports.
22. Parking for maintenance and delivery vehicles.
23. Landscaping acceptable to the City is to be provided.
24. Interior and exterior of pipework to be coated to AWWA standards.
25. Exterior colors to be:
 - Inlet piping – mid blue
 - Outlet piping – mid blue
 - Drain piping – gull grey
 - All Other piping – mid blue
26. Pump system to be PLC controlled and connected to City pump operations SCADA system.
27. Control system to include, but not limited to:
 - security switches
 - discharge and suction pressure transmitters
 - temperature sensor
 - uninterruptable power supply
 - radio or hard wire modem
 - external antenna
 - operator interface panel
 - power meter without outputs to PLC
 - phase loss protection
 - five (5) spare fuses for all fuse holders
 - current copy of PLC and MMI program to be left in control enclosure (see Pump Operations department for current standards)
28. Motors to be 600 volt, 3 phase.
29. Hour meters and ammeters for each pump.
30. Power factor correction if required by electrical provider.
31. MCC, breaker boxes and receptacles to be labeled.
32. Station to be cleaned and dust free.

33. Noise attenuation.
34. Manuals to be provided as per “Manuals” section.

The General Manager of Engineering and Public Works may modify the criteria in this section at their discretion.

3.4.4 PRESSURE REDUCING STATIONS

Pressure reducing station design must incorporate the following features:

1. Chamber size: 4.0 m x 2.0 m x 2.0 m.
2. Minimum 30 amp, 120 VAC service.
3. Forced air ventilation, heat and light (access and ventilation details shall comply with WorkSafe BC regulations).
4. External kiosk and antenna.
5. Parallel pressure reducing valves.
6. Air release valves.
7. Water quality sample points.
8. Sump drain to storm.
9. Hatch as per reservoir section.
10. Parking for maintenance and delivery vehicles.
11. Manuals as per “Manual” section.
12. Landscaping acceptable to the City is to be provided.
13. PLC control to City’s SCADA system, including:
 - Security switches
 - Discharge and suction pressure transmitters
 - Temperature sensor
 - Flow meter;
 - Uninterruptable power supply
 - Radio or hard wire modem
 - External antenna
 - Operator interface panel

3.4.5 MANUALS

Supply three (3) copies of operating and maintenance manuals (Including one (1) digital copy).

Bind contents in a three-ring, hard covered, plastic jacketed binder, with the name of the facility embossed onto binder cover and spine. Each section shall be separated from the preceding section by a plasticized cardboard divider with a tab denoting contents of the section.

Contents to include:

- Title sheet, labeled “Operation and Maintenance Instructions”, and containing project name and date.
- List of contents.

- Reviewed shop drawings of all equipment.
- Equipment list showing all model and serial numbers.
- All equipment manufacturers manuals.
- Record drawings of all mechanical, electrical, control and alarm installations.
- Full description of system operation, including: design points; designed pump and system curves; ultimate capacity; area served; and any relevant design criteria relevant to the operation of the system.
- Full description of entire mechanical, electrical and alarm system operation.
- Names, addresses and telephone numbers of all major sub-contractors and suppliers.
- Commissioning report showing pressures, flows and current draw for all possible operating conditions.

3.5 ONSITE POTABLE WATER SUPPLY

3.5.1 REQUIREMENTS FOR WELLS

All wells must be drilled and cased in accordance with the Groundwater Protection Regulation under the *Provincial Water Act*.

All wells must be tested and certified for each proposed parcel within a subdivision prior to the approval of the subdivision plan. All wells must be capable of delivering water at a rate of not less than 20 litres per minute per well over a one hour period to a minimum of 2,300 litres per day per dwelling unit. Wells must be restricted to supplying water to only one parcel.

All quantity and quality testing must be verified by an Engineer specializing in groundwater hydrology. A water sample taken from the well must be tested to determine conformity to potable drinking water standards. Testing must be undertaken in accordance with the latest edition of the Guidelines for Canadian Drinking Water Quality, and the results must be submitted to the General Manager and Interior Health. The test results are to be registered in the Land Title Office against the title of the parcel as a Section 219 covenant. Any changes to the wording of the restrictive covenant are subject to the written approval of the General Manager.

A legal plan prepared by a surveyor must be provided indicating the location of all wells.

3.5.2 REQUIREMENTS FOR A SURFACE WATER SOURCE

A domestic water license is required or written assurance that a domestic water license will be issued, and must be obtained from the Ministry of Environment. A copy of the water license must be submitted to the General Manager.

The quantity of water authorized to be used under the water license shall be as determined by the Comptroller of Water Rights, but shall not be less than 20 litres per minute over a one hour period to a minimum of 2,300 litres per day per dwelling unit.

A water sample taken from the surface water source must be tested to determine conformity to potable drinking water standards. The test results must be submitted to the General Manager and Interior Health Authority. The test results are to be registered in the Land Title Office against the title of the parcel as a Section 219 covenant. Any changes to the wording of the restrictive covenant are subject to the written approval of the General Manager. Any requested changes must be accompanied by analysis clearly demonstrating the need for the change and how the change does not adversely impact the City technically, operationally or financially.

3.5.3 REQUIREMENTS FOR PARK IRRIGATION

A fully automatic underground irrigation system may be required including all necessary preparatory work, electrical wiring and plumbing connections for City park space. Instances where this may apply include, but are not limited to, voluntary community amenity contributions as part of applications.

All locations of heads, pipe and valves must be coordinated prior to installation with the City to ensure landscaping, building and physical features do not conflict.

4.0 SCHEDULE 4 – SANITARY SEWER SYSTEMS

Sanitary sewer systems shall be designed in accordance with the requirements of this Schedule and the MMCD. City of West Kelowna Standards and Specifications shall take precedent over the MMCD. Standards and Specifications contained in this Schedule shall apply to all sanitary sewer installations constructed in the City. All standards not specifically covered in this Schedule or in MMCD standards shall be as instructed by the General Manager.

4.1 DESIGN CRITERIA

4.1.1 DESIGN FLOWS

Sewage flows shall be based upon population or sewage quantities as follows:

- | | | |
|-----|--------------------------|---------------------------|
| (a) | Domestic Flow Rate | 350 litres/capita/day |
| (b) | Infiltration Rate | |
| | Pipes Not in Water Table | 5,000 litres/hectare/day |
| | Pipes in Water Table | 8,000 litres/hectare/day |
| | Old Pipes | 10,000 litres/hectare/day |
| (c) | Densities | |

Refer to Section 3.2.2, Table B-2 – Population Densities

- (d) Peaking Factor

A peaking factor must be applied to the average flow, and modified to the type of residential area:

- $$\text{Peaking Factor} = f \times \left(1 + \frac{14}{4 + \sqrt{P}}\right)$$

P = Population (in thousands)

f = Residential Factor

New residential areas = 0.75

Old residential areas = 0.85

Commercial and industrial areas = 1.00

- Peak design flows must be determined by applying the peaking factor to the average daily flow, then adding infiltration.
- Pipe sizes must be selected so that sewers flow $2/3$ to $3/4$ full at peak hour design flow.

(e) Pipe Flow Formulas

- Gravity Sewers

Manning's formula is to be used as follows:

$$Q = \frac{1}{n} A R^{2/3} S^{1/2}$$

A = Cross sectional area in m²

R = Hydraulic radius (area/wetted perimeter) in m

S = Slope of hydraulic grade line in m/m

n = Roughness coefficient

n = 0.011 PVC

n = 0.013 Concrete

4.1.2 GRAVITY SEWER MAINS

(a) Pipe Diameter

The minimum permitted size of pipe is:

- 200 mm Residential Areas
- 250 mm Commercial and Industrial Areas

(b) Minimum Velocities

The minimum velocity is 0.6 m/sec. There is no maximum velocity; however, consideration must be given to scour problems and the dynamic loading on manholes where flow exceeds 3 m/sec.

(c) Minimum Grades

The minimum grade for all pipes must be 1%, unless restricted by subsurface conditions. The grade of any sewer is governed by the minimum velocity required of 0.6 m/sec. If the calculated design flow is not expected to produce a velocity of at least 0.6 m/sec., then the minimum grade shall be calculated on the basis of the pipe flowing 35% full at a theoretical velocity of 0.6 m/sec. Anchoring must be in accordance with MMCD drawing G8.

(d) Sewer Main Alignment

Sanitary sewers are to be located within the roadway, as shown in the applicable standard road cross-section drawings. Where permitted,

horizontal and vertical curves will require a constant offset and must be uniform throughout the curve. In no case shall the radius of curvature be less than 300 times the outside diameter of the pipe barrel, or 1.5 times the pipe manufacturer's guidelines for minimum radius, whichever is greater. The design velocity must exceed 0.9 m/sec., the minimum grade must be 1%, and the curve midpoint and two 1/4 points are to be located by survey and shown on the as-constructed drawings with an elevation and offset of the invert at each point. Manholes are required at both upstream and downstream of the curve.

Servicing from the roadway is required unless the main would need to be in excess of 5.0 m depth of cover to provide a gravity service, in which case the City will allow a design based on sewer pumps for basement levels, provided that the main floor of the building is serviced by gravity.

Rear yard sewers are discouraged and must be approved by the General Manager. When the utility is required to cross private land(s), the right-of-way must be a minimum of 4.5 m wide for a single pipe. The width must be suitable to accommodate excavations based on WorkSafe BC regulations for side slopes. The right-of-way width must allow for the clearances outlined in section 3.3.3 when water mains are also provided. A cross-section of the proposed trench(es) must be shown, indicating the minimum safe elevation of adjacent building footings based on a safe angle of repose from the limits of the excavation. When a utility or appurtenances which require maintenance are located within the statutory right-of-way, a constructed road access may be required. The access road is to provide access and support for maintenance vehicles from a City road, and must be an appropriate road structure for City vehicles.

(e) Depth of Cover

The depth of cover of the sewer main must be sufficient to provide "gravity flow" service connections to adjacent properties, and must allow for future extension(s) to properly service all of the upstream tributary lands. The minimum depth of cover shall be 1.2 m, measured from surface to the top of pipe.

The maximum depth of cover shall be 5.0 m, except under special circumstances and with permission of the General Manager.

4.1.3 SANITARY MANHOLES

a) Location

Manholes must be installed at all:

- Changes in grade.
- Changes in direction, except for curvilinear sewers.

- Upstream and downstream at either end of the curve, for curvilinear sewers.
- Changes in pipe sizes.
- Intersecting sewers.
- Terminal sections.

Manholes must be placed at all locations where future extensions are anticipated and must be spaced no further than 150 m apart. Placement of manholes in existing or future wheel paths is to be avoided.

For sanitary manholes not located within the road prism, the rim elevation must be designed to be:

- Above the adjacent storm manhole rim elevation.
- Above the surrounding ground so that infiltration from ponding will not occur.

b) Hydraulic Losses Across Manholes

The crown of the upstream pipe must not be lower than the crown of the downstream pipe. When connecting a collector sewer main to a trunk sewer 300 mm or greater, the invert of the collector main must not connect lower than $0.75D$ ($\frac{3}{4}$ of the pipe diameter).

- Minimum drop in invert levels across manholes:
 - Straight run slope of pipe.
 - Deflections up to 45° 25 mm.
 - Deflections 45° to 90° 50 mm.
- Drop manholes and outside ramps must be installed in accordance with the standard detail drawings.
- Inside ramps will be permitted up to 450 mm from invert to channel bed. The maximum deflection angle created in a junction is 90° .

4.1.4 TEMPORARY CLEANOUTS

Temporary clean-outs may be provided at terminal sections of a main where:

- Future extension of the main is anticipated.
- The length of sewer to the downstream manhole does not exceed 45 m.
- The depth of the pipe does not exceed 2.0 m of cover at the terminal point.
- Design of the anticipated extension is completed to the next manhole to ensure the work will not require realignment when extended.

4.1.5 SERVICE CONNECTIONS

Service connections to be installed in accordance with standard detail drawings, as follows:

- a) Service connections must be provided to each parcel fronting the main. Service connections shall not be extended at an angle that exceeds 45° from perpendicular to the main, and in no case shall a service connection be placed so that it extends in front of any parcel other than the one being serviced.
- b) Parcels are allowed one service connection per parcel. Where the servicing of all buildings on existing properties is not feasible, two (2) services may be permitted if authorized by the General Manager of Engineering and Public Works.
- c) Connections to new mains must be made using standard wye fittings; connections to existing mains must be made using wye saddles or other pre-approved methods. All services must enter the main at a point just below the spring line.
- d) Service sizes are to be determined by an Engineer. The minimum size for sanitary service connections is:
 - 100 mm for residential
 - 150 mm for multi-residential, industrial and commercial
- e) The minimum grade from the main to the parcel boundary is 2%. The minimum grade for services 150 mm and greater is 1%.
- f) The minimum depth of a service at the parcel boundary must be 1.2 m in a road right-of-way, provided that gravity service to the Minimum Building Elevation is available. The minimum cover must be 1.0 m in a statutory right-of-way, provided that gravity service to the Minimum Building Elevation is available.
- g) Service connections may be permitted into manholes, provided that:
 - The connection is not in an adverse direction to the flow in the sewer main.
 - The connection enters the manhole so the service crown is no lower than the sewer main crown.
- h) Inspection Chambers are required for all service connections; Brooks Boxes are to be installed on every inspection chamber in a highway or travelled path.
- i) Service connections must be installed at the lower (downstream) portion of the parcel for larger lots or parcels of land at an offset of 3.0 m from the parcel pin.
- j) The maximum length of any service connection is 30 m, unless authorized by the General Manager.

4.2 SANITARY LIFT STATIONS AND FACILITIES

The use of sanitary pump stations is to be discouraged. Any proposed use of lift stations must receive prior approval from the General Manager of Engineering and Public Works. Sanitary lift stations should normally be located within a right-of-way outside the required road dedication.

This criterion covers both dry well and submersible sewage lift stations. Larger capacity sewage lift stations or lift stations with special design or siting requirements may require additional assessment and review of criteria.

4.2.1 PRE-DESIGN REQUIREMENTS

The Owner's Engineer must attempt to:

- Minimize the number of sewage lift stations.
- Thoroughly consider other options to avoid lift stations wherever practical.
- Must obtain approval from the General Manager of Engineering and Public Works prior to siting the lift station.

The Owner's Engineer must submit a pre-design report that addresses the design considerations of the above criteria. Approval of the pre-design concepts must be obtained prior to the Owner's Engineer commencing detailed design.

4.2.2 LOCATION AND LAYOUT

The location and layout of a lift station must include an assessment of the following basic design considerations:

- Capacity to handle ultimate flows of the designated catchment.
- Type of station and impact on neighbours.
- Construction dewatering requirements.
- Access for construction.
- Access for maintenance.
- Aesthetics, noise, odour control and landscaping requirements.
- Security against vandalism and theft.
- Flood elevations. Station uplift design must be based on maximum load level.
- Proximity of receiving sewers, water mains and adequate power supply.
- Minimizing energy requirements.
- Standby power and its compatibility.
- Soils. Sub-surface investigations must be undertaken prior to site approval.
- Convenience of operation and maintenance.
- Safety for operators and public.
- Capital costs and operation and maintenance costs.

4.2.3 DESIGN CRITERIA

a) Pumps must:

- Pass solids up to 75 mm in size.
- Be equipped with hour meters.
- Be easily removed for maintenance.

- Operate with a motor running at 1750 RPMs.
 - Operate on a 347/600 volt electrical source (pump motors 5 hp and greater are to be 600 volt, 3 phase type).
 - Operate alternately and independently of each other.
 - Meet maximum flow condition with one pump in failure mode.
 - Be designed so that each motor does not cycle more than four (4) times in one (1) hour under normal operating conditions. For example, in a duplex pump station that is designed to alternate the pump starts, each motor can have a maximum of four (4) starts in an hour which could result in a total of eight (8) motor starts per hour for this station.
 - Be capable of 15 starts per hour in worst case scenario.
- b) Motor cables, power cables, etc., must be continuous from within the pump station to within the kiosk unless an adequate exterior pull pit and junction box are installed. Levels to be controlled by ultrasonic level transmitter with emergency high and low level balls.
- c) All auxiliary equipment and control panels must be mounted in a suitable kiosk adjacent to the station. The kiosk must be located a minimum of 3.0 m from the station lid.
- d) The control kiosk must be designed to contain all control and telemetry equipment on the front panel, and all power equipment on the rear panel.
- e) Check valves must be ball lift check valves.
- f) All stations require an explosion-proof exhaust fan, which can be activated by manual switch and which meets WorkSafe BC requirements for ventilation in a confined space.
- g) Fabricate ventilation duct with c/w bird screen with 150 mm diameter F.R.P air exhaust vent.
- h) The entrances to all stations must be waterproof and be provided with a suitable lock. Requirement of one access hatch per pump and one for ladder access. The access must be a minimum 900 mm x 900 mm in size.
- i) The access hatch shall have the following:
- Aluminium ¼" tread plate
 - Perimeter drain
 - Perimeter sealing gasket or neoprene weather strip tape around perimeter of hatch to prevent odour escape.
 - Slam lock with an aluminium removable sealing plug and opening tool.
 - Flush lift handle.
 - Gas spring assist cylinder.
 - 90° hold open arm that will lock and be secured in open position.
 - Flush fitting padlock tang.
 - All access hatches must allow/provide:
 - for removal of pumps without removing or damaging of other equipment;
 - to be opened, secured and locked in an open position;
 - have safety grating and fall restraint anchors;
 - easy opening with a lifting force less than 225N; and

- a padlock hasp with box enclosure to prevent vandalising of lock.
- j) The hatch shall be reinforced for 1465 kg/m² (300 lb/ft²) and be capable of supporting the weight of one of the pumps in the station. All fasteners to be made of 316 stainless steel. The entrance must be above ground level where feasible, but in no case more than 300 mm above the ground and provide an aluminium or stainless steel grab bar at the exterior of the wet wall cover above the access ladder.
- k) Access into the stations must be by an aluminium ladder. The location of the ladder must not interfere with the removal and installation of the pumps, etc. The ladder must be designed to extend and lock at least 600 mm above the station entrance. A platform is to be provided above the high water level float to permit wet well access. The platform is to be a fibreglass grating. The access, ladder and platform must meet WorkSafe BC standards.
- l) All wiring must be explosion-proof and Class 1 Division 2; electrical design and installation is subject to the acceptance of the Provincial Safety Inspector. Metal stations must be protected by impressed current cathodic protection.
- m) All stations must be equipped with explosion-proof high water alarm switch as specified under Electrical Instrumentation Controls Section and be restrained as to prevent tangling with equipment.
- n) All stations must provide an automatic generator for standby power in case of power failure. Provision for a Telemetry System must be included for connection into the Municipality's Telemetry System. For small lift stations with an ultimate capacity less than 100 units, emergency storage may be considered in place of standby power; emergency storage is to be based on eight (8) hours of average day flows.
- o) All equipment must be CSA approved and have at least a one (1) year guarantee for parts and labour. The Owner's Engineer is to provide to the City three (3) sets of Operating and Maintenance Manuals. All pumps must be factory tested prior to installation.
- p) A gate valve is required on the influent line and on each pump discharge. The valves must be outside the station and be complete with square operating nut and nelson box.
- q) If a lift station is authorized by the General Manager of Engineering and Public Works to be constructed in an area that may be subject to vehicle loads, the roof and cover of the pump station should be designed to withstand a loading of H-20 (Highways Standard).
- r) Provision(s) must be made for standby pumping from an external source. An adaptor flange ("Kamlock"), complete with a quick coupling and lockable cap will be required.
- s) The area around the station and all associated equipment or building must be asphalted. The size of the area is to be determined by the requirements for maintenance.
- t) The surfaces of all steel components and fibreglass stations must receive at least two (2) coats of two (2) component, white epoxy enamel. All concrete stations must be designed and constructed to prevent a hydrogen sulphide attack, include epoxy coated rebar, and the concrete surface must

- be coated with at least two (2) coats of blue epoxy and then an additional two (2) coats of white epoxy.
- u) The wet well bottom must be benched to direct all solids into the pump suction. The influent line must be located tangent to the wet well to encourage scouring of the wet well.
 - v) The station shall be complete with an Uninterruptable Power Supply (UPS) to serve all alarms and controls.
 - w) The pump control panel must incorporate an operator interface (Panelmate or equivalent) and the panel must be complete with a lamp test button.
 - x) Separate starter enclosures must be provided for each pump.
 - y) PLC control to be based on City standards.
 - z) Station communication to be provided via radio transmission compliant with the City's telemetry system, and an antenna must be installed on a suitable mast or pole to ensure reliable transmission.
 - aa) An hour meter must be built into the panel for each pump.
 - bb) An amp meter must be provided for each pump.
 - cc) Minimum storage between the high level alarm and the start of overflow to be under the more critical of:
 - Minimum one (1) hour in wet well at average wet weather flow.
 - Minimum one (1) hour in wet well and influent pipes at peak wet weather flow.
 - dd) Must have a magnetic flow meter.
 - ee) The design must allow removal of pumps using hoist truck with 1.8 m (6') boom.
 - ff) Must have an anchor frame, self-seating discharge connection, stainless steel lifting cable or chain fastened to the top of the pump and the chamber with stainless steel guide rails for the easy removal of pumps without entering chamber all supplied by the pump manufacturer.
 - gg) Must include lifting davit sockets, suitably anchored to lift stations and capable of supporting the specified lifting davits.
 - hh) Supply one uni-hoist confined space retrieval system.
 - ii) Where vandalism or safety is a concern, perimeter fencing is to be provided. The fence must be made of black chain link.
 - jj) Landscaping acceptable to the City is to be provided, including irrigation.
 - kk) Noise control may be required when criteria in Section 4.2.5 is exceeded.
 - ll) Odour control may be required when criteria in Section 4.2.6 is exceeded.
 - mm) Minimum barrel size must be 2440 mm (8') in diameter.
 - nn) Provide sufficient hanger space for coiling of excess electrical cables and supporting lifting chains close to access hatch opening.

4.2.4 FORCE MAIN

In conjunction with sanitary pumping facilities, specific criteria must be noted in the design of force main systems. Design computations for force mains must be made using a 'C' factor of 120 (for PVC pipe), and then the system curve must be re-calculated using a 'C' factor of 145 to ensure adequate motor horsepower and pump characteristics. Pump and system curves must be shown on design drawings.

- Hazen-Williams formula is to be used as follows:

$$V = 0.849C R^{0.633} S^{0.54}$$

a) Velocity

At the lowest pump delivery rate anticipated to occur at least once per day, a minimum cleansing velocity of 1.0 m/s should be maintained. Maximum velocity should not exceed 3.5 m/s.

b) Air Relief Valve

A combination automatic air/vacuum relief valve must be placed at high points in the force main to prevent air locking when the difference in elevation between the invert of the summit and the invert of the valley is greater than the diameter of the pipe. The air relief valve must be located in a chamber, complete with adequate and environmentally safe drainage and odour control, unless a suitable injected odour control agent is used at the Lift Station. Air valve must be vented and drained into the gravity sanitary sewer system at a manhole, where possible.

c) Termination

Force mains should enter the gravity sewer system so that the force main invert is not more than 200 mm above the crown of the pipe in the receiving manhole. A smooth, turbulent free transition must be incorporated; however, if the receiving manhole design does not allow this, then a manhole drop structure in accordance with the standard detail drawings is required.

d) Size

The minimum size for force mains is 50 mm diameter.

e) Materials

Force mains must generally meet the standards specified for water mains, however there are specific requirements for force mains that may supersede water main standards, as follows:

- Force main pipe must be identifiably different than water main pipe.
- Valves used on force mains and pigging ports or cleanouts shall be lubricated full port plug valves size on size sufficient for long term use in a corrosive environment.

f) Loads and Transient Pressures

All force mains must be designed to prevent damage from superimposed loads, as well as to prevent damage from water hammer or column separation phenomena. Transient surge and cyclic surge analysis must provide at least a 75 year life of the pipe.

g) Corrosion and Odour

Corrosion and Odour control is required when limited daytime flows, or long force main lengths cause the pumped sewage to remain in the force main for longer than 45 minutes.

4.2.5 NOISE CONTROL CRITERIA

Noise levels for facilities must not exceed 65 dB at parcel boundary or 20 m away, whichever is closer.

4.2.6 CORROSION AND ODOR CONTROL

Dissolved sulphide maximum limit at any point in the system is to be 0.5 mg/l.

Odour Criteria:

- At 10 m from any gravity main, force main, manhole and lift station, or other sewer facility (summer conditions, winds between 2-10 km/h), 1.0 odour units is the limit.
- Where sewer facilities are close to houses, parks or walkways, 0.0 odour units is the limit.
- Analysis for odour and sulphides may be required.

4.3 ONSITE SEWAGE DISPOSAL SYSTEM (SEPTIC TANK)

Where permitted, site conditions and on-site sewage disposal systems shall be in accordance with applicable Interior Health requirements and the Sewerage System Regulation of the *Public Health Act*.

A minimum of 1.2 m of natural porous soil must cover the entire disposal area and must be located above the seasonal high water table, above bedrock, and above any impervious layer of soil. The topography over the entire disposal area must not exceed 30% slope, unless accompanied by a report by a soil professional allowing for a greater slope.

5.0 SCHEDULE 5 – STORMWATER MANAGEMENT

5.1 GENERAL

Storm water management systems shall be designed in accordance with the requirements of this schedule and the MMCD. City of West Kelowna Standards and Specifications shall take precedent over the MMCD. Standards and Specifications contained in this Schedule shall apply to all storm water installations constructed in the City. All standards not specifically covered in these Standards or MMCD standards shall be as directed by the General Manager.

5.1.1 DRAINAGE DESIGN OBJECTIVES

The drainage design objectives are:

- To safely convey the 1:100 year storm event with overland and piped flows to a suitable receiving water body.
- To safely contain the 1:5 year storm event within the minor system without surcharge.
- To convey storm flows such that downstream capacity is not exceeded for the 1:5 year storm event, and that the major system is not adversely affected.
- To ensure that the quantity and quality of flows do not adversely affect the receiving waters.

Runoff after completion of development must not exceed the criteria specified in this document. To meet the flow criteria specified in these standards, the use of detention/retention methods or other Best Management Practices may be required. Engineering techniques which identify and incorporate natural processes can be used to preserve and enhance natural features, as well as improve the effectiveness of natural systems. A wide range of methods are feasible for the control of storm water, and Engineers are encouraged to explore and implement the most suitable techniques.

5.2 MAJOR SYSTEM DESIGN

The major system includes all drainage pathways that convey, detain, divert and intercept the major design storm runoff from the 100 year recurrence interval. This section contains the major system scope, provisions and technical requirements for Storm Water Management Design.

5.2.1 MAJOR SYSTEM DESIGN CRITERIA

- The combined capacity of the major (overland) and minor (piped) systems must be able to safely contain storm flows resulting from the 1 in 100 year design storm.

- Major flows shall be contained within public road allowances and rights-of-way, and shall discharge off-site to public road allowances and rights-of-way capable of accepting the design flows.
- Major flow channels shall be designed to resist erosion or other detrimental effects at design flows.
- Overland flow channel capacities shall be calculated using the Manning formula at critical design sections.
- Emergency overland flow route must be provided at low points or downhill cul-de-sacs.

5.2.2 PEAK FLOW AND RUNOFF VOLUME CONTROL

Peak flow and runoff volume control for both major and minor storms will be required to protect downstream properties, infrastructure, natural streams and other resources.

In general, storm water management measures shall include both flood prevention and erosion control measures for natural watercourses for both large, infrequent storms and smaller, more frequent storms. Potential storm water measures suitable for flood protection and erosion control are described in the City of West Kelowna's Storm Water Best Management Practices Manual. Controls to prevent erosive flows in watercourses shall recognize both peak flow rates and the duration of peak flows. The objective is to limit both the magnitude and the duration of post-development peak flows to that of the pre-development flow regimes as much as possible.

5.2.3 GENERAL CONSIDERATIONS

Downstream detrimental impacts shall not be increased. Where peak flow rates or volumes are increased and will cause detrimental impacts, provisions for downstream improvements must be provided. Increases in peak storm flows and volumes to the major watercourses and receiving waters shall be minimized. Consideration shall be given to fish bearing streams and to streams presently at capacity.

The number of storm water control facilities (if required) shall be minimized. In general, where detention is used, off-line storage is preferred rather than on-line storage within a watercourse, in keeping with the policies of Fisheries and Oceans Canada. Detention facilities designed for flow control shall account for the effects of multiple storms that do not allow the detention facility to empty completely between storms. As a guideline, where single-event models are used to determine the volume of detention facilities designed for flow control, a factor of safety can be used to account for the effects of sequential storms. The factor of safety shall be 1.1 for development sites with a post-development impervious cover of 20 percent, and shall increase linearly to a factor of safety of 1.5 for development sites with a post-development impervious cover of 100%. Alternatively, continuous models may be used to check for the effects of multiple storms. (The design governing storm must be comparable to the probability of the design event. For

example, a required 1:25 protection can be simulated by a 1:25 year and an annual storm combined event, or a 1:10 year and 1:25 year combined event. Various combinations and storm durations shall be used to determine the governing design).

Groundwater infiltration is to be encouraged only where a hydrogeological study determines that this practice is appropriate. Allowance shall be made for infiltration in hydraulic design only if specified in the hydro-geological study or if approved by the General Manager.

5.2.4 SUBDIVISIONS

Permanent storage facilities provided as a condition of subdivision under the *Land Title Act* are to be owned and maintained by the City. Permanent storage facilities provided in Strata subdivisions will be owned and maintained by the Strata Corporation, or as specified by the City.

Where land developments occur in advance of completed detention facilities or major flow routes, the General Manager of Engineering and Public Works may consider temporary storage facilities on an individual basis.

5.2.5 COMMERCIAL, INDUSTRIAL, INSTITUTIONAL, AND MULTI- RESIDENTIAL

Storage facilities (if required) may be located at the surface or underground, and may be either privately or City owned as specified by the City. Rooftop or parking lot storage may be considered, where appropriate. B.C. Building Code and City Bylaw regulations shall be met when designing rooftop storage.

The owner shall be responsible for the maintenance of private systems.

5.2.6 STRUCTURAL CONSIDERATIONS

If a detention basin is to be constructed on-line within a watercourse it may be constructed upstream of a road crossing of the watercourse, as long as geotechnical evaluations conclude that the road design can adequately support the additional structural loading. All detention or retention facilities must be constructed to allow an overtopping release to a major floodway, without causing undue erosion or damage. All facilities on fish-bearing streams shall be designed to allow for fish passage.

All storm water control facilities are to be designed with due concern for safety, environmental needs and aesthetics.

A pre-design engineering report is to be completed prior to design of detention facilities and is to include geotechnical assessments of the site and structure, as well as the location, number, size and release rate of the proposed detention facilities.

5.2.7 OUTLET STRUCTURES FROM STORMWATER CONTROL FACILITIES

Where a dry or wet retention, or detention, basin is proposed for flow control on a major system watercourse, the outlet structure must be designed for ease of operation and for hydraulic efficiency. All operational structures are to be of a free-flow, un-gated type. Manual controls such as gates, valves, or stop log structures are unacceptable; although, a valve for an emergency drain is required and sluice gates shall be provided for emergency releases.

Multi-inlet control structures shall be used rather than culvert restrictions, as they provide consistent control for design storm flows of different return periods, as well as improve sediment capture for initial runoff. For example, three (3) orifices located vertically on a control structure are normally designed such that the lower, smaller orifice restricts smaller frequent storms, and the larger, upper orifices control larger, less frequent storms.

Consideration shall be given to the design of smaller sediment trap basins at the points of discharge into detention/retention facilities. Normally, basin inlets shall be designed to provide sediment containment in fore bays. Accumulation of sediment shall not restrict inflow and suitable designs shall be provided to allow ease of sediment removal.

Where storm drains or culverts exceed 150 m in length, inlets and outlets are to be protected from child entry. All inlets are to be protected from debris build-up. Downstream channels are to be protected from erosion by channel lining and/or energy dissipation.

Any berms or fill creating the basin must be designed to safely pass extreme flow events by overtopping or otherwise safely conveying excess storm flows.

5.2.8 CULVERT AND BRIDGE DESIGN

The following design parameters are to be used for design of culverts and bridges.

<u>Road Classification</u>	<u>Design Flood Frequency</u>
Arterial and Collector	1 in 200 year
Local	1 in 100 year

Bridges and bottomless culverts shall be selected over conventional culverts to satisfy Fisheries concerns. Where approved, culverts shall be constructed with headwalls and endwalls. Where necessary, these structures shall be designed to restrict entry by small animals, such as beavers, and to allow fish passage.

5.2.9 DRAINAGE ON CUL-DE-SACS/DEAD-END STREETS

All cul-de-sacs or dead-end streets shall be designed with a positive major storm flow path/outlet to either an abutting street or a watercourse.

5.2.10 GROUNDWATER RECHARGE SYSTEMS

Groundwater recharge shall not normally be considered for major flood routing. Special cases may include subdivisions where infiltration is shown in a hydro-geotechnical study to be adequate for a major storm flow, and where a surface outlet is not practical.

5.3 MINOR SYSTEM DESIGN

The minor system includes all drainage works that convey, detain, divert and intercept minor design storm runoff. The minor design storm shall be the 1:5 year storm. The interception capacity of the system of street, gutters and catch basins must be compatible with the design flow rates of the storm mains. The determination of the minor runoff depends on the design storm, building code requirements, private parcel drainage, road drainage and storm drain hydraulics. Should downstream capacity be insufficient, the City may require some additional internal control in the form of storage on flat roofs, temporary ponding on parking areas furthest away from the building, or underground storage.

This section is to be used to determine minor flows, and for sizing drainage collectors for containment and conveyance of minor flows.

5.3.1 SURFACE FLOW ON ROADWAYS

a) Urban Roads

Where City highways receive and convey minor storm flows, the maximum flood level shall not exceed (for a 1 in 5 year storm) the following levels:

- There shall be no curb over-topping.
- Maximum depth of ponding at sag location or inlets is 100 mm.
- On Local Roads the flow may spread to the crown, except where curb overtopping would occur.
- On Collector Roads the flow spread must leave one (1) lane, or a road surface equivalent, free of water to ensure access for emergency vehicles.
- On Arterial Roads the flow spread must leave one (1) lane in each direction free of water.

Flow across urban road intersections shall not be permitted for storms, with a return frequency of 5 years or less.

b) Rural Roads

Rural Roads, gravel or paved, shall be constructed with swales or ditches that ensure adequate road subgrade drainage, in compliance with standard road design. Where ditching for minor drainage is provided, ditch design shall consider the following:

- Erosion protection to eliminate incising.
- Freeboard of 0.30 m, minimum.
- Free surface elevation permitting agricultural tile drainage where required.
- Stable side slopes.
- Road subgrade.
- Roadside clear zone requirements.

c) Maximum Permissible Velocity

Velocity of flow in ditches and/or swales is not to exceed the limits given below for the various types of materials used as the conveyance surface:

<u>Surface Material</u>	<u>Maximum Permissible Velocity</u>
Sand	0.45 m/s
Gravel	0.75 m/s
Clay	1.00 m/s

For velocities higher than the above maximums, suitable erosion control measures shall be incorporated into the system design.

5.3.2 PIPE DESIGN

a) Pipe Capacity

The Manning formula shall be used for calculating pipe capacity under free flow (non-surcharged) conditions. The roughness co-efficient shall be as follows:

- PVC Pipe n=0.011
- Concrete Pipe n=0.013
- Corrugated Metal Pipe n=0.024

b) Velocity

The minimum design velocity for pipes flowing full or half full is 0.6 m/s. Where design velocity is supercritical or exceeds 5.0 m/s, special provision shall be made to protect against displacement of sewers by erosion, thrust or hydraulic jump.

c) Minimum Pipe Diameter

The minimum storm drain diameter shall be as follows:

- Storm Mains 250 mm
- Catch Basin Leads 200 mm for single catch basins
250 mm for double catch basins
- Service Connections 100 mm for residential
150 mm for commercial/industrial

Downstream pipe sizes are not to be reduced unless the proposed downstream pipe is 600 mm diameter or larger and increased grade provides adequate capacity. The maximum allowable reduction is one (1) standard pipe size.

d) Curvilinear Storm Sewers

Horizontal and vertical alignments may be formed using pipe joint deflections as follows:

- Storm sewers shall be on a constant simple curve and only one (1) horizontal and vertical curve is allowed between manholes.
- Horizontal curves shall be parallel to the right-of-way at a constant offset.
- The midpoint and quarter points shall be located by survey and the offset shown on record drawings.
- Manholes are required both upstream and downstream at either end of the curve, for curvilinear sewers.
- The minimum design velocity shall be 0.9 m/s.

e) Depth of Storm Sewer

The minimum depth of the main shall be sufficient to provide all service connection piping with a minimum cover of 1.2 m to the top of the service, anywhere within the finished right-of-way. In no instance shall the cover over the crown of the main be less than 1.2 m.

The maximum depth of cover shall be 5 m, except under special circumstances and with permission of the General Manager.

For catch basin leads, the minimum depth of cover is 0.9 m.

f) Pipe Joints

Use watertight joints except where storm sewers are part of a subsurface disposal system.

g) Locations/Rights-of-Way

Storm mains are to be located as shown on the standard detail drawings within a City road or lane.

Where it is determined to be technically impractical and as approved by the General Manager, storm sewers may be situated in side yard and rear yard areas, provided that statutory rights-of-way are provided. Any such statutory right-of-way shall be a minimum of 4.5 m wide and situated in a location acceptable to the General Manager. The Owner's Engineer shall ensure that the right-of-way width is suitable to accommodate safe excavation and repair of the storm mains, based on WorkSafe BC regulations for excavation of side slopes. Lot grading and retaining wall locations shall be given due consideration in establishing the required right-of-way widths.

If a storm sewer is located within a statutory right-of-way, the landowner/developer must ensure that sufficient maintenance access is provided within that right-of-way, such that future repair/replacement using conventional construction equipment can be reasonably accommodated. When the utility is required to cross private land(s), the right-of-way must be sufficient to repair or replace the utility line without the use of caging or shoring, and be a minimum of 4.5 m wide.

5.3.3 MANHOLES

a) Location

Manholes shall be provided at the following locations:

- Every change of pipe size.
- Every change in grade, except on curvilinear sewers.
- Every change in direction, except on curvilinear sewers.
- Upstream and downstream at either end of the curve, for curvilinear sewers.
- Every pipe intersection except for 100 mm and 150 mm service connections.
- Upstream end of every sewer line.
- 135 m maximum spacing for pipes 250 mm – 300 mm diameter.
- 120 m maximum spacing for pipes 300 mm – 600 mm diameter.
- 100 m maximum spacing for pipes 600 mm diameter and larger.

b) Hydraulic Details

Crown elevations of inlet sewers shall not be lower than crown elevations of outlet sewers.

Minimum drop in invert elevations across manholes:

- Straight run Slope of pipe
- Deflections up to 45° 25 mm drop
- Deflection of 46 to 90° 50 mm drop

Horizontal deflection of greater than 90° is not permitted in a manhole.

Hydraulic losses are to be calculated for manholes with significant change of grade or alignment. For high velocity flow or large pipes (>600 mm diameter), detailed analysis is required.

5.3.4 CATCH BASINS

Catch basins shall be provided at regular intervals along roadways, at the upstream end of radius at intersections and at low points (sags). The Owner’s Engineer must ensure that sufficient inlet capacity is available to collect the entire minor flow, or major flow if required, into the underground pipe system by means of a catch basin interception analysis.

The capacity of a single catch basin (in a sump condition) can be calculated using the orifice equation:

- $Q=KCA\sqrt{2gh}$

Where: Q=inlet capacity (m³/s)
 K=clogging factor (0.6)
 C=orifice coefficient (0.8)
 A=open area (m²)
 g=gravitational acceleration (9.81 m/s²)
 h=depth of ponding (m)

Space catch basins to drain maximum paved areas of:

- 675 m² on highways with grades equal to or up to 4%
- 450 m² on highways with grades greater than 4%

Other spacing requirements include:

- Prevent overflows to driveways, boulevards, sidewalks and private property
- Avoid interference with crosswalks

- Avoid low points in curb returns if possible

All catch basin leads shall discharge into manholes. The minimum grade of catch basin leads shall be 2%.

Lawn basins are required on boulevards and private properties where necessary to prevent ponding or flooding of sidewalks, boulevards, driveways, buildings and yards.

Double catch basins shall not be connected directly together rather one basin will be wyeed into the lead of the other. Maximum lead length shall be 30 meters.

Double catch basins are to be provided at all sag points or sump locations.

5.3.5 SERVICE CONNECTIONS

Service connections are permitted when recommended by an Engineer and approved by the General Manager.

The Minimum Building Elevation (MBE) shall be a minimum 0.6 m above the 100 year hydraulic grade line by gravity. Building elevations should be established accordingly. Service connections shall not be extended at an angle that exceeds 45° from perpendicular to the main, and in no case shall a service connection be placed so that it extends in front of any parcel other than the one being serviced.

Each parcel is permitted one service connection. In special circumstances, where servicing of all buildings on existing Industrial or Commercial properties is not feasible, two (2) services may be allowed if permitted by the General Manager of Engineering and Public Works.

Connections to new mains shall be made using standard wye fittings. Connections to existing mains shall use wye saddles or, where permitted by the General Manager, insert-a-tees may be used. All services shall enter the main at a point just below the springline of the pipe.

The standard size for single detached residential service connections shall be 100 mm, for which the minimum grade from the main to the parcel boundary shall be 2%.

The minimum depth of a service at the parcel boundary shall be 1.2 m provided that gravity service to the Minimum Building Elevation is available.

Where rear yard sewers are necessary, due to steep topography, the minimum cover shall be 1.0 m provided that gravity service to the Minimum Building Elevation is available.

5.3.6 ROOF LEADERS

Roof drainage leaders are to be connected to the storm service connection only where the geotechnical requirements dictate the need. The evaluation of this requirement is to be included in the scope of the hydrogeological study. Otherwise, roof leaders are to be directed onto a splash pad for disposal to the ground. Roof leaders shall not be directed onto driveways which drain directly onto City right-of-way or areas draining onto neighbouring properties.

5.3.7 CULVERTS

The minimum culvert diameter shall be 400 mm CSP for driveway culverts and 600 mm CSP for roadway crossings unless smaller diameter culverts can provide adequate conveyance in retrofit applications approved by the General Manager

Driveway culverts shall be designed to accommodate the minor flow with the headwater not backed up above the crown of the culvert.

Culverts located on natural watercourses and culverts under roadways shall be designed to convey the major flow.

Inlet and outlet structures with energy dissipating scour protection, overflow protection and erosion control are required on all culverts designed to convey the major flow.

Surcharging at an inlet under major flow is acceptable provided that the headwater profile does not negatively encumber residential properties or slope stability.

5.3.8 INLET AND OUTLET STRUCTURES

The standard detail drawings shall be used as a guide for designing inlet and outlet structures for storm sewers and culverts. Outlets for culverts and storm sewers, having discharge velocities greater than 1.0 m/s require evaluation of the downstream channel and rip-rap or an approved energy dissipating structure may be required for erosion control.

Safety grating is required at the entrance of every storm sewer or on culverts 450 mm diameter or greater which exceed 30 m in length.

Ditch inlets to storm sewers shall include safety grillage, debris screens and sedimentation sumps.

5.4 GROUNDWATER RECHARGE SYSTEMS

To promote a reduction in storm flows and maintenance of stream base flows, groundwater recharge systems shall be investigated and used where shown to be

appropriate and technically feasible. The application of recharge systems shall be supported by a hydrogeological evaluation which supports the long-term viability of the infiltration system.

Only infiltration of uncontaminated runoff will be considered. Recharge facilities are to be installed in accordance with standards established by good engineering practice. Stilling ponds, sumps or filtration beds are to be used for protection of groundwater recharge systems.

5.4.1 HYDROGEOLOGICAL INVESTIGATION

As a minimum, the following hydrogeological determinations shall be undertaken by a qualified hydrogeologist when assessing a groundwater infiltration system:

- Area availability and integration with land use plans.
- Review soil permeability and infiltration rates.
- Groundwater levels (may require piezometers to evaluate levels over seasonal groundwater highs).
- Accessibility of high permeability soil units capable of accepting a high flow with minimum effect on groundwater table (determine transmissibility and storage coefficients - a test well or wells may be required).
- Confirmation that no groundwater discharge areas will substantially decrease or increase in flow as a result of the infiltration system.
- Effect of sediment loads on infiltration structures and the consequences of plugging of the water-soil interface.
- Impact on groundwater quality.
- Maintenance of structures and costs.
- Design simplicity.
- Provision for overflow.
- Provisions for system failure (1.5 times design or 50 percent standby areas minimum).

The hydrogeological review shall include the potential cumulative impacts of nearby developments as well as the impacts resulting from irrigation components and inflow.

5.4.2 METHODS AND GENERAL SUITABILITY

The following methods should be considered where shown to be suitable:

Table C-1 – General Suitability of Groundwater Disposal Methods		
1	Exfiltration (retention) basins and drainfields (areas underlain with perforated pipe networks)	not suited for fill areas or areas with high groundwater tables
2	Trenches or drainfields	suitable only for undistributed ground where water can move horizontally out of trenching and where drainage water is free from silts – this is especially a concern in

		areas with new development where filtration or stilling basins will be required
3	Dry wells or sumps	suitable for areas with low groundwater tables or suitable as part of a storm sewer network in conjunction with outfall – where used independently, an accessible filtration bed shall be included

5.5 WATER QUALITY PROTECTION AND ENHANCEMENT

5.5.1 WATER QUALITY CONTROL

A water quality control plan may be required as part of the Stormwater Management Plan at the discretion of the City where there are reasonable grounds to anticipate discharge of prohibited materials to the drainage system as defined in City bylaws.

A Water Quality Inlet or Coalescing Plate Separator shall be required to treat the runoff from all impervious surfaces at fuel transfer stations and other operations where there is a risk of spills of petroleum hydrocarbons.

Bio-retention or dry swale with under-drain systems or equivalent shall be provided to treat the runoff from all uncovered paved parking areas capable of containing ten or more vehicles. Parking areas surfaced with porous concrete grid or modular pavers shall be exempt from providing bio-retention or dry swale systems. Refer to the City of West Kelowna’s Storm Water Best City of West Kelowna Best Management Practices design guidance.

5.5.2 WATER QUALITY DESIGN VOLUME

Where structural facilities for contaminant removal are required and single event runoff models are used, facilities shall be designed to treat the runoff volume resulting from the 24-hour storm with a six-month return frequency. The six-month, 24-hour storm can be estimated as 70 percent of the two-year, 24-hour storm. Where continuous runoff modeling is used, contaminant removal facilities shall be designed to treat 90 percent of the runoff volume in an average year.

5.5.3 SEDIMENT CAPTURE AND TREATMENT

If runoff water is contaminated, it must be treated prior to infiltration. Where heavy silt laden water is anticipated on a temporary basis (during a subdivision development including the period of building erection up until all open areas are grassed or stabilized), sediment traps or temporary filtration devices shall be used to offload any permanent facilities. The development proponent is required to submit to the City a Sediment Control Plan in accordance with the requirements of City bylaws as part of the Phase 2 – Stormwater Management Plan submission. Refer to the City of West Kelowna Construction Best Management Practices Guidelines for design guidance.

5.6 HYDROLOGIC ANALYSIS

5.6.1 RATIONAL METHOD

The use of the Rational Method for final design calculations is to be limited to the design of minor or major storm drainage system components proposed to accommodate flows from catchments with an area of approximately 10 ha or smaller. Computer simulation programs based on hydrograph techniques are required for catchments greater than 10 ha.

The Rational Method formula and variables are presented as follows:

- $Q=KCIA$

Where: Q=flow in m³/s

K=Dimensionless constant to establish units of compatibility (= 0.00278)

C=Runoff coefficient (dimensionless)

I=Rainfall intensity (mm/hr)

A=Runoff area (hectares)

The Time of Concentration is defined as the time required for stormwater runoff to travel from the most hydraulically remote point of the drainage basin to the point of interest. The time of concentration is the sum of the inlet time plus the travel time for the flow to reach the point of interest.

The inlet time is the overland flow time for runoff to enter the conveyance system, and will vary with the size of the catchment area and surface conditions. In developed urban areas where paved surfaces drain directly to catch basins, an inlet time of 10 minutes shall be utilized for assessment of 1 in 5 year and smaller design storms. Inlet times for higher intensity design storm events are as follows:

Table C-2 – Minimum Inlet Times		
Event	Inlet Times (Minutes)	The inlet time in rural areas shall be calculated using the Airport Method: $T_i = \frac{3.26 (1.1-C) L^{0.5}}{S^{0.33}}$ Where: T _i =Inlet time (minutes) C=Runoff coefficient L=Length of travel (m) : maximum=300 m S=Slope of travel path (%)
1 in 5 yr	10	
1 in 10 yr	9	
1 in 25 yr	8	
1 in 50 yr	7	
1 in 100 yr	5	

a) Rainfall Intensity

The rainfall intensity shall be determined using Environment Canada Intensity – Duration – Frequency (IDF) curves or may be interpolated from the following IDF equation.

$$I = a \times (T)^b$$

Where: I = Rainfall intensity (mm/hr)

T = Time (hours)

a,b = Constants as specified in the following table:

Table C-3 – IDF Curve Parameters						
Coefficient	Return Period (Years)					
	2	5	10	25	50	100
Coefficient a	8.8	12.2	14.4	17.2	19.3	21.3
Coefficient b	-0.685	-0.723	-0.738	-0.753	-0.761	-0.767

b) Runoff Coefficients

Runoff coefficients should be established based on the proposed land uses and hydrogeological information. Calculations and justifications for the determination of runoff coefficients are to accompany development submissions. In the case of applying the Rational Method to mixed land uses in a drainage area, a weighted average runoff coefficient should be used.

The following table suggests ranges of C values for various categories of ground cover.

Table C-4 – Runoff Coefficients	
Commercial Development	Runoff Coefficient
• Downtown areas	0.70-0.95
• Neighbourhood areas	0.30-0.70
Residential Development	Runoff Coefficient
• Single detached areas	0.30-0.50
• Multi-residential, detached	0.40-0.60
• Multi-residential, attached	0.60-0.75
• Suburban	0.25-0.40
• Apartment dwelling areas	0.40-0.70
Industrial or Institutional Development	Runoff Coefficient

• Light areas	0.40-0.80
• Heavy areas	0.60-0.90
Parks, cemeteries	0.07-0.25
Playgrounds	0.07-0.20
Railroad yards	0.20-0.40
Undisturbed Areas	Runoff Coefficient
• Sand or sandy loam soil, 0-5%	0.05-0.10
• Sand or sandy loam soil, >5%	0.10-0.20
• Rock and soil mix, 0-10%	0.07-0.15
• Rock and soil mix, >10%	0.10-0.20
Landscaped Areas	Runoff Coefficient
• Sandy soil, flat 2%	0.05-0.10
• Sandy soil, average 2-7%	0.07-0.15
• Sandy soil, steep 7%	0.15-0.20
• Heavy soil, flat 2%	0.13-0.17
• Heavy soil, average 2-7%	0.18-0.22
• Heavy soil, steep >7%	0.25-0.35
Streets/Roadways/Structures	Runoff Coefficient
• Asphaltic	0.90-0.95
• Concrete	0.90-0.95
• Brick	0.70-0.85
Drives and walks	0.85-0.95
Roofs	0.90-0.95

Runoff coefficients, listed for urban and rural watersheds and others apply to storms of two year, five year and ten year frequencies. Higher frequency storms require modifying the runoff coefficient because infiltration and other abstraction have a proportionally smaller effect on runoff. Adjust the runoff coefficient by the factor C_f as indicated in the following table. The product of C and C_f should not exceed 1.0.

Recurrence Interval (Years)	C_f
25	1.10
50	1.20
100	1.25

The Owner's Engineer shall tabulate the design calculations using Table E-2 or similar, for submittal with the stormwater management plans. Hydraulic grade lines throughout the drainage system, including any backwater effects shall be shown.

5.6.2 COMPUTER MODELING METHODS (CONTINUOUS EVENT MODELLING)

a) Application

Computer modeling methods are to be used for a drainage basin larger than 10 hectares and for the design of all stormwater detention facilities.

Prior to commencing any computer modeling for purposes of drainage design studies, the Owner's Engineer shall obtain acceptance from the General Manager, on the selection of the proposed computer program.

It is necessary to use computer models which have the capability to adequately represent the hydrologic characteristics of the watersheds, rainfall distribution and generate hydrographs for a critical storm or series of storms. The computer model must also have the capacity to route these hydrographs through a network of conduits, surface channels and storage facilities.

b) Design Storms

Design storms that reflect the most recent data from Atmosphere Environment Canada, shall be used in the computer model. Use Environment Canada design hyetographs with durations from 1 hour to 24 hours and various return frequencies.

The design hyetographs are suitable for most hydrological studies, however, the simulation of large watersheds or complex drainage systems may require extended duration storms or continuous rainfall data. It is incumbent on the Owner's Engineer to obtain the appropriate rainfall data for the analysis.

c) Presentation of Model Results

The Owner's Engineer shall document the design rational and parameters used to develop the computer simulation and present the results within the design report. As a minimum, the design report shall include the following:

- Type and version of model software;
- Summary of all parameters and assumptions used;
- Presentation of design storms used in the analysis;
- Summary of peak flow rates;
- Inflow and outflow hydrographs of storage facilities; and
- Hydraulic grade lines throughout the drainage system including backwater effects if appropriate.

5.7 STORMWATER STORAGE

This section identifies the general design parameters and requirements that must be considered by development proponents in the planning and design of stormwater storage facilities.

5.7.1 PEAK FLOW CONTROL

Control on peak flow rates and volumes in the City are necessary:

- To minimize impacts on watercourses and downstream developments from flow increases which will result from land development.
- To maintain or lessen flows in watercourses so that creek channels and existing structures, such as bridges and culverts, will continue to operate without being flooded or damaged.

In consideration of the above, the City has the following objectives and requirements:

- Impact and expenditures to existing downstream users shall not be increased.
- Increases in peak storm flows and volumes to the watercourses and receiving waters shall be limited.
- The number of storage facilities shall be minimized. Permanent detention will not be permitted under private ownership, unless incorporated on-site within a private development.
- Permanent storage facilities are to be owned and maintained by the City.
- Where land developments occur in advance of permanent detention facilities, the City may consider temporary storage facilities on an individual basis. Maintenance charges and responsibility for temporary storage facilities will be borne by the developer.
- Storage facilities may be surface or underground. Rooftop or parking lot storage may be considered, where appropriate.
- Private property owners are to indemnify the City from liability arising out of private facilities.

5.7.2 RELEASE RATES

a) Level of Service

Developments within the City of West Kelowna are required to provide storage up to the 100 year event, plus a 10% volumetric safety factor. The release rates from storage facilities shall be staged to reduce the impacts downstream, and mimic the pre-development conditions as much as possible. The following level of service shall be followed in determining the storage facility requirements.

Design Event	Design Condition
1 in 6 month post-development	Maximum release rates – 6 month pre-development Provide BMPs for Water Quality Control
1 in 5 year post-development	Maximum allowable release equivalent to the 1 in 2 year pre-development flow rate
1 in 100 year post-development	Maximum release rate – equivalent to the 1 in 5 year pre-development flow rate

b) Geotechnical Considerations

Special geotechnical investigations to address issues related to the design of all stormwater management lakes and dry ponds are to be undertaken as part of the planning and design studies, and are a prerequisite to the final design of such facilities.

Wherever possible, the stormwater storage facility shall be excavated in natural, stable ground. Should topography dictate that a berm be constructed along one or more sides of the basin, the berm shall be designed by a qualified Engineer with relevant training and experience.

c) Staged Construction – Standards for Interim Facilities

When stormwater management storage facilities are to be implemented in stages, the standards applicable to the design and construction of the interim facilities are to be generally in accordance with the standards set out herein for permanent facilities of that type. Refer to the City of West Kelowna Construction Best Management Practices Guidelines for design guidance.

5.7.3 STORAGE FACILITY DESIGN REQUIREMENTS

a) Land Dedication

Generally, the area of land covered by water when the basin is at the 100 year water level will be dedicated to the City. This dedication will also apply to all accesses to inlets/outlets, any structures and maintenance access routes to the facility.

A restrictive covenant will be placed on parcels abutting the facility to control parcel development so as not to compromise design requirements at the high water level. This is to ensure an adequate freeboard is maintained.

b) Maintenance Access Requirements

An all-weather access for maintenance vehicles must be provided to all facility works. A vehicle access route shall also be provided to the edge of all storage facilities suitable to carry maintenance vehicles (H-20/M-18 AASHTO loading) and for use as a boat launch point if required. The access surface shall be a minimum of 4.6 m wide, shall extend into the pond beyond the edge at normal water depth to a point where the normal water depth is 1.0 m, and shall be accessible from and extend to a public road. Sharp bends are to be avoided, and it shall have a straight run of 12 m or more leading to the pond edge (to permit a straight run in for launching of boats).

c) Emergency Overflow Provisions

An overflow spillway is to be provided for each storage facility design and, such provisions are to be incorporated in the facility design. The Owner's Engineer is to identify the probable frequency of operation of the emergency spillway. Where provision of an emergency spillway or overflow route is found to be unfeasible, the design is to include an analysis of the impact of overtopping of the storage facility and the probable frequency of occurrence of overtopping. The functional requirements of the spillway, and the impact analysis for the absence of one, are to consider the possible consequences of blockage of the system outlet or overloading due to consecutive runoff events, such that the storage capacity of the facility may be partially or completely unavailable at the beginning of a runoff event.

d) Landscaping Requirements

Landscaping plans for areas bounding the facility shall be submitted as part of the Engineering Drawings. Landscaping of all proposed public lands included for purposes of the facility and of all proposed rights-of-way on proposed private property up to the design high water level, is to be part of the construction requirement and be dependent on the location and the context of the facility. The requirement for landscaping may be irrigated turf, constructed to the satisfaction of the City.

e) Sediment Removal Provisions

The facility design shall incorporate the ability for sediment capture and efficient removal for the control of solids which may be washed into the facility.

f) Maintenance and Service Manual

As part of the responsibility for design of a stormwater management storage facility, the development proponent shall prepare and provide a maintenance and service manual for the facility.

Three complete copies of the manual are to be provided to the City of West Kelowna prior to the time when the operation responsibility of the facility is transferred to the City of West Kelowna, which will generally be at the time of substantial completion. The manual shall include complete equipment manufacturer's operation, maintenance, service and repair instructions, and complete parts lists for any mechanized or electrical equipment incorporated in the design.

The manual is to include, at a minimum, the following information:

- A copy of the approved Engineering Drawings relating to the Stormwater Storage Facility and appurtenances, updated to "As-Constructed".
- Schematic diagrams of the inlet and outlet arrangements, connections to and arrangement of upstream and downstream systems, including all controls, shutoff valves, bypasses, overflows, and any other operation or control features.
- Location plans for all operating devices and controls, access points and routes, planned overflow routes, or likely point of overtopping in the case of exceeding the design containment volume.
- Stage Discharge Curves with clear relationships of the stages relative to surrounding features.
- An outline of the normally expected operational requirements for the facility.

g) Signage for Safety

The design for stormwater management facilities shall include the installation of signage to warn of anticipated water level fluctuations, with demarcation of maximum water levels to be expected for design conditions. Warning signs will be provided and installed by the development proponent.

h) Stormwater Management Plans/Drawing Requirements

The stormwater management plans/engineering drawings for any stormwater management facility are to include the following information, in addition to the physical dimensions:

- Stage-Volume; Stage-Area Curves; and Stage-Discharge Curves for the 2, 5 and 100 year level storms.
- Elevations at Normal Water Level (NWL), 5 Year Level and High Water Level (HWL).
- Volumes at NWL, 5 Year Level and HWL.
- Freeboard elevation.
- Notation indicating the lowest allowable building elevation for parcels abutting the facility.
- Contributing basin size (ha).

- Measurements to locate submerged inlet(s), outlet(s) and sediment traps referenced to identifiable, permanent features which are not submerged at NWL.

i) Side Slopes

- Areas normally or infrequently covered by water, from the design high water level down to a point 1.0 m below the normal water level shall have a maximum slope of 5 (horizontal) to 1 (vertical).
- A slope of 3 (horizontal) to 1 (vertical) may be required from the 1.0 m depth point (below NWL) to the pond bottom. The requirement for maximized slopes below water is an attempt to discourage the growth of unwanted vegetation.
- In the case of constructed wetlands, benched areas above and below the NWL to encourage growth of aquatic and riparian plants is desirable.

j) Pond Bottom Material

For areas where the groundwater table is below the NWL, the pond bottom and side slopes are to be composed of impervious material with a suitably low permeability (e.g. with a permeability coefficient in the order of 1×10^{-6} cm/s). For area where the groundwater table is expected to be near or above the NWL, the pond bottom may be of a pervious material as dictated by geotechnical considerations.

k) Minimum Depths

The minimum depth from normal water level to pond bottom shall be 0.6 m.

l) Circulation Requirements:

- Narrow or dead bay areas where floating debris may accumulate are to be avoided. Inlets and outlets should be located with consideration of the need to maximum detention time and circulation within the pond water body.
- The length of the wet pond relative to the width should not be less than 3.1 or greater than 6.1 so as to promote natural water circulation and avoid water quality deterioration associated with stagnant reaches within the facility.

m) Outflow Control Works

The outlet from a stormwater management storage system must incorporate appropriate means for control of outflow. In addition, the outlet works must include provisions for operational flexibility and to address

unintentional blockage of the outlet and the possible need to either stop outflow or increase the rate of outflow.

n) Drawdown Provisions

The means should be provided to permit discharge from storage facilities at the maximum rate of flow which the downstream system can accommodate after storm runoff peak flows have passed and the flows from other contributing areas have decreased or ended. The rate of discharge to be provided for drawdown purposed is to be sufficient to restore availability of storage capacity of facilities sufficiently to accommodate subsequent runoff events within a reasonable time frame. To achieve this purpose, drawdown of facilities is to be possible at rates to satisfy the following relationship of available volume to the time from commencing drawdown with the facility at the design high level.

Table C-6 – Drawdown Requirements for Wet Ponds	
Drawdown from Maximum Flood Elevation	Available Volume Required Below Maximum Flood Elevation
24 hours	Volume equivalent to 1 in 5 year runoff
72 hours	100% of total storage volume

o) Submergence of Inlets and Outlets

Inlets and outlets are to be fully submerged. Inlet and outlet pipe inverts are to be minimum 0.1 m above the pond bottom.

p) Provisions of Free Outfall from Storm Inlets

The invert elevation at the first manhole upstream from, the pond in a minor system shall be at or above the NWL of the pond to avoid deposition of sediments in the inlet pipe. To avoid backwater effects on the upstream sewers leading to the pond, the obvert of the inlet sewer at the first manhole upstream from the pond shall be at or above the pond level for the 1 in 5 year storm. A drop structure upstream from the pond will generally be required to achieve this. “Inlet” and outlet” control calculations are required to verify the mode of operation of the pond inlets.

q) Provisions for Lowering the Water Level

The provision of the means to drain the pond (for maintenance purposes) completely by gravity drainage is desirable. The incorporation of this provision with the outlet control bypass should be considered. Where a gravity drain is not feasible, provisions are to be made in association with the outlet works or otherwise, so that mobile pumping equipment may be installed and used to drain the pond.

r) Pond Edge Treatment

Edge treatment or shore provision is required and shall be compatible with the adjacent land use. The treatment used shall meet criteria for low maintenance, safety and ease of access to the water’s edge.

The edge treatment is to cover ground surfaces exposed or covered by water during a water level fluctuation to 0.3 m below or above the NWL and shall be adequate to prevent erosion of the pond edge due to wave action. The typical acceptable edge treatment shall be, but is not limited to a 250 mm deep layer of well graded washed rock with a 75 mm minimum size or vegetated strip consisting of hardy materials suitable for this application. The proposal of variations to the edge treatment minimum is encouraged. The final selection of edge treatment is subject to the approval of the City.

5.7.4 DRY PONDS

a) Outflow Control Works

The outlet from a stormwater management storage system must incorporate appropriate means for control of outflow. In addition, the outlet works must include provisions for operational flexibility and to address unintentional blockage of the outlet and the possible need to either stop outflow or increase the rate of outflow.

b) Drawdown Provisions

The means should be provided to permit discharge from storage facilities at the maximum rate of flow which the downstream system can accommodate after storm runoff peak flows have passed and the flows from other contributing areas have decreased or ended. The rate of discharge to be provided for drawdown purposed is to be sufficient to restore availability of storage capacity of facilities sufficiently to accommodate subsequent runoff events within a reasonable time frame. To achieve this purpose, drawdown of facilities is to be possible at rates to satisfy the following relationship of available volume to the time from commencing drawdown with the facility at the design high level.

Table C-7 – Drawdown Requirements for Dry Ponds	
Drawdown from Maximum Flood Elevation	Available Volume Required Below Maximum Flood Elevation
24 hours	Volume equivalent to 1 in 5 year runoff
72 hours	100% of total storage volume

c) Depth of Ponding

The maximum live storage limit in a dry pond is 3.0 m, as measured from the invert elevation of the outlet pipe.

d) Dry Pond Bottom Grading and Drainage

The dry pond shall be graded to properly drain all areas after its operation. The dry pond bottom shall have a slope of 1.0% or greater. Sub-surface drains or similar means may be required where it is anticipated that these slopes will not properly drain the dry pond bottom, or where dictated by multiple use or other special considerations.

e) Side Slopes

The facility shall be designed with maximum side slopes of 5 (horizontal) to 1 (vertical), both above and below permanent pool elevation. In confined areas away from public access points, the provision of slopes of 3 (horizontal) and 1 (vertical) may be permitted (subject to the approval of the General Manager of Engineering and Public Works).

f) Safety Provisions at Inlet and Outlet Structures

All inlet and outlet structures associated with dry ponds shall have safety grating installed over their openings to restrict access and prevent unauthorized entry into storm sewers. A maximum clear bar spacing of 0.10 m shall be used for gratings.

Grated outlet structures are to be designed with a hydraulic capacity of at least twice the required capacity to accommodate potential clogging. Further, the arrangement of the structures and the location of the grating shall be such that the velocity of the flow passing through the grating will not exceed 0.45 m/s.

Appropriate fencing and guard-rails are to be provided to restrict access and reduce the hazard presented by the structure headwalls and wingwalls.

5.7.5 INFILTRATION BASINS

a) Outlet Design

Infiltration basins do not have a formal outlet structure. As such, the storage volume must be based upon the complete runoff generated by the 1 in 100 year storm with no provision for outlet during the event, plus a 50% safety factor as applied to the design infiltration rate.

b) Depth of Ponding

The maximum live storage limit in a basin is 3.0 m.

c) Side Slopes

Side slopes subject to inundation upon filling of the basin shall have a maximum slope of 5 (horizontal) to 1 (vertical).

d) Safety Provisions at Inlets

All inlet structures associated with infiltration basins shall have grates provided over their openings to restrict access and prevent entry into sewers by children or other persons. A maximum clear bar spacing of 0.10 m shall be used for gratings.

Appropriate fencing and guard-rails are to be provided to restrict access and reduce the hazard presented by the structure headwalls and wingwalls.

e) Other Considerations

- A detailed hydrogeological investigation must be conducted to support the proposed infiltration basin. The investigation must assess impacts to upstream and downstream properties and identify measures to alleviate impacts, if necessary.
- To address the issue of sediment plugging during development in the catchment area, the basin is to be constructed to 90% of its ultimate depth and volume. When development in the catchment reaches 90%, the infiltration basin is to be completed.

5.8 EROSION AND SEDIMENTATION CONTROL

5.8.1 OBJECTIVES

All proposed projects must provide erosion and sedimentation controls to prevent the displacement of soil and the transport of sediment from the project site resulting from land-disturbing activities. To prevent the displacement of soil and the sediment transport during land-disturbing activities, Erosion and Sedimentation Control (ESC) measures are required and shall be performed as described below. Both temporary and permanent erosion and sedimentation controls shall be implemented.

The objective of erosion and sedimentation control is to prevent the displacement of soil and the transport of sediment to streams, wetlands, lakes, drainage systems

and adjacent properties. Erosion on construction sites can result in excessive sediment transport to adjacent properties and to surface waters. Sediment transport can result in adverse impacts such as flooding due to obstructed drainage systems, smothering of aquatic habitat and the creation of algal blooms in lakes, among others.

a) Engineered Plan

An erosion and sediment control plan shall be provided. The purpose of this plan is to prevent the release of silt, raw concrete, concrete leachate and other deleterious substances into any ditch, storm sewer, watercourse or ravine. Construction materials, excavation wastes, overburden soils, or other deleterious substances shall be disposed of or placed in such a manner as to prevent their entry into any watercourse, ravine, storm sewer system, or restrictive covenant area.

All station control devices shall be situated to allow for ready access for cleaning and maintenance. Siltation control structures shall be maintained throughout the course of construction and to the end of the maintenance period (final acceptance). Changes in the design of the structure shall be required if the proposed structure is found to perform inadequately.

At minimum, the erosion and sediment control plan shall provide the following:

- Project description: A brief description of the nature and purpose of the land-disturbing activity and the amount of grading involved.
- Existing site conditions: A description of the existing topography, vegetation, and drainage.
- Adjacent areas: A description of neighbouring areas, such as streams, lakes, residential areas, and highways that might be affected by the land disturbance.
- Soils: A brief description of the soils on the site including erosion capability and particle size distribution (texture).
- Critical areas: A description of areas within the developed site that have potential for serious erosion or sediment problems.
- Erosion and sediment control measures: A description of the methods that will be used to control erosion and sediment on the site including, temporary erosion control and temporary sediment control measures. Financial guarantees may be required to assure proper implementation.
- Permanent stabilization: A brief description of how the site will be stabilized after construction is completed.
- Maintenance: A schedule of regular inspections and repairs of erosion and sediment control structure, and the person responsible for maintenance.

b) Details

- Detailed drawings: Enlarged dimensioned drawings of such key facilities as sediment basin risers, energy dissipaters, waterway cross-sections, and sediment barriers.
- Seeding and mulching specifications: Seeding dates, seeding, fertilizing, and mulching rates in pounds per acre, and application procedures.
- Maintenance program: Inspection schedules, spare materials needed, stockpile locations, and instructions for sediment removal and disposal and for repair of damaged structures.

b) Calculations

- Calculations and assumptions: Data for design storm used to size pipes and channels and sediment basins and traps, design particle size for sediment trap efficiencies, basin discharge rates, size and strength characteristics for filter fabric, wire mesh, fence posts, etc. and other calculations necessary to support drainage, erosion, and sediment control systems.
- Attachments: The erosion control plan shall be accompanied by a grading plan.

6.0 SCHEDULE 6 – GRADING AND EARTHWORKS

6.1 GENERAL

The Owner's Engineer shall prepare detailed grading, drainage, and erosion and sediment control plans for any proposed development or subdivision, clearly delineating the manner in which the site will be graded and drained. Local topography (slope stability) shall form a key element in the design of grading/drainage. Said plans shall also establish the measures and practices proposed for control of erosion from the proposed development or subdivision during the various phases of construction.

6.2 LOT GRADING

6.2.1 PURPOSE

The purpose of Lot Grading is to ensure individual parcels are designed to minimize the impact precipitation events have on that parcel and the surrounding area.

6.2.2 DESIGN CRITERIA

In general, the design shall:

- Follow applicable drainage standards criteria.
- Ensure surface drainage from or on adjacent lands is accommodated or not adversely affected.
- Not encroach into Environmentally Sensitive Areas.
- Incorporate erosion and sediment control measures.
- Provide proper surface drainage and maximum usable land area.
- Preserve existing trees where possible.
- Direct flows away from buildings.

Yard grades shall not exceed a slope ration of 3 horizontal to 1 vertical.

Side Lot Lines grades shall be:

- Minimum slope of 2% (always away from the house).
- Optimum slope of 4%.

Walkway grades shall be:

- Minimum cross slope of 2% (where gradient is less than 2%).
- Maximum walkway gradient and cross slope of 5% (combined).

6.2.3 MINIMUM TOPSOIL DEPTH

Boulevard areas, City rights-of-way or easements shall be provided with a minimum 300 mm of topsoil.

7.0 SCHEDULE 7 – UTILITIES

7.1 GENERAL

Utilities shall be designed in accordance with the requirements of this schedule, the Master Municipal Construction Documents (MMCD); Canadian Electrical Code (CE Code), American National Standards Institute/Illuminating Engineering Society RP-8-14 Roadway Lighting Manual (ANSI/IES RP-8-14).

All development is provided with electrical, telephone, cablevision and natural gas service where available. Electrical, telephone, cablevision and natural gas systems shall be provided to serve each parcel, consistent with the standards and specifications set out in this Schedule. Wherever possible existing overhead systems are to be removed and replaced with underground utility systems. All utility servicing from overhead systems must be designed to enable the future removal of the overhead systems and their replacement with underground systems with minimal or no disturbance to users. Where overhead systems remain in place the installation of approved conduit or carrier pipe for future utility use in the designated utility corridors along the frontage is required. Road crossing conduit and or carrier pipe is also required as part of any road construction where underground servicing is anticipated within the service life of the road structure.

The following provisions shall apply to the design, installation or relocation of any utility infrastructure required as a condition of subdivision or development. The Owner's Engineer shall submit a composite utility plan showing all utilities.

7.1.1 REGULATIONS

Equipment, installation, wiring methods, and materials used must be in accordance with the Rules and Regulations for the Installation and Maintenance of Electrical Equipment as issued by the British Columbia Ministry of Transportation & Infrastructure.. Work must also be in accordance with all applicable City bylaws, policies and regulations, Provincial statutes or regulations in effect at the site.

7.1.2 LOCATION

All shallow utilities shall be installed in the standard locations shown on the standard detail drawings.

7.1.3 MATERIALS

All materials used in the underground or overhead electrical distribution system shall be as specified by the electrical provider. All materials used shall be as specified by the telephone provider. All materials used shall be specified by the television provider and supplied by the Owner unless otherwise directed by the cablevision company. All materials used in the underground natural gas distribution system shall be specified by the gas provider. Gas distribution may be

permitted on both sides of the roadway where development is present on both sides if requested by the gas provider.

7.1.4 WORKMANSHIP

Installation requirements such as trenching, installation of ducting and backfilling shall be according to specifications supplied by the particular utility company and City Bylaws. All installations shall conform to Worksafe BC requirements for excavations. All conduits must be bedded and covered with bedding as required by the particular utility company, complete with marker tape over the works at 0.3 m cover.

7.2 ELECTRICAL AND COMMUNICATION UTILITIES

7.2.1 WIRING STANDARDS

Underground systems shall include the supply and installation of all necessary conduits, wiring, transformers, service runs and connections for a complete and fully operative underground electrical system that conforms to the MMCD and CE Code, as provided by the electrical provider and approved by the B.C. Inspector of Electrical Energy.

The ducts and conductors should be laid in a straight line at a constant offset and a uniform grade. Ducts and cables may be designed to have a horizontal curve at a constant offset to parcel boundary. Roadway crossings shall be laid in a straight line and, where possible, should be at right angles to the center-line of the roadway.

7.3 NATURAL GAS

Natural gas distribution system shall include the supply and installation of the necessary conduit and main line tubing for a complete and fully operative main line as laid out by the gas provider prior to the construction and installation of such a system. All mains forming part of a natural gas distribution system shall be buried at a minimum depth of 600 mm. The system or extension shall be installed following installation of sewer, drainage, and water mains.

7.4 STREET LIGHTING

Street lighting design shall be coordinated with the electrical provider and conform to MMCD and CE Code.

7.4.1 LOCATION

Street lighting must provide adequate illumination of intersections, transit stops, and community post boxes.

7.4.2 ORNAMENTAL STREETLIGHTING

The City has established a standard for ornamental roadway street lighting that may apply to subdivision or development applications dependent upon road cross-sections required. The use of Eaton UTLD Traditionaire LED Downlight fixture is acceptable for 'top-hat' style retrofit applications as approved by the General Manager of Engineering and Public Works.

7.4.2 DESIGN CRITERIA

A licensed professional, approved by the City specializing in lighting design is to provide a street lighting photometric design layout for submission to the electrical provider showing the following:

- a) Luminaire mechanical and electrical details.
- b) Pole construction and installation details. All poles to be galvanized and or Powder Coated Green (CSY E4Y KXS24).
- c) Overall layout and dimensional locations of all poles and luminaires along roadway allowance;
- d) The preferred layout of poles and luminaires shall be on both sides of the highways in a staggered pattern. Exceptions shall be on divided median highways and at intersections.
- e) Anti-theft devices must be incorporated into the design.
- f) Design must result in uniform lighting of roadways and sidewalks with maximum spill light cut-off beyond the sidewalk.
- g) Design must meet ANSI /IES RP-8-14 practices and requirements.
- h) All luminaires to be Phillips Road Focus LED Cobra heads complete with 7 pin receptacle.
- i) 4000K color temperature to be used on all collector and arterial roadways, 3000K color temperature fixtures to be used on all local roadways.

8.0 SCHEDULE 8 – HILLSIDE DEVELOPMENT STANDARDS

8.1 GENERAL

The hillside development standards are intended for land within DPA 4 Hillside Development Permit Areas as identified in the City's Official Community Plan.

8.2 ROAD CLASSIFICATIONS

Road classifications are simplified for hillside roads into a Hillside Collector, three variations of a Hillside Local and a Hillside Public Lane. Descriptions of each are provided in the following subsections. Table D-1 provides specifications on each hillside road class and Table D-2 provides criteria for design. The hillside road classifications and subsequent cross-sections found in Schedule 9 are typical applications. Where the cross-sections on adjacent highways have been constructed and do not meet these standards, new construction shall be consistent with these standards rather than the old design. If the General Manager determines that it would not be in accordance with good engineering practice to do so, the cross-sections may be constructed to an intermediate standard to better tie-in to the surrounding environment.

8.2.1 HILLSIDE COLLECTOR

Hillside Collector roads provide a combination of mobility and access. The Hillside Collector is expected to handle lower traffic volumes serving a maximum of 500 units. If the proposed collector is serving more than one neighbourhood or is servicing commercial properties, then the standard urban collector is to be used. Hillside collectors are established based on the intended function of the roadway and expected volumes. If on street parking is desired it may require additional right-of-way width or use of the standard collector roadway cross-section.

8.2.2 HILLSIDE LOCAL

The hillside local provides access to residential dwellings to serve a maximum of 200 units. Three alternative designs are considered for access on both sides of the road, one side and no access. No parking is permitted within the no access alternative and no parking signs are required to be placed on both sides of the road. Local Roads must either connect to another road on each side or provide a turnaround at the terminus. Sidewalks are required on all Hillside Local Roads servicing 30 units or more.

8.2.3 PRIVATE HILLSIDE LANES

Private hillside lanes must provide turnaround at or near the terminus. right-of-way will be a minimum of 6.0 m and a 6.0 m roadway must be provided. Lengths exceeding 90 m will require turnarounds at 90 m increments.

8.2.4 CUL-DE-SACS

Cul-de-sacs require a minimum right-of-way for a 14.0 m radius and a minimum 12.0 m radius from the edges of the paved surface. This will require a larger right-of-way than the connecting roadway for most hillside roads. No parking signs are to be posted around the cul-de-sac. Sidewalks are to be included in cases where there is a connecting trail or pathway. Alternative types of road turnarounds will be considered for use based on site specific topographic conditions. In certain circumstances, hammerhead or eyebrow type turnarounds will be permitted. Cul-de-sacs shall not exceed the fire-fighting capability of the fire department.

A secondary emergency access is required for public roads terminating on cul-de-sacs. The requirement may be modified at the discretion of the General Manager.

8.2.5 HILLSIDE EMERGENCY ACCESS

Maximum grades for hillside emergency access roads are 15% with a 6.0 m right-of-way and 6.0 m roadway. Emergency access routes should restrict non-emergency vehicles through the use of gates or similar moveable obstructions.

Pedestrian access to the emergency route should be accommodated. Primary access to individual properties cannot be via emergency access roads.

8.3 UTILITIES

8.3.1 LIGHT STANDARDS

Light standards should be located to one side of the road to minimize road width requirements and ground disturbance. As much as possible, they will be located on the uphill side at the back of the sidewalk to illuminate the pedestrian space. Additional lighting may be required for intersections to satisfy the City's illumination level requirements.

8.3.2 COMBINED TRENCH

Electrical, telephone, and cablevision are to share an 800 mm wide shallow utility trench with natural gas where possible. A minimum of 1.25 m clearance from deep utilities is required. Transformers shall not be located on top of gas mains. Gas mains are to be sleeved with carrier ducts.

8.3.3 SANITARY AND STORM SEWER LOCATION AND CORRIDORS

In cases where rear yard sewer are used, rights-of-way for rear yard serviced parcels shall be constructed in a manner that allows for practical and unencumbered access by maintenance equipment with grades less than 15% and minimum width of 4.5 m. No permanent structures are to be built within the right-of-way. Maintenance vehicles require right-of-way protection for access to manholes. Accesses will be perpendicular to the roadway.

To reduce the number of manholes around horizontal curves, manufactured long radius bends may be used if acceptable to the General Manager. The following standards apply:

- Maximum of 3 bends between manholes.
- Minimum of 1 full pipe length (4.0 m) between each bend.
- All bends shall be supplied by an approved pipe manufacturer.
- All bends shall be a long radius bend.
- Maximum bend angle of 11.25 degrees.
- Minimum storm pipe diameter of 250 mm.
- Minimum sanitary pipe diameter is 200 mm.
- The resulting pipe alignment shall have a constant radius (i.e., no compound or reverse curves) which shall be noted on the design and record drawings. If bends are to be installed within a roadway, the radius for the pipe alignment shall have a constant offset from the road centreline or edge of curb.
- Manholes must be installed within 10 m of each end of the resulting equivalent radius.
- Maximum distance between manholes of 100 m.
- The minimum sanitary pipe grade shall be governed by a minimum design velocity of 0.9 m/s. If flows of 0.9 m/s are not expected, the minimum grade shall be calculated based on the pipe flowing 35% full at 0.9 m/s. However, the minimum grade shall be no less than 1%.
- The record drawings shall detail the coordinates of each bend location.

Additional right-of-way may be required on narrow roadways to provide space for lift stations as necessary.

8.3.4 PRESSURE REDUCING VALUE (PRV) STATIONS

When necessary to add PRV stations, additional right-of-way may be required on narrow roadway.

8.4 ROCK CUTS

Rock cut catchment areas will be a minimum catchment width of 3.0 m and may be greater based upon the geotechnical studies. The entire catchment area is to be located within the road right-of-way.

8.5 HILLSIDE ROAD CLASSIFICATION SPECIFICATIONS

Table D-1: HILLSIDE ROAD CLASSIFICATION SPECIFICATIONS									
Road Classification		Max Units Served	Design Speed (km/h)	Max Grade (%)	ROW¹ (m)	Asphalt Width² (m)	Parking	Curb & Gutter	Sidewalk³
Hillside Collector Roads		500							
HC-1	Hillside Collector		50 (40) ⁴	10	18.0 ⁵	10.1	Permitted	Barrier Curb	One Side Minimum
Hillside Local Roads		200							
HL-1	Access on Both Sides		50 (30) ⁴	12	14.0	7.6	Permitted	Rollover Curb	One Side Minimum
HL-2	Access on One Side		50 (30) ⁴	12	14.0	7.6	Permitted	Rollover Curb on Access Side. Barrier Curb on No Access Side	One Side Minimum
HL-3	No Access		50 (30) ⁴	12	12.9	6.8	Not Permitted ⁶	Barrier Curb	One Side Minimum
Hillside Public Lanes		10 (15)⁷							
HP-1	Public Lane		30	12	9.3	5.6 ⁸	Not Permitted ⁶	Rollover Curb	None
Hillside Emergency Access		-							
		-	-	15	4.5	4.5	-	-	-

¹ Right-of-way requirements may increase for catchment area of rock cuts.

² Measured from edge of pavement.

³ Sidewalks shall terminate at a destination or connect with another sidewalk or trailhead.

⁴ Minimum permitted design speed reduction due to topographic constraints and approved by General Manager.

⁵ Where required, right-of-way will be increased to provide space for turning lanes.

⁶ All parking shall be accommodated on-site or with small parking pullouts.

⁷ 15 units may be served if lane connects to roadway on each end.

⁸ 6.0 m of driveable surface provided in accordance with building code.

8.6 ALIGNMENT DESIGN CRITERIA

TABLE D-2: ALIGNMENT DESIGN CRITERIA			
1. Horizontal Curve Radii			
Criteria	30 km/h	40 km/h	50 km/h
Roadway Crossfall			
Normal Crown (-2%)	45 m	90 m	165 m
2% Superelevation	30 m	65 m	120 m
4% Superelevation	22 m	45 m	80 m
Through Intersections	40 m	70 m	120 m
2. Superelevation Transition Lengths			
Criteria	30 km/h	40 km/h	50 km/h
Transition Lengths ¹			
Normal Crown to +2%	20 m	20 m	22 m / 34 m
Normal Crown to +4%	30 m	30 m	33 m / 50 m
Min. Tangent Length Between Reversing			
2% Superelevation	12 m	12 m	13 m / 20 m
4% Superelevation	22 m	24 m	26 m / 40 m
¹ Values for transition lengths include tangent run-out applied at the same rate as superelevation runoff. ² 60% of superelevation runoff occurs on the tangent approach and 40% on the curve, resulting in a minimum length of tangent between reversing curves of 120% of the superelevation runoff length.			
3. Grades			
Criteria	30 km/h	40 km/h	50 km/h
Minimum Grade	0.5%	0.5%	0.5%
Maximum Grades			
on Minimum Radius Horizontal Curves ¹	10%	10%	8%
Grades Through Intersection			
with Design Speed on Major Road	-	8%	8%
Approach Distance for Major Road ²	-	0 m	5.0 m
with Design Speed on Minor Road	6%	6%	5%
Approach Distance for Minor Road ³	5.0 m	5.0 m	15 m
¹ Applies where radius is less than 1.5 times the minimum allowable radius. ² Minimum distance back from the gutter line of the minor road that the specified grade may not be exceeded. ³ Minimum distance back from the gutter line of the major road that the specified grade may not be exceeded.			
4. Vertical Curve K Values			
Criteria	30 km/h	40 km/h	50 km/h
Minimum Crest	2	4	7
Minimum Sag	2	4	6
Crest / Sag on Approach to Stop Condition	2	2	3
<i>K values listed assume that new roadways will be illuminated.</i>			

9.0 SCHEDULE 9 – STANDARD DETAIL DRAWINGS

STANDARD DRAWING INDEX AND CROSS-REFERENCE TO MMCD		
GENERAL AND MISCELLANEOUS DETAILS		
Dwg	Title	Location
000	Drawing List	CWK
100	Alignment Of Utilities	CWK
101	Emergency Access Roads	CWK
102	Sidewalk Fence Welded Or Slip On	CWK
103	Reinforced Concrete Stairs (With Bicycle Channel)	CWK
104	Rural Walkway	CWK
105	Multi Use Pathway Sections	CWK
106	Speed Cushion And Hump	CWK
107	Sidewalk (With Boulevard Strip)	CWK
108	Wheelchair Ramp (With Boulevard Strip)	CWK
109	Tactile Warning Strip And Name Plate (Westbank Centre)	CWK
110	Driveway Crossings For Barrier Curbs	CWK
111	Chainlink Fence	CWK
112	Split Rail Fence	CWK
113	Park Entrance Sign	CWK
114	Gate	CWK
115	Walkway Sign Installation	CWK
116	Sign Installation (Regulatory Type)	CWK
G1	General Legend for Contract Documents	MMCD
G2	Legend for Materials	MMCD
G3	Legend for Street Light and Traffic Signal Drawings	MMCD
G4	Utility Trench	MMCD
G5	Pavement Restoration	MMCD
G6	Concrete Encasement for Watermain / Sewer Separation	MMCD
G7	Concrete Protection for Underground Utilities	MMCD
G8	Pipe Block Anchors	MMCD
C2	Concrete Sidewalk and Barrier Curb	MMCD
C3	Concrete Sidewalk and Roll-Over Curb	MMCD
C4	Concrete Curbs – Narrow Base	MMCD
C9	Wheelchair Ramp for Sidewalk and Barrier Curbs	MMCD
C10	Concrete Walkway	MMCD
C11	Bicycle Baffle	MMCD
C12	Removable Restriction Post	MMCD
C13	Chain Link Fence for Walkway	MMCD
C14	Handrail on Concrete Retaining Wall	MMCD

ROADWORKS		
Dwg	Title	Location
200	Urban Arterial Road - 20.0 m ROW	CWK
201	Rural Arterial Road - 20.0 m ROW	CWK
202	Wine Trail Arterial Road - 20.0 m ROW	CWK
203	Urban Collector Road - 20.0 m ROW	CWK
204	Rural Collector Road - 20.0 m ROW	CWK
205	Urban Minor Collector Road - 18.0 m ROW	CWK
206	Rural Minor Collector Road 18.0 m ROW	CWK
207	Urban Local Road - 18.0 m ROW	CWK
208	Rural Local Road - 18.0 m ROW	CWK
209	Rural Reserve Local Road - 18.0 m ROW	CWK
210	Urban Centre Road - 20.0 m ROW	CWK
211	Urban Centre Public Lane Road	CWK
212	Hillside Collector Road (HC-1)	CWK
213	Hillside Local - Access Both Sides (HI-1)	CWK
214	Hillside Local - Access One Side Road (HI-2)	CWK
215	Hillside Local - No Access Road (HI-3)	CWK
R1	Paved Shoulders	MMCD
WATERWORKS		
Dwg	Title	Location
300	Gate Valve Thrust Blocks	CWK
301	Agricultural Service Connection	CWK
302	Park Irrigation Service Connection	CWK
303	Park Point Of Connection (25 mm and 50 mm)	CWK
304	Tracer Wire Installation	CWK
305	Above Ground Pressure Reducing Station (Plan View)	CWK
306	Above Ground Pressure Reducing Station (Front and Back View)	CWK
307	Above Ground Pressure Reducing Station Kiosk	CWK
308	Above Ground Pressure Reducing Valves Antenna Pole and Base	CWK
W1	Typical Thrust Block Arrangements	MMCD
W2a	Water Service Connection – Service Box	MMCD
W2b	Water Service Connection	MMCD
W2c	Meter Installation for 19 mm & 25 mm Service Connection	MMCD
W2d	Meter Installation for 38 mm & 50 mm Service Connections	MMCD
W3	Gate Valve Installation	MMCD
W4	Fire Hydrant Installation	MMCD
W5	Test Point Installation	MMCD
W6	Air Valve Assemblies – 25 mm and 50 mm Valves	MMCD
W7	Air Valve Assembly – 100 mm Valve	MMCD
W9	Blow-Down Chamber	MMCD
W10	Waterworks Chamber Drain	MMCD

STORM AND SANITARY SEWERS		
Dwg	Title	Location
400	Manhole Frame and Cover	CWK
401	Pressure Service Connection to Forcemain	CWK
402	Roadway Type Precast Concrete Catch Basin	CWK
403	Catch Basin Detail	CWK
404	Catch Basin Gutter Detail	CWK
405	Barrier Curb Two Piece Side Inlet	CWK
406	Rollover Curb Grate and Frame	CWK
407	Bicycle Safe Catch Basin Grate	CWK
408	Manhole Requirement For Services	CWK
409	Drainage Drywell with Sump	CWK
410	Drainage Drywell Installation	CWK
411	Pipe Bed Perforation and Bedding (Detail For Ground Water Recharge)	CWK
412	Catch Basin Trapping Hood	CWK
413	Flow Control Chamber (With Sediment and Grease Trap)	CWK
414	Sanitary Sewer Service Connection (without IC plug)	CWK
415	Inspection Chamber for 100 to 200 mm Sanitary Sewer Connection	CWK
S1	Standard and Sump Manholes	MMCD
S2	Standard Manhole Connection Details	MMCD
S3	Manhole Connection Details - Drop and Ramp Type	MMCD
S4	Inside Drop Manhole	MMCD
S5	Precast Riser Manhole	MMCD
S6	Sewer Cleanout	MMCD
S7	Sanitary Sewer Service Connection	MMCD
S8	Storm Sewer Service Connection	MMCD
S9	Inspection Chamber For 100 To 200 Sanitary Sewer Connection	MMCD
S10	Inspection Chamber For 250 To 375 Storm Sewer Connection	MMCD
S11	Top Inlet Catch Basin	MMCD
S12	Lawn Drains	MMCD
S13	Storm Sewer Inlet With Safety Grillage	MMCD
S14	Concrete Block Endwall	MMCD
S15	Driveway Culvert With Concrete Block Endwalls	MMCD
STREET LIGHTING		
Dwg	Title	Location
500	Street Lighting Luminaire	CWK
501	Decorative Street Lighting	CWK
502	Decorative Street Light Pole Base	CWK

STANDARD DETAIL DRAWINGS

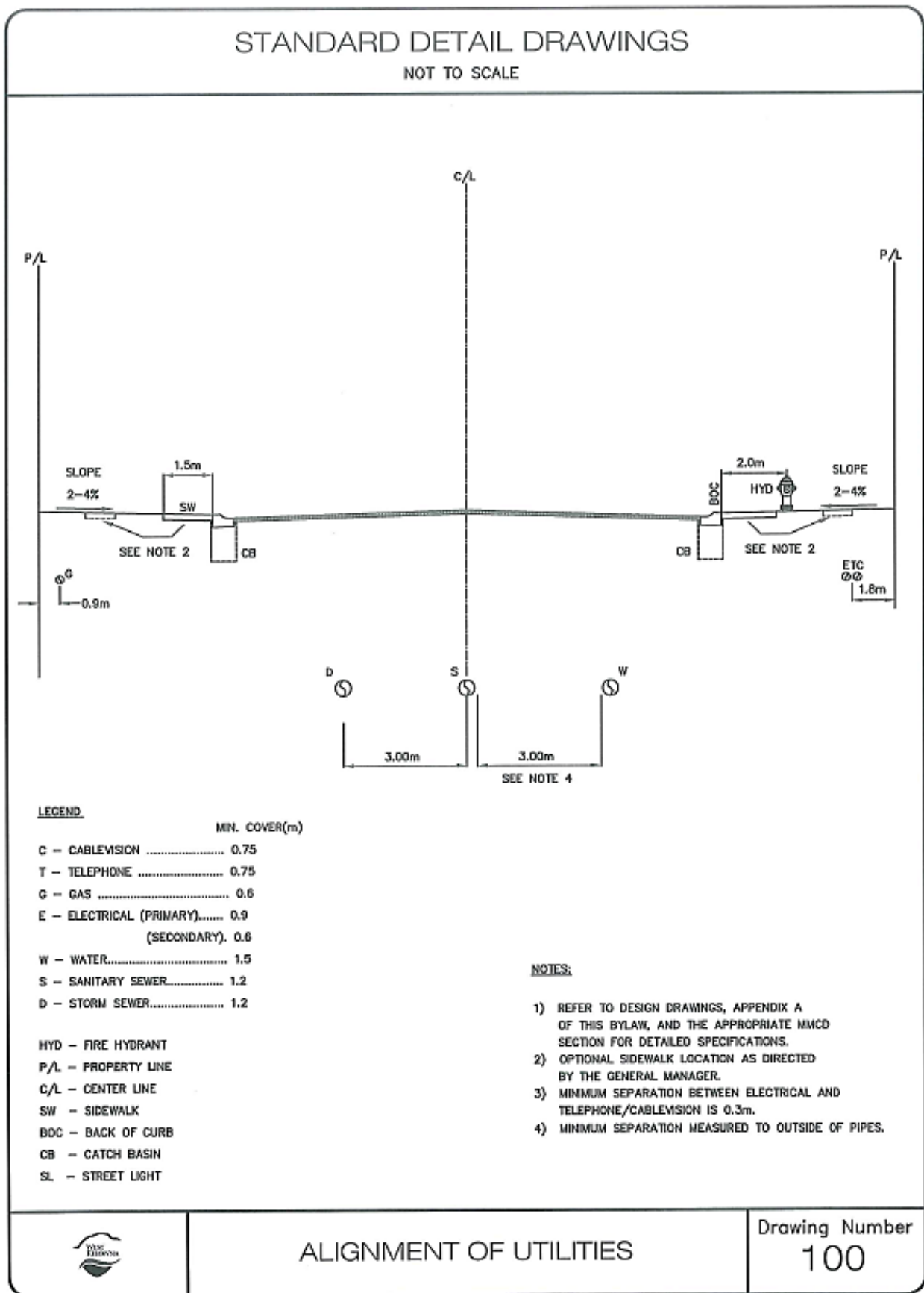
DRAWING #	DRAWING NAME	DRAWING #	DRAWING NAME
000	DRAWING LIST	400	MANHOLE FRAME AND COVER
100	ALIGNMENT OF UTILITIES	401	PRESSURE SERVICE CONNECTION TO FORCEMAIN
101	EMERGENCY ACCESS ROADS	402	ROADWAY TYPE PRECAST CONCRETE CATCH BASIN
102	SIDEWALK FENCE WELDED OR SLIP ON	403	BARRIER CURB SIDE INLET CATCH BASIN
103	REINFORCED CONCRETE STAIRS WITH BICYCLE CHANNEL	404	CATCH BASIN GUTTER DETAIL
104	RURAL WALKWAY	405	BARRIER CURB TWO PIECE SIDE INLET
105	MULTI USE PATHWAY SECTIONS	406	ROLLOVER CURB SINGLE AND TWIN FRAMES AND GRATE
106	SPEED CUSHION AND HUMP	407	BICYCLE SAFE CATCH BASIN GRATE
107	SIDEWALK (WITH BOULEVARD STRIP)	408	MANHOLE REQUIREMENT FOR SERVICES
108	WHEELCHAIR RAMP (WITH BOULEVARDE STRIP)	409	DRAINAGE DRYWELL WITH SUMP
109	TACTILE WARNING STRIP AND NAME PLATE (WESTBANK CENTRE)	410	DRAINAGE DRYWELL INSTALLATION
110	DRIVEWAY CROSSINGS FOR BARRIER CURBS	411	PIPE BED PERFORATION AND BEDDING DETAIL FOR GROUND WATER RECHARGE
111	CHAINLINK FENCE	412	CATCH BASIN TRAPPING HOOD
112	SPLIT RAIL FENCE,	413	FLOW CONTROL CHAMBER (WITH SEDIMENT AND GREASE TRAP)
113	PARK ENTRANCE SIGN	414	SANITARY SEWER SERVICE CONNECTION
114	GATE	415	INSPECTION CHAMBER FOR 100 TO 200 SANITARY SEWER CONNECTION
115	WALKWAY SIGN INSTALLATION		
116	SIGN INSTALLATION (REGULATORY TYPE)	500	DECORATIVE STREET LIGHTING
200	URBAN ARTERIAL ROAD - 20.0m ROW	501	DECORATIVE STREET LIGHT
201	RURAL ARTERIAL ROAD - 20.0m ROW	502	POLE BASE
202	WINE TRAIL ARTERIAL ROAD - 20.0m ROW		
203	URBAN COLLECTOR ROAD - 20.0m ROW		
204	RURAL COLLECTOR ROAD - 20.0m ROW		
205	URBAN MINOR COLLECTOR ROAD - 18.0m ROW		
206	RURAL MINOR COLLECTOR ROAD 18.0m ROW		
207	URBAN LOCAL ROAD - 18.0m ROW		
208	RURAL LOCAL ROAD - 18.0m ROW		
209	RURAL RESERVE LOCAL ROAD - 18.0m ROW		
210	URBAN CENTRE ROAD - 20.0m ROW		
211	URBAN CENTRE PUBLIC LANE ROAD		
212	HILLSIDE COLLECTOR ROAD (HC-1)		
213	HILLSIDE LOCAL - ACCESS BOTH SIDES ROAD (HL-1)		
214	HILLSIDE LOCAL - ACCESS ONE SIDE ROAD (HL-2)		
215	HILLSIDE LOCAL - NO ACCESS ROAD (HL-3)		
300	GATE VALVE THRUST BLOCKS		
301	AGRICULTURAL SERVICE CONNECTION		
302	PARK IRRIGATION SERVICE CONNECTION		
303	PARK POINT OF CONNECTION (25mm AND 50mm)		
304	TRACER WIRE INSTALLATION		
305	ABOVE GROUND PRESSURE REDUCING VALVES (PLAN VIEW)		
306	ABOVE GROUND PRESSURE REDUCING VALVES (FRONT AND BACK VIEWS)		
307	ABOVE GROUND PRESSURE REDUCING VALVES KIOSK		
308	ABOVE GROUND PRESSURE REDUCING VALVES ANTENNA POLE AND BASE		



DRAWING LIST

Drawing Number

000

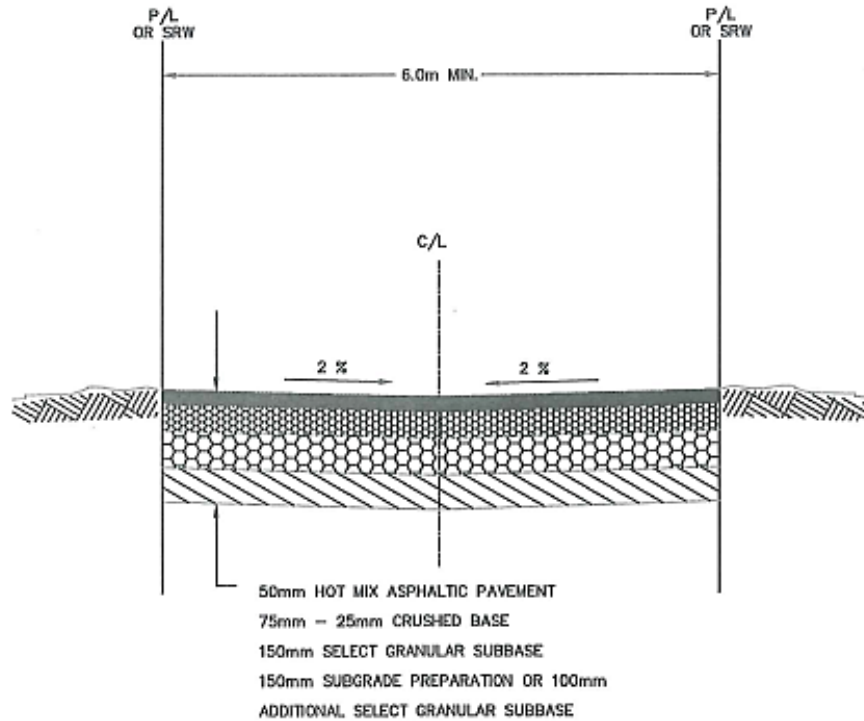


ALIGNMENT OF UTILITIES

Drawing Number
100

STANDARD DETAIL DRAWINGS

NOT TO SCALE



NOTES:

- 1) REFER TO DESIGN DRAWINGS, APPENDIX A OF THIS BYLAW, AND THE APPROPRIATE MMCD SECTION FOR DETAILED SPECIFICATIONS.
- 2) THE STRUCTURAL ROAD ELEMENTS SHOWN ARE THE MINIMUM REQUIREMENTS. THE DESIGN THICKNESS MUST BE INCREASED WHEN POOR SUB-GRADE MATERIAL IS ENCOUNTERED AND BENKELMAN BEAM TESTS MAY BE REQUIRED TO VERIFY DESIGN THICKNESS.



EMERGENCY ACCESS ROADS

Drawing Number
 101

STANDARD DETAIL DRAWINGS

NOT TO SCALE

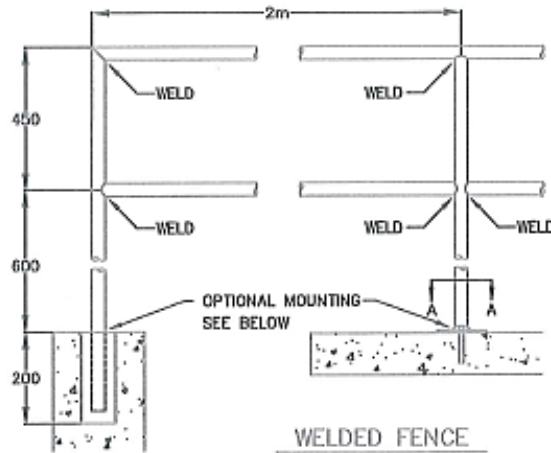
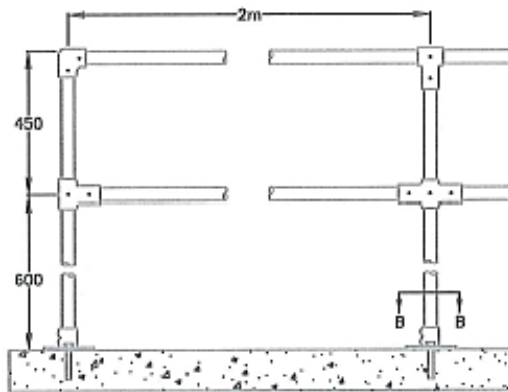
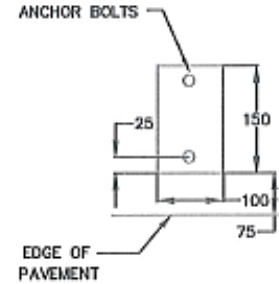
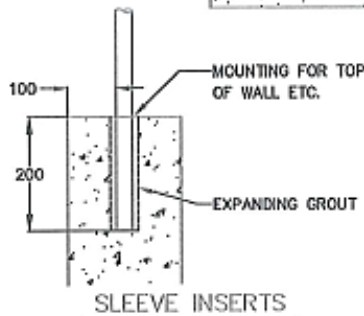
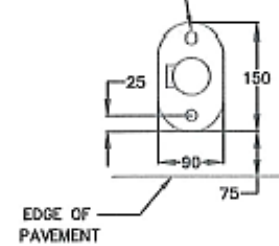


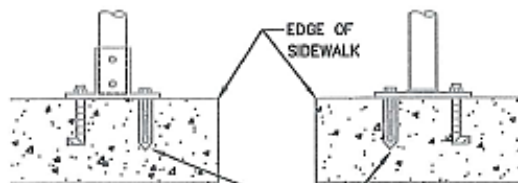
PLATE 10mm THICK
WITH 2-19mm HOLES
FOR 2-18mm x 100mm
ANCHOR BOLTS



2-19mm HOLES FOR
2-18mm x 100mm
ANCHOR BOLTS



ANCHOR FLANGE



ANCHOR PLATE

NOTES:

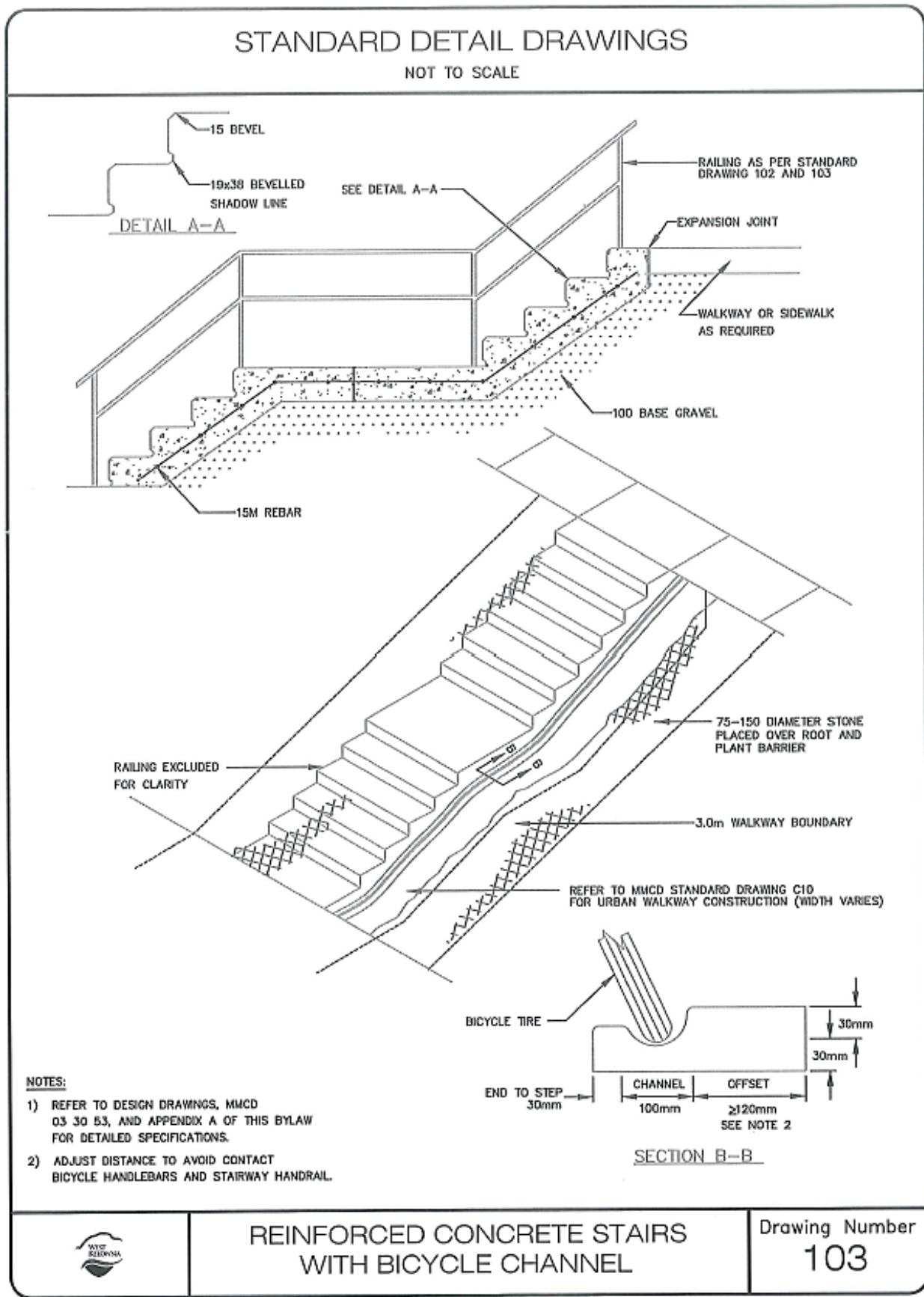
- 1) ALL POSTS AND ROLLS TO BE 48mm O.D. TO A.S.T.M. A120 "STANDARD" WEIGHT (SCHEDULE 40) GALVANIZED PIPE.
- 2) WELDS SHOULD BE FULL LOAD.
- 3) WELDING SHALL HAVE ALL ROUGH EDGES GROUND SMOOTH FOLLOWED IMMEDIATELY BY TWO APPLICATIONS OF A ZINC RICH COATING CONFORMING TO THE CGS8 I-GP-1B1 M.

- 4) PIPE FITTINGS SHALL BE GALVANIZED MALLEABLE IRON WITH CORE HARDENED SAL-SCREWS CONFORMING TO A.S.T.M. A 4T GRADE 32510 AND A.S.T.M. A 153 CLASS A (1610 g/sq.m OF ZINC COATING)



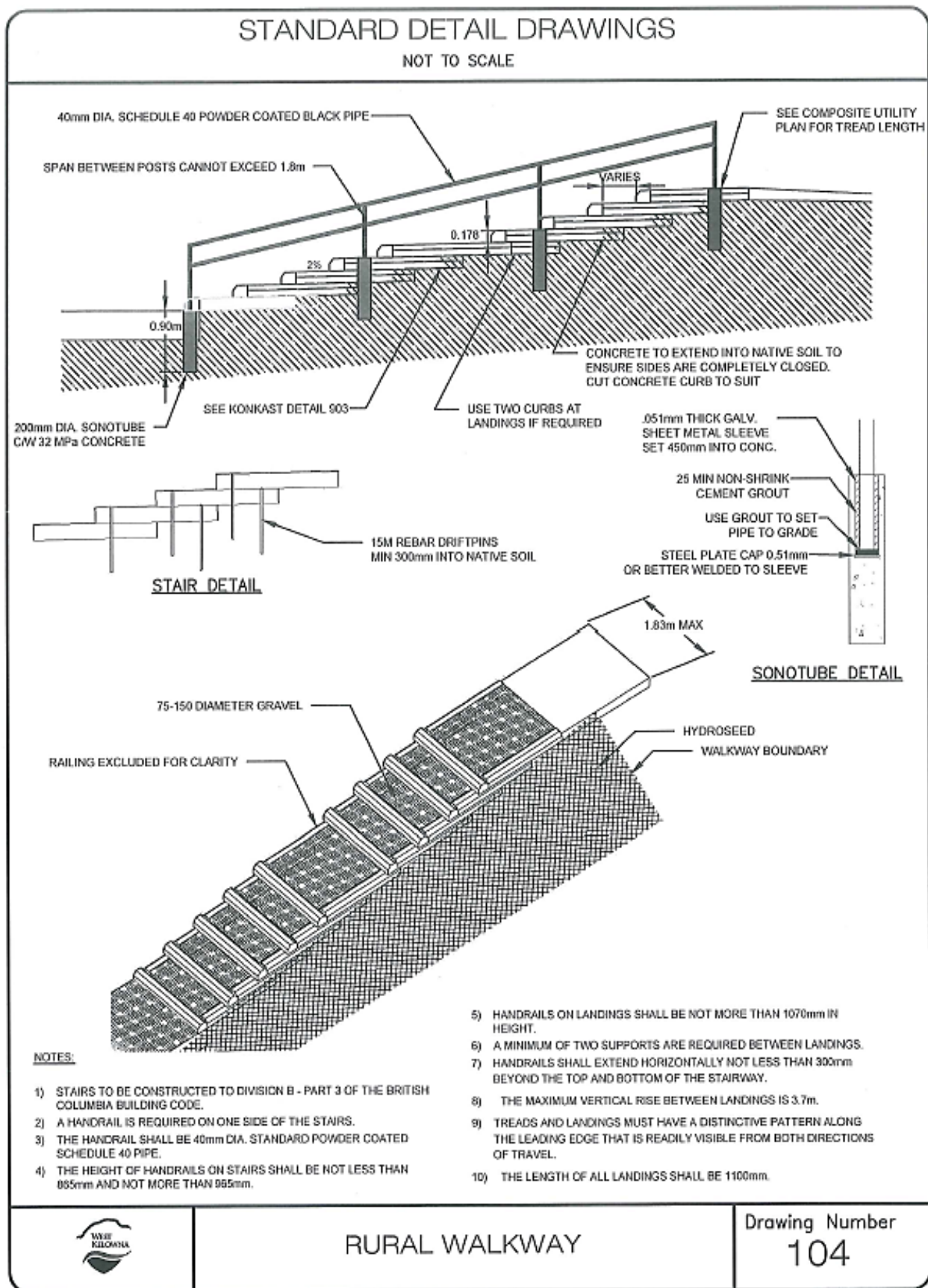
SIDEWALK FENCE WELDED OR SLIP ON

Drawing Number
102



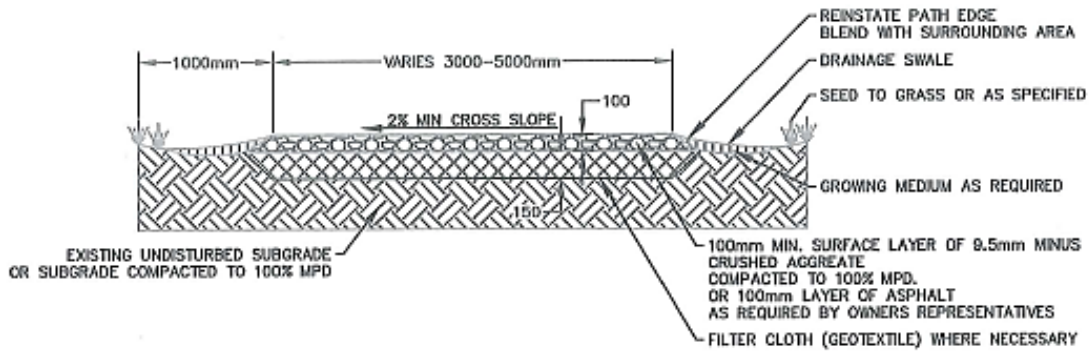
REINFORCED CONCRETE STAIRS WITH BICYCLE CHANNEL

Drawing Number
103

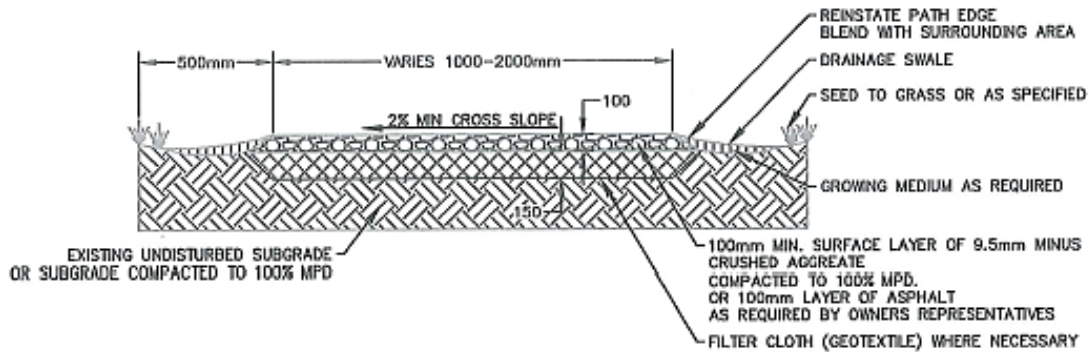


STANDARD DETAIL DRAWINGS

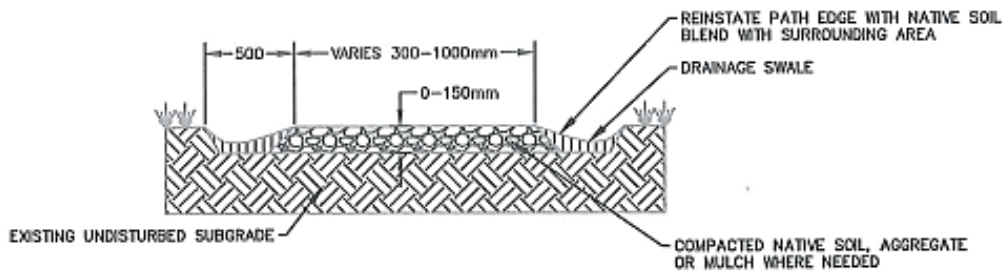
NOT TO SCALE



MAJOR MULTI USE TRAIL DETAIL



NARROW MULTI USE TRAIL DETAIL



NATURE TRAIL DETAIL

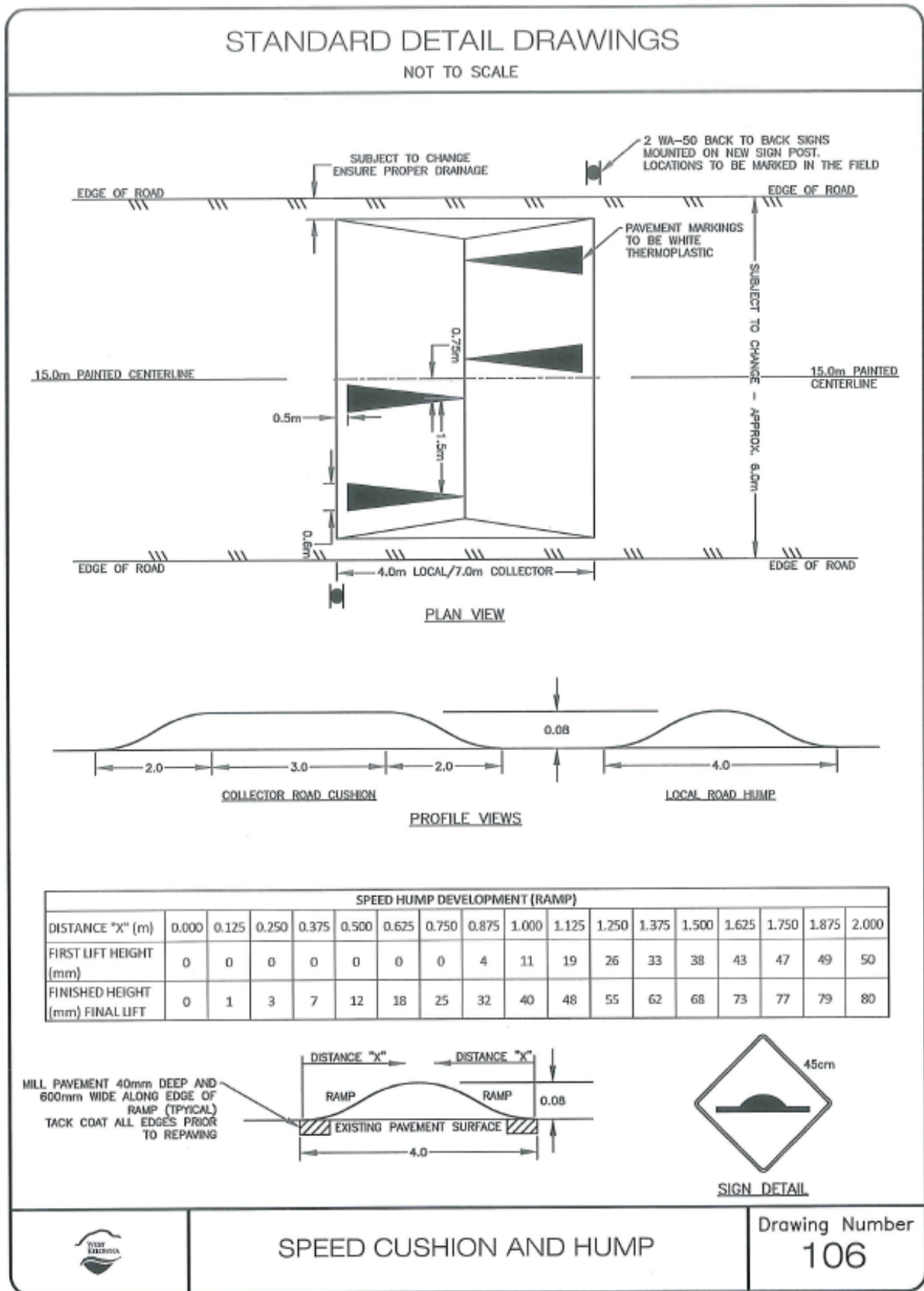
NOTES:

- 1) REFER TO RECREATION TRAILS MASTER PLAN FOR FURTHER INFORMATION.



MULTI USE PATHWAY SECTIONS

Drawing Number
105

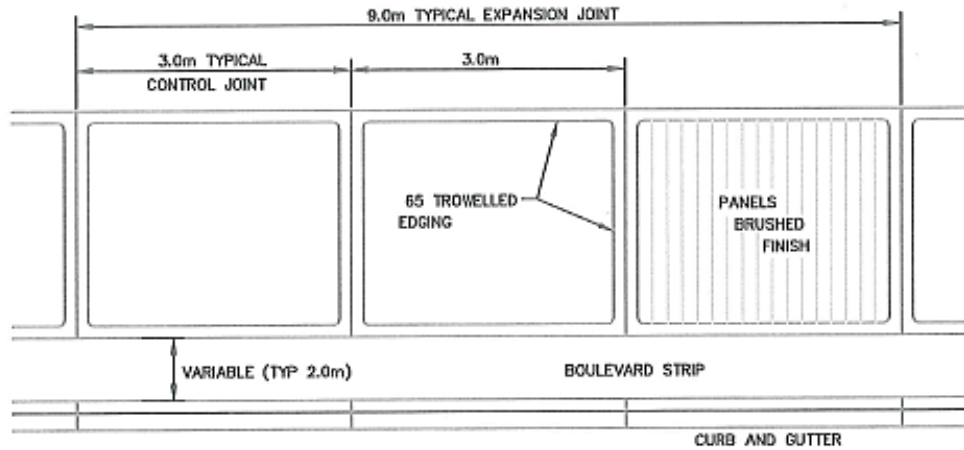


SPEED CUSHION AND HUMPS

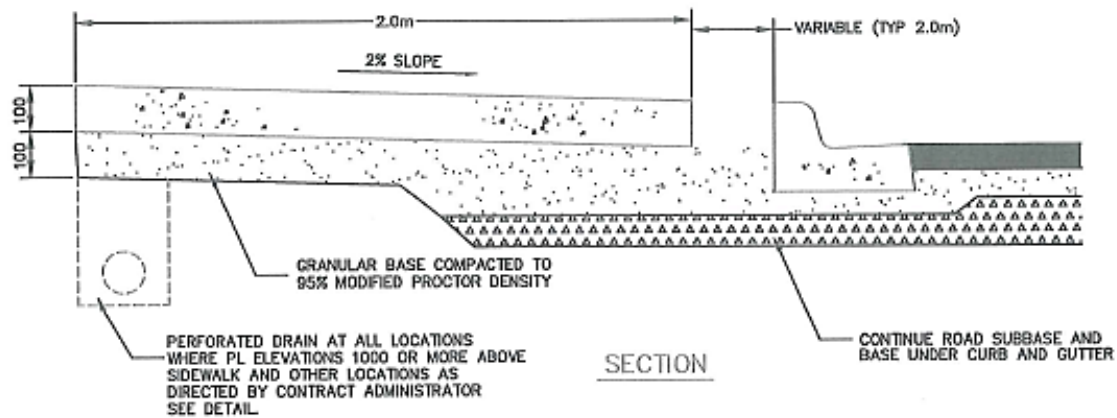
Drawing Number
106

STANDARD DETAIL DRAWINGS

NOT TO SCALE



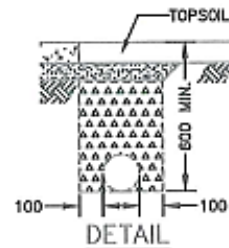
PLAN



SECTION

NOTES:

- 1) REFER TO DESIGN DRAWINGS, MMCD 03 30 20 AND APPENDIX A OF THIS BYLAW FOR DETAILED SPECIFICATIONS.



DETAIL

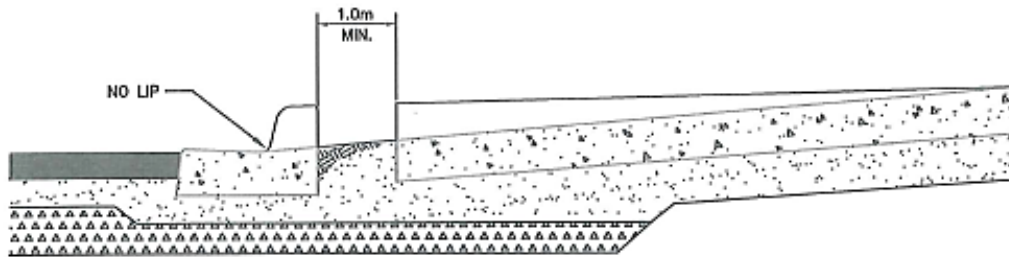
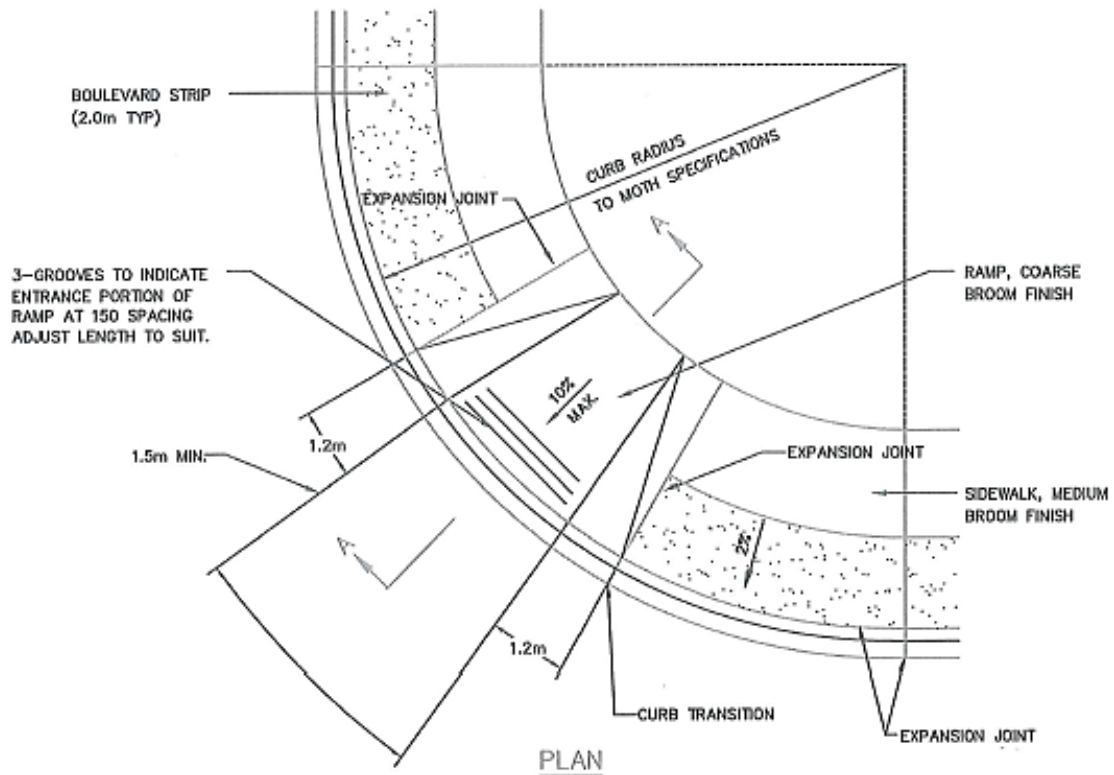


SIDEWALK (WITH BOULEVARD STRIP)

Drawing Number
107

STANDARD DETAIL DRAWINGS

NOT TO SCALE



NOTES:

- 1) REFER TO DESIGN DRAWINGS, MMCD 03 30 20 AND APPENDIX A OF THIS BYLAW FOR DETAILED SPECIFICATIONS.
- 2) REFER TO MMCD STANDARD DRAWINGS C2 AND C4 FOR INSTALLATION DETAILS.

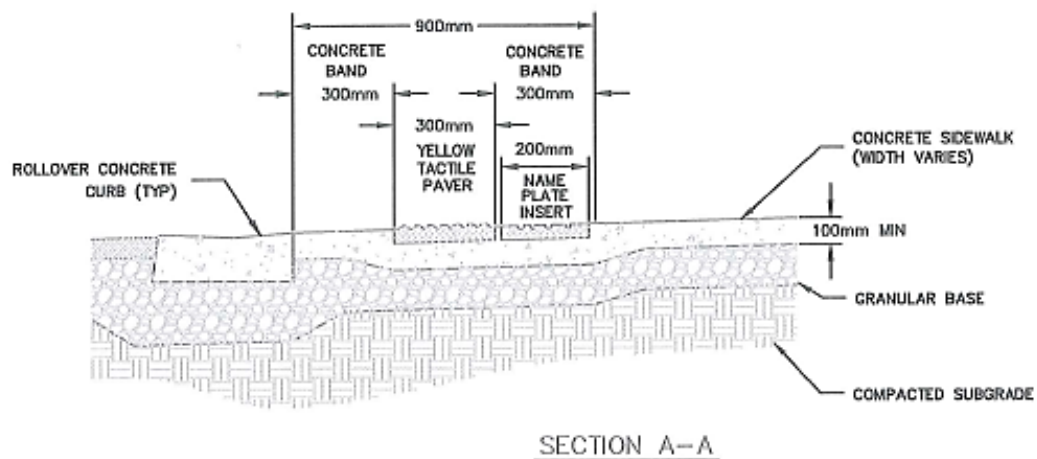
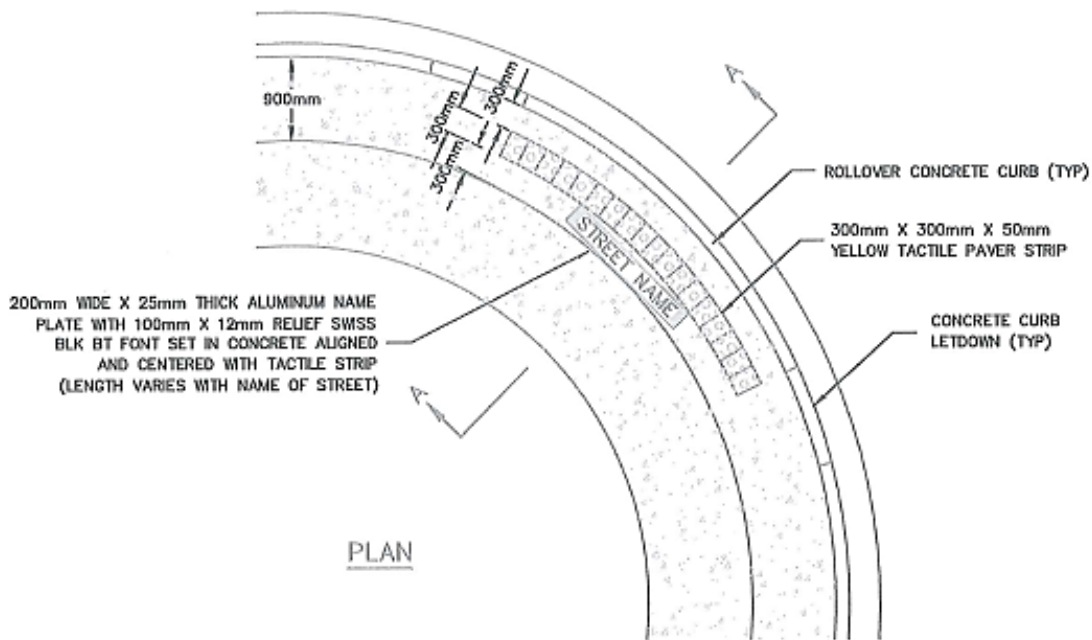


WHEELCHAIR RAMP
(WITH BOULEVARD STRIP)

Drawing Number
108

STANDARD DETAIL DRAWINGS

NOT TO SCALE



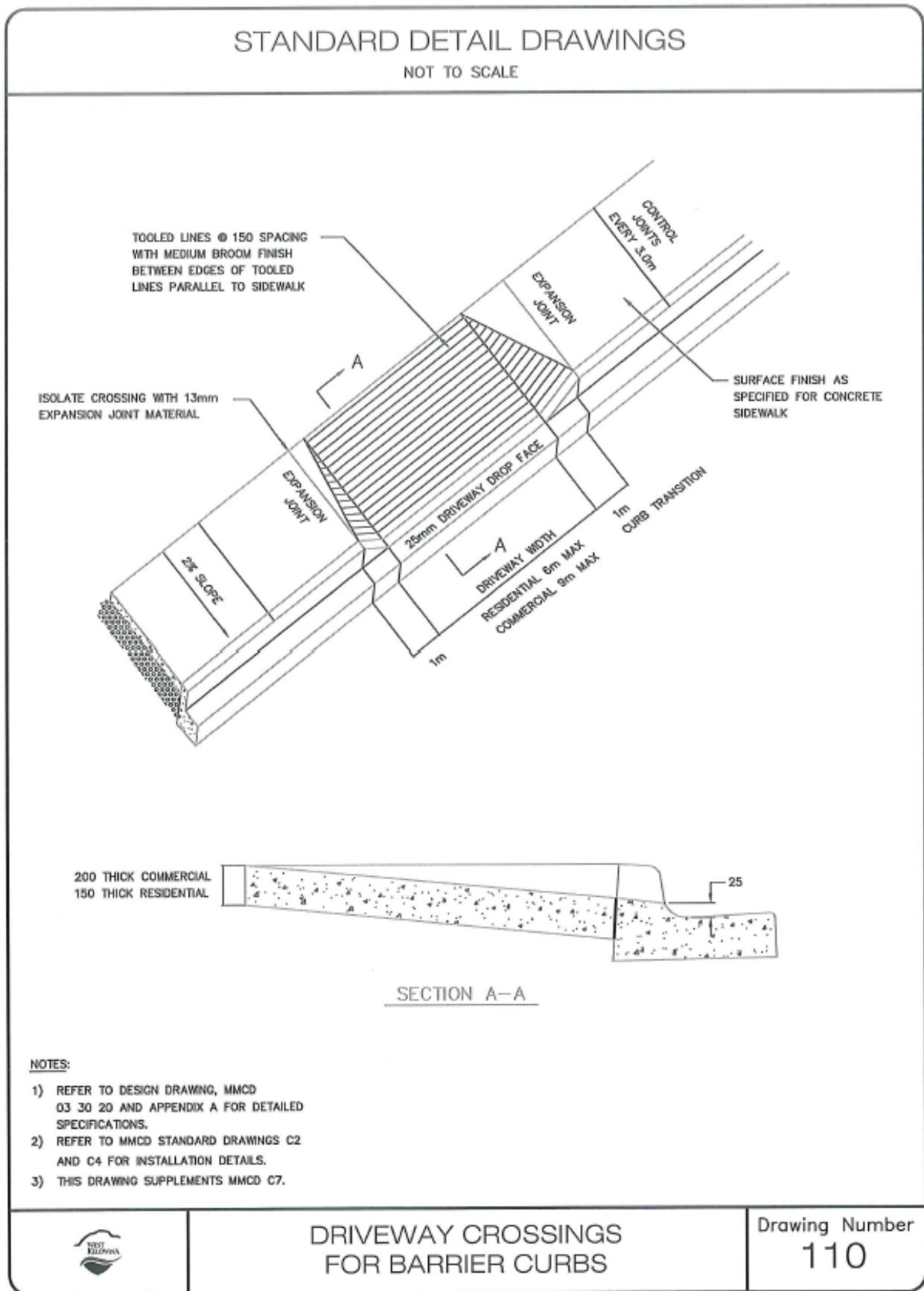
NOTES:

- 1) NAME PLATE TO BE SET FLUSH AND TRUE TO ALL EDGES.
- 2) CONCRETE SIDEWALK TO BE THICKENED UNDER NAME PLATE AND TACTILE PAVERS TO MAINTAIN 100mm CONCRETE THICKNESS.
- 3) EACH TACTILE PAVER TO BE CUT TO FIT RADIUS ALLOWING TIGHT BUTT FIT BETWEEN EACH UNIT.
- 4) ANY RAISED TACTILE PAVER BUMPS PARTIALLY CUT TO BE GROUND SMOOTH.
- 5) LAYOUT TO BE CONFIRMED ON-SITE PRIOR TO INSTALLATION.



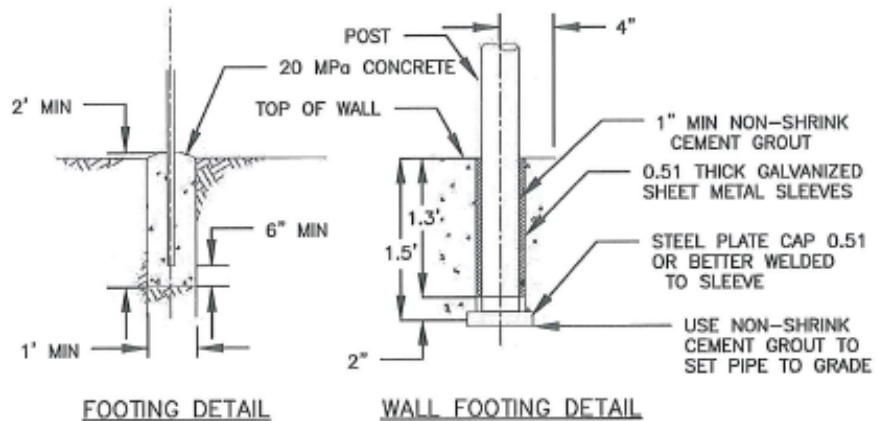
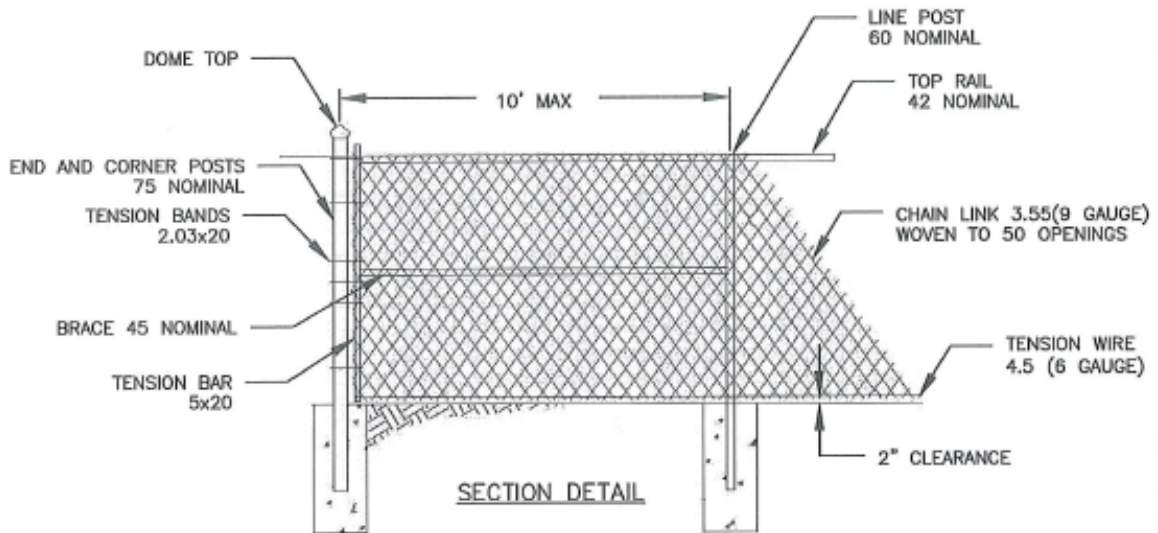
TACTILE WARNING STRIP AND
NAME PLATE (WESTBANK CENTRE)

Drawing Number
109



STANDARD DETAIL DRAWINGS

NOT TO SCALE



NOTES:

- 1) ALL RAILS AND POSTS TO BE BLACK VINYL COATED SCHEDULE 40 PIPE.
- 2) GATE POSTS AS SPECIFIED (89 NOMINAL MINIMUM).
- 3) REFER TO MMCDSECTION 02831 FOR DETAILED SPECIFICATIONS.
- 4) FOR CLARITY TENSION BARS/BANDS AND MISCELLANEOUS FITTINGS NOT SHOWN.



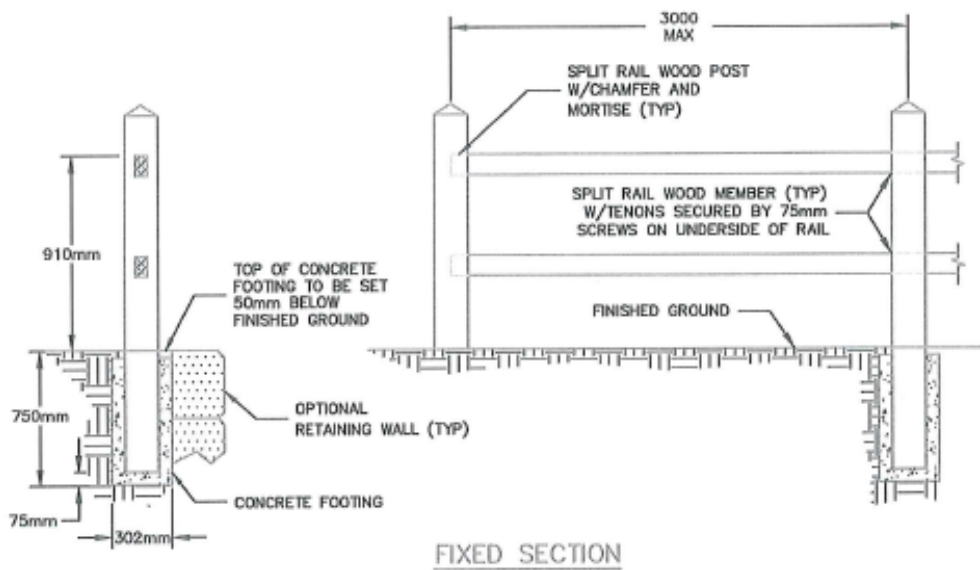
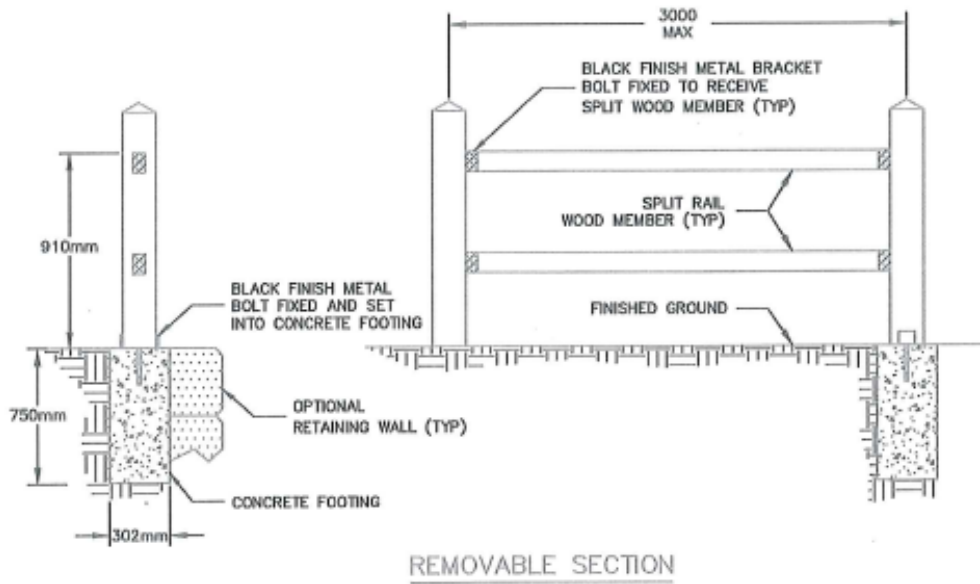
CHAIN LINK FENCE

Drawing Number

111

STANDARD DETAIL DRAWINGS

NOT TO SCALE



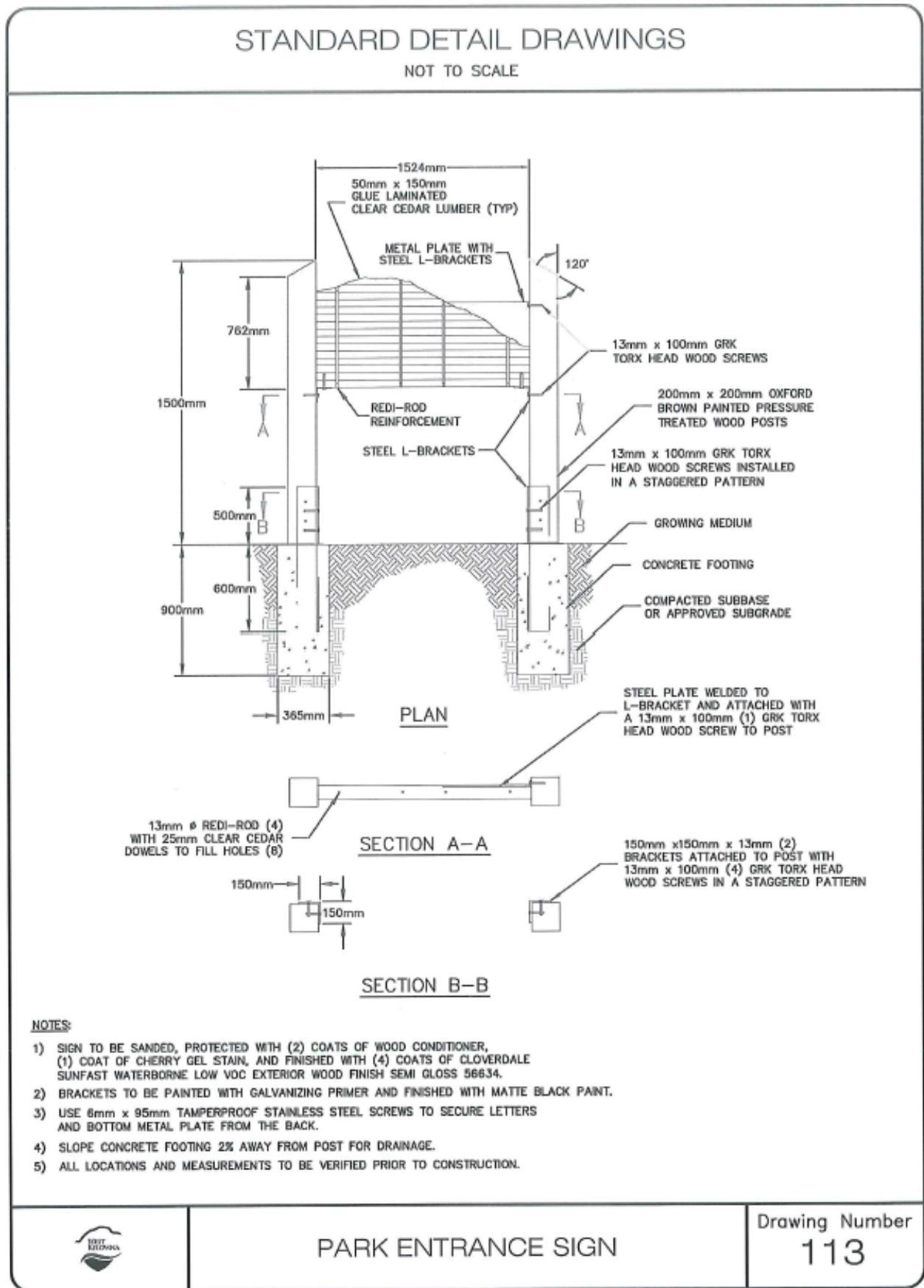
NOTES:

- 1) POSTS LOCATED IN ASPHALT OR CONCRETE TO BE SAWCUT AND CONCRETE FOOTING FLUSH TO GRADE.



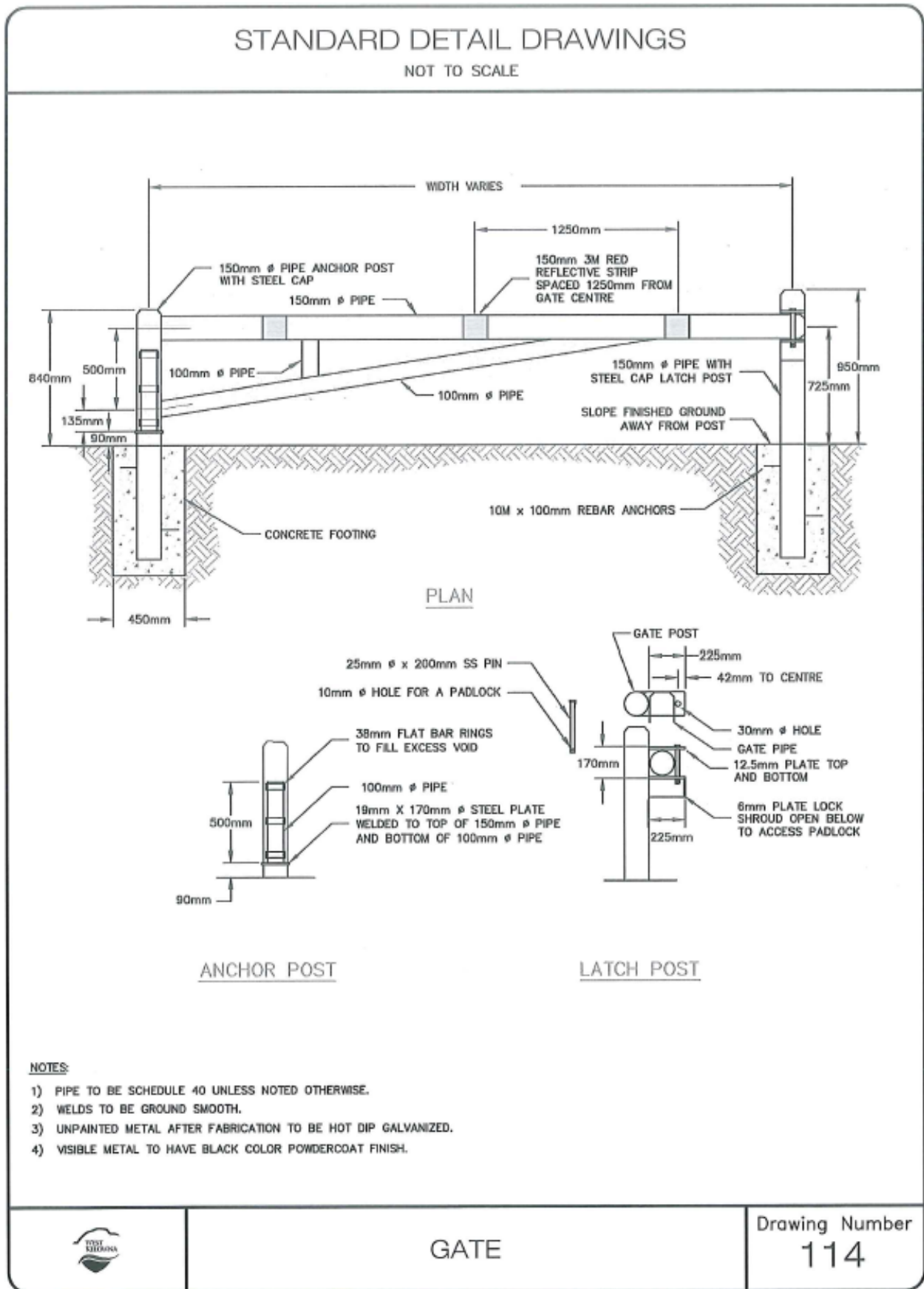
SPLIT RAIL FENCE

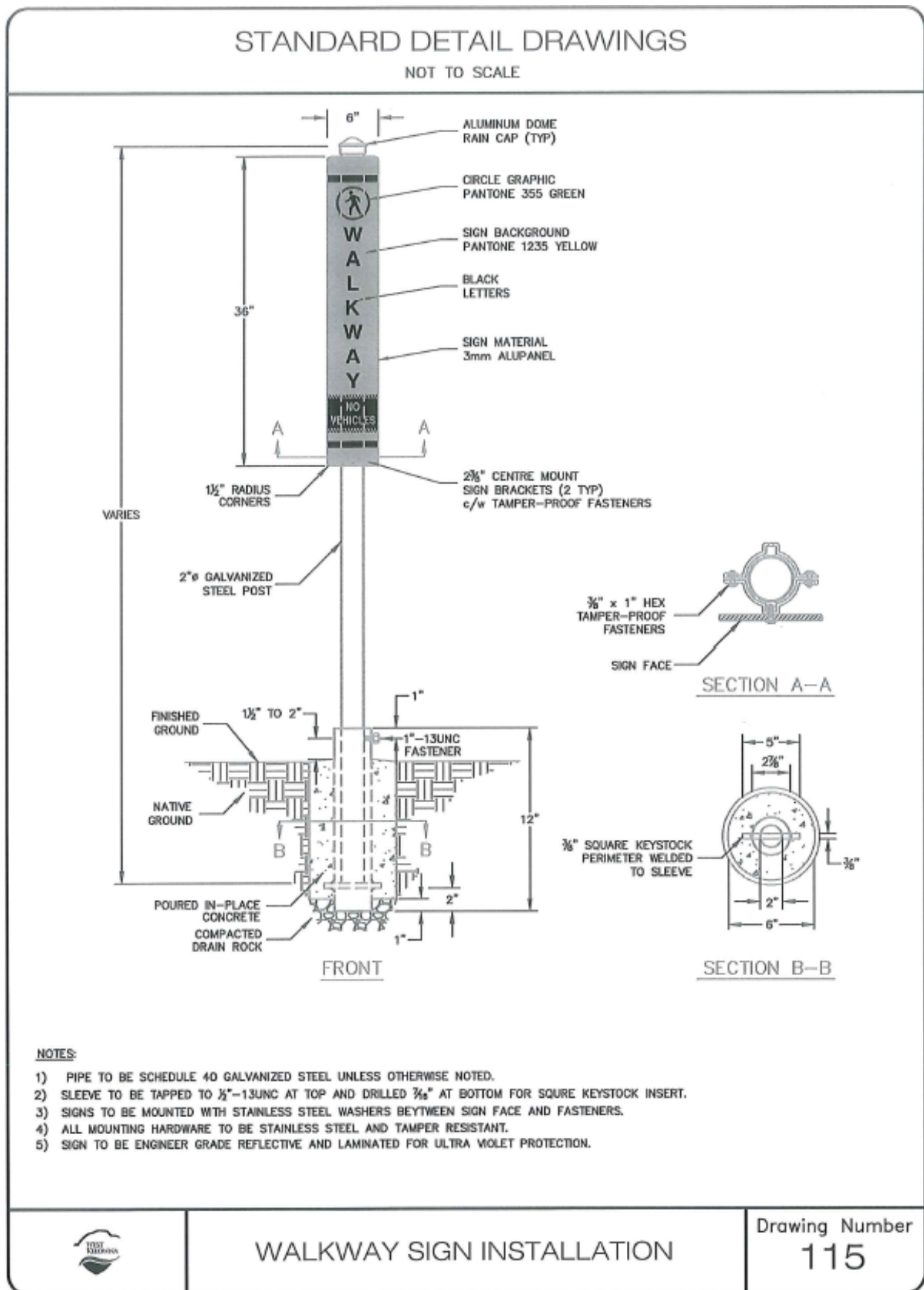
Drawing Number
112



PARK ENTRANCE SIGN

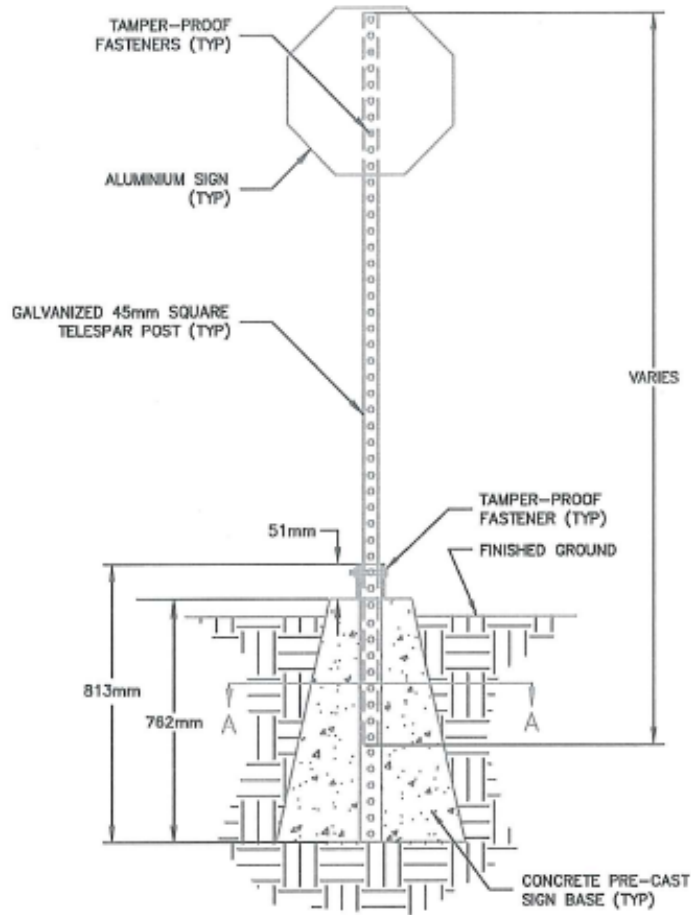
Drawing Number
113



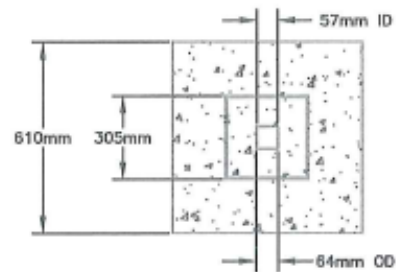


STANDARD DETAIL DRAWINGS

NOT TO SCALE



PLAN



SECTION A-A

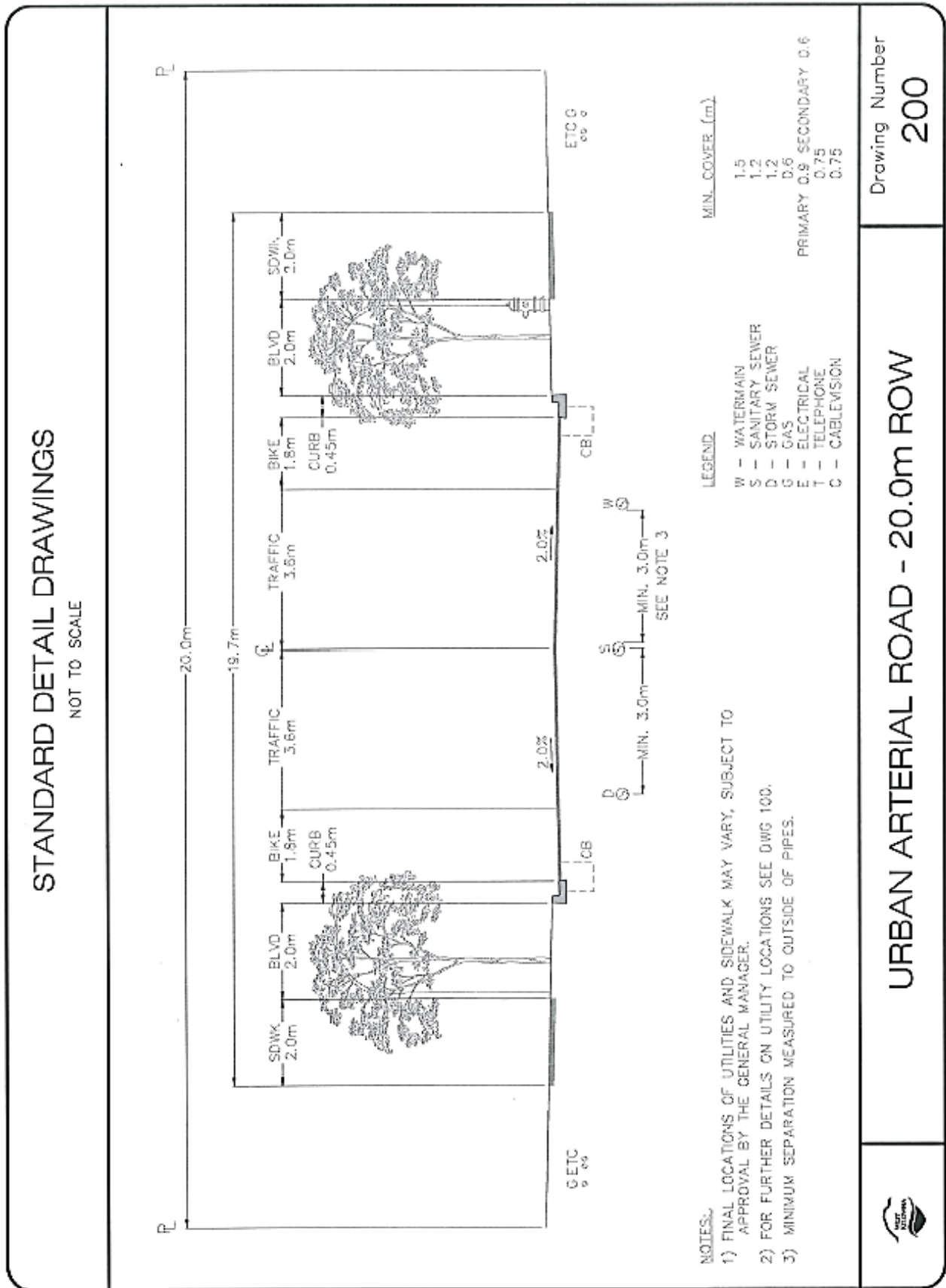
NOTES:

- 1) POSTS TO BE GALVANIZED 45mm SQUARE TELES PAR.
- 2) PRE-CAST CONCRETE BASE COMES WITH A BREAKAWAY SLEEVE ATTACHED.
- 3) SIGNS TO BE MOUNTED WITH STAINLESS STEEL WASHERS BETWEEN SIGN FACE AND FASTENERS.
- 4) ALL MOUNTING HARDWARE TO BE STAINLESS STEEL AND TAMPER RESISTANT.



SIGN INSTALLATION
(REGULATORY TYPE)

Drawing Number
116

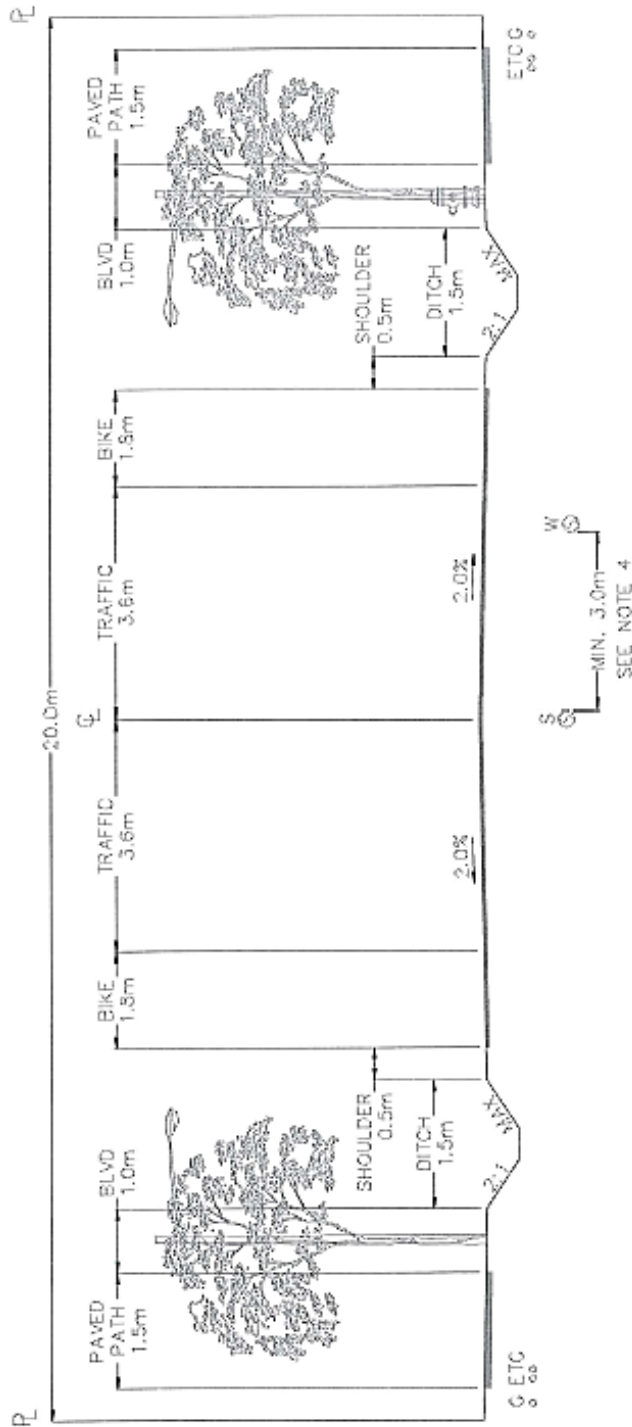


URBAN ARTERIAL ROAD - 20.0m ROW

Drawing Number
200

STANDARD DETAIL DRAWINGS

NOT TO SCALE



NOTES:

- 1) DITCH DEPTH AT ANY LOCATION TO BE AS REQUIRED TO CONVEY ALL CONTRIBUTING STORMWATER RUNOFF FROM THE 100 YEAR RETURN FREQUENCY STORM.
- 2) FINAL LOCATIONS OF UTILITIES AND PATH MAY VARY, SUBJECT TO APPROVAL BY THE GENERAL MANAGER.
- 3) FOR FURTHER DETAILS ON UTILITY LOCATIONS SEE DWG 100.
- 4) MINIMUM SEPARATION MEASURED TO OUTSIDE OF PIPES.

LEGEND:

- W - WATERMAIN
- S - SANITARY SEWER
- G - GAS
- E - ELECTRICAL
- T - TELEPHONE
- C - CABLEVISION

MIN. COVER (m)

- 1.5
- 1.2
- 0.8
- PRIMARY 0.9
- SECONDARY 0.6
- 0.75
- 0.75

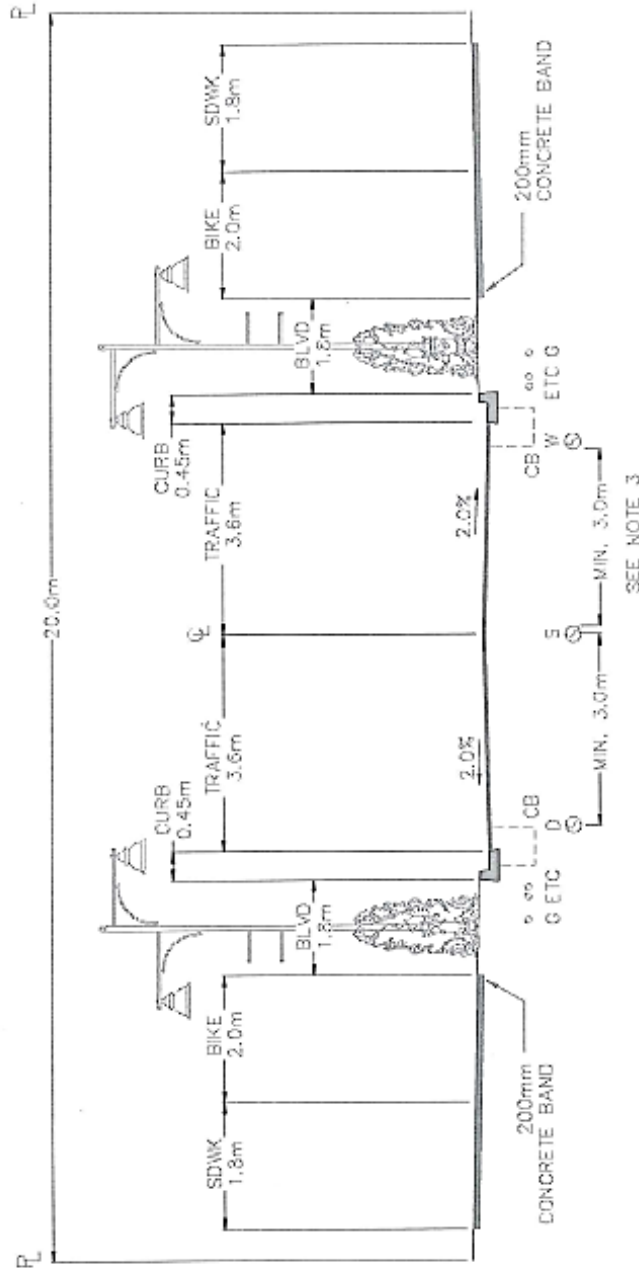


RURAL ARTERIAL ROAD - 20.0m ROW

Drawing Number
201

STANDARD DETAIL DRAWINGS

NOT TO SCALE



NOTES:

- 1) FINAL LOCATIONS OF UTILITIES, SIDEWALK AND PATH MAY VARY, SUBJECT TO APPROVAL BY THE GENERAL MANAGER.
- 2) STREETLIGHTS TO HAVE IRRIGATION AND TREE SPECIES TO BE COLUMNAR IN GROWTH.
- 3) FOR FURTHER DETAILS ON UTILITY LOCATIONS SEE DWG 100.
- 4) MINIMUM SEPARATION MEASURED TO OUTSIDE OF PIPES.

LEGEND

	MIN. COVER (m)
W - WATERMAIN	1.5
S - SANITARY SEWER	1.2
D - STORM SEWER	1.2
G - GAS	0.5
E - ELECTRICAL	PRIMARY 0.8 SECONDARY 0.6
T - TELEPHONE	0.75
C - CABLEVISION	0.75



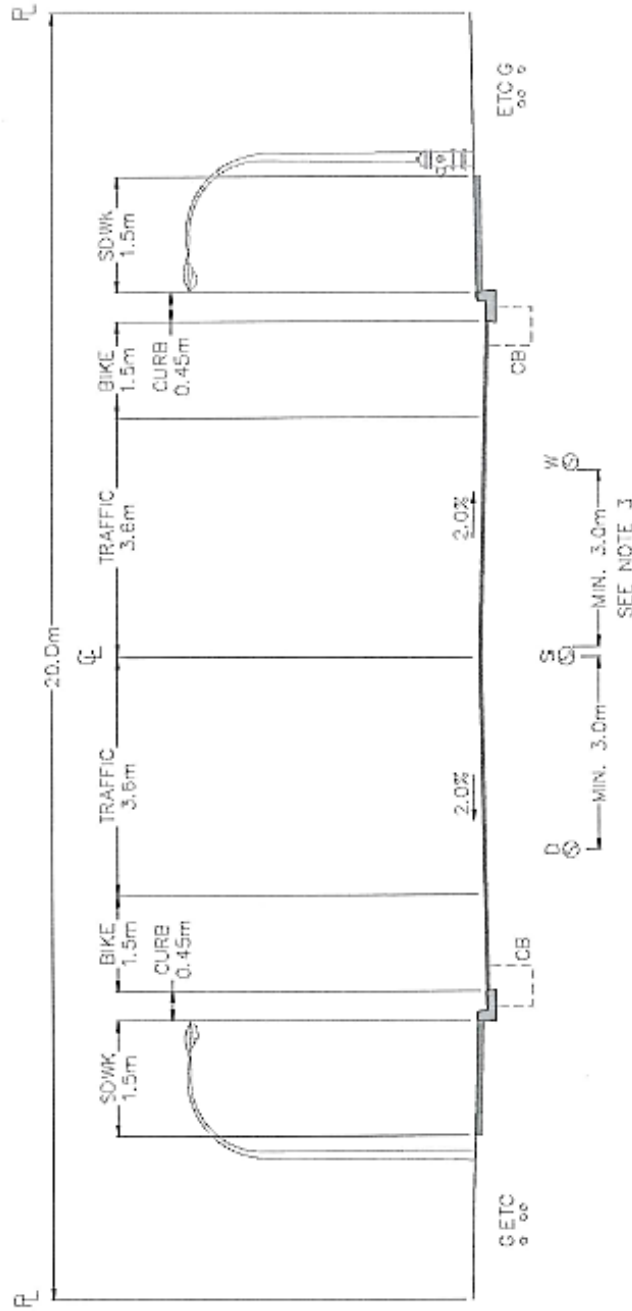
WINE TRAIL ARTERIAL ROAD - 20.0m ROW

Drawing Number

202

STANDARD DETAIL DRAWINGS

NOT TO SCALE



LEGEND:

W	WATERMAIN	1.5
S	SANITARY SEWER	1.2
D	STORM SEWER	1.2
G	GAS	0.6
E	ELECTRICAL	0.9
T	TELEPHONE	0.75
C	CABLEVISION	0.75
	PRIMARY	0.9
	SECONDARY	0.6

NOTES:

- 1) FINAL LOCATIONS OF UTILITIES AND SIDEWALKS MAY VARY, SUBJECT TO APPROVAL BY THE GENERAL MANAGER.
- 2) FOR FURTHER DETAILS ON UTILITY LOCATIONS SEE DWG 100.
- 3) MINIMUM SEPARATION MEASURED TO OUTSIDE OF PIPES.

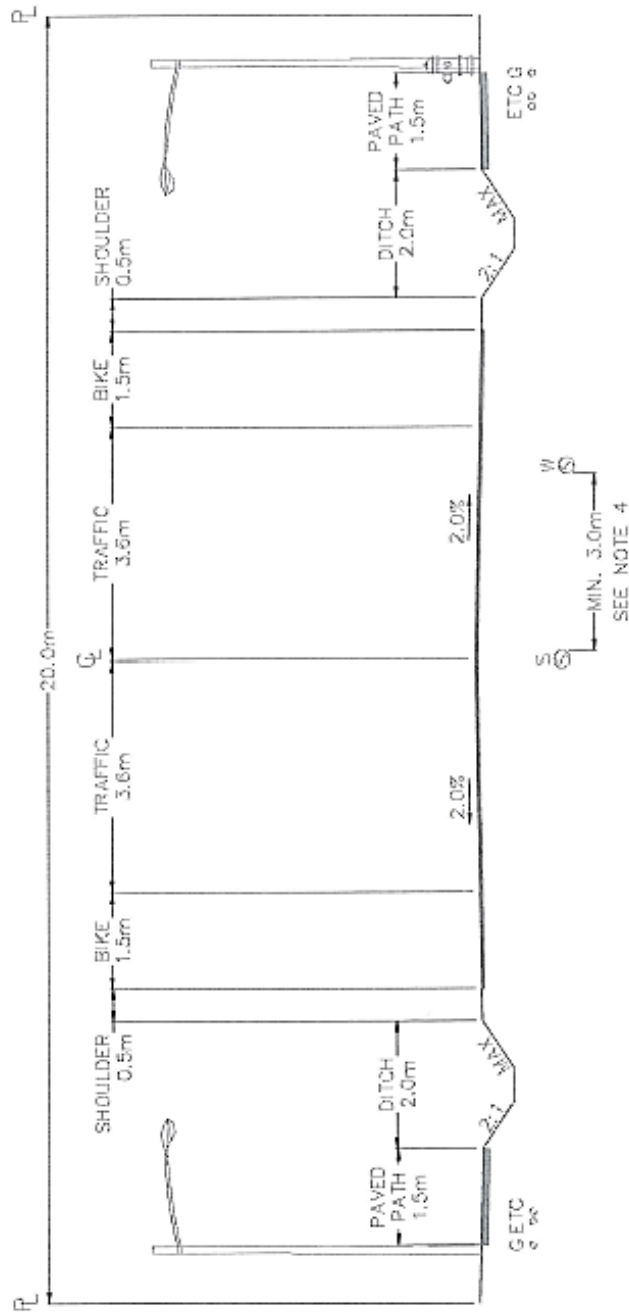


URBAN COLLECTOR ROAD - 20.0m ROW

Drawing Number
203

STANDARD DETAIL DRAWINGS

NOT TO SCALE



NOTES:

- 1) DITCH DEPTH AT ANY LOCATION TO BE AS REQUIRED TO CONVEY ALL CONTRIBUTING STORMWATER RUNOFF FROM THE 100 YEAR RETURN FREQUENCY STORM.
- 2) FINAL LOCATIONS OF UTILITIES AND PATH MAY VARY. SUBJECT TO APPROVAL BY THE GENERAL MANAGER.
- 3) FOR FURTHER DETAILS ON UTILITY LOCATIONS SEE DWG 100
- 4) MINIMUM SEPARATION MEASURED TO OUTSIDE OF PIPES.

LEGEND:

	MIN. COVER (m)
W - WATERMAIN	1.5
S - SANITARY SEWER	1.2
G - GAS	0.6
E - ELECTRICAL	PRIMARY 0.9 SECONDARY 0.6
T - TELEPHONE	0.75
C - CABLEVISION	0.75

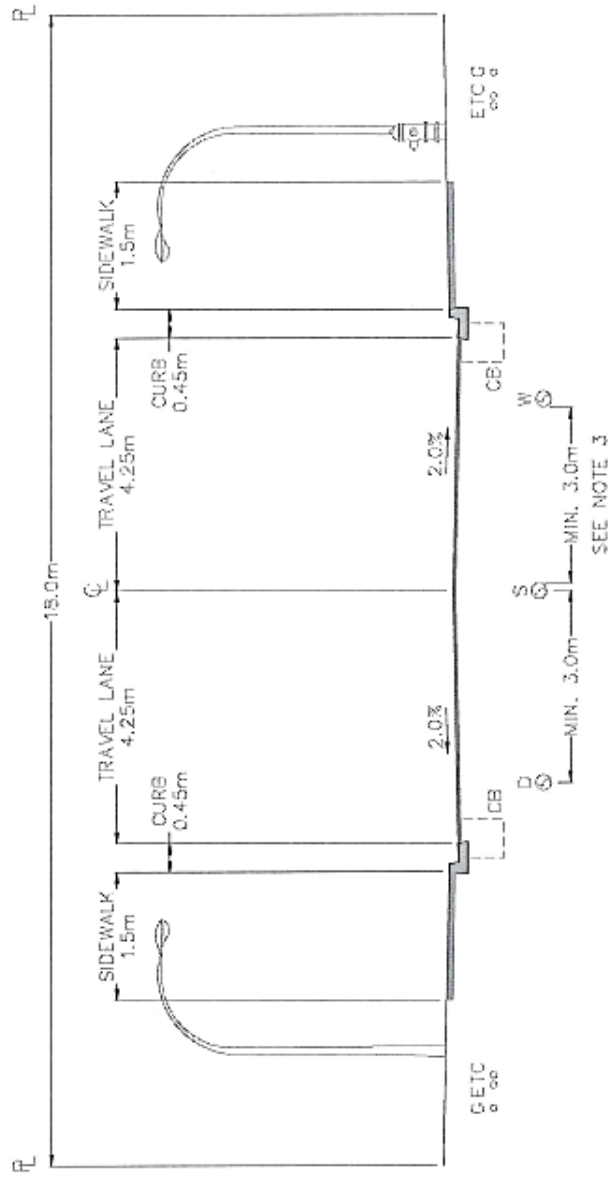


RURAL COLLECTOR ROAD - 20.0m ROW

Drawing Number
204

STANDARD DETAIL DRAWINGS

NOT TO SCALE



NOTES:

- 1) FINAL LOCATIONS OF UTILITIES AND SIDEWALK MAY VARY, SUBJECT TO APPROVAL BY THE GENERAL MANAGER.
- 2) FOR FURTHER DETAILS ON UTILITY LOCATIONS SEE DWG 100.
- 3) MINIMUM SEPARATION MEASURED TO OUTSIDE OF PIPES.

LEGEND:

- W - WATERMAIN
- S - SANITARY SEWER
- D - STORM SEWER
- G - GAS
- E - ELECTRICAL
- T - TELEPHONE
- C - CABLEVISION

MIN. COVER (m.)

- 1.5
- 1.2
- 1.2
- 0.6
- PRIMARY 0.9 SECONDARY 0.6
- 0.75
- 0.75

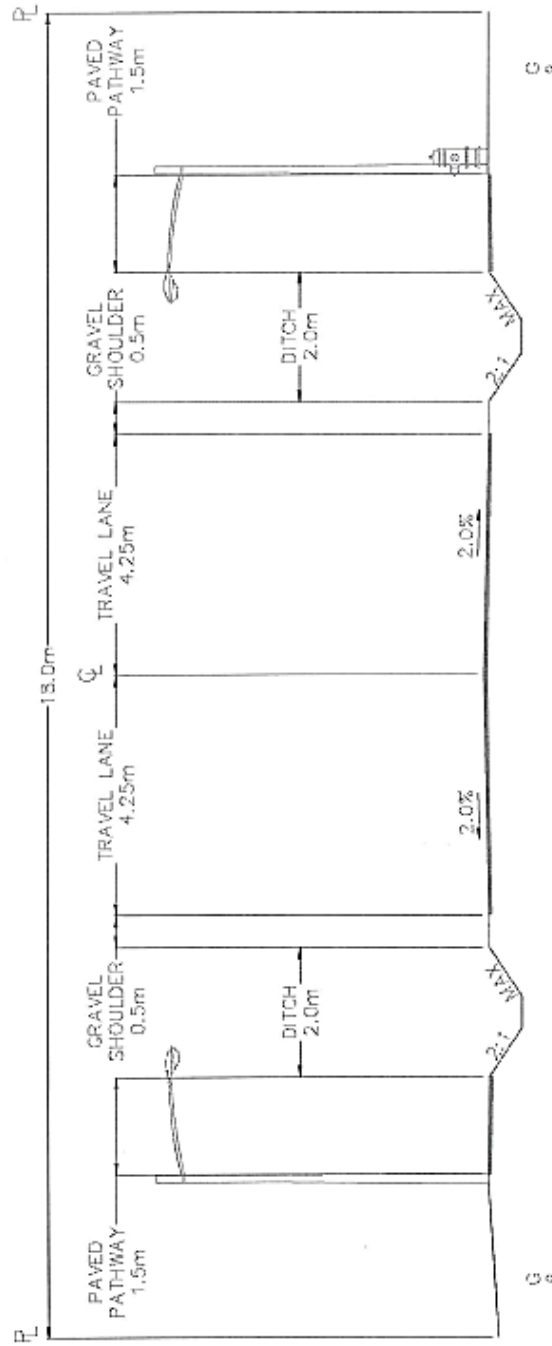


URBAN MINOR COLLECTOR ROAD - 18.0m ROW

Drawing Number
205

STANDARD DETAIL DRAWINGS

NOT TO SCALE



NOTES:

- 1) DITCH DEPTH AT ANY LOCATION TO BE AS REQUIRED TO CONVEY ALL CONTRIBUTING STORMWATER RUNOFF FROM THE 100 YEAR RETURN FREQUENCY STORM.
- 2) FINAL LOCATIONS OF PATH MAY VARY, SUBJECT TO APPROVAL BY THE GENERAL MANAGER.
- 3) FOR FURTHER DETAILS ON UTILITY LOCATIONS SEE DWG 100.
- 4) DAVIT TO BE PLACED ON EXISTING POLE WHERE NO UNDERGROUND UTILITIES ARE PRESENT.

LEGEND:

- W - WATERMAIN
- S - SANITARY SEWER
- G - GAS
- E - ELECTRICAL
- T - TELEPHONE
- C - CABLEVISION

MIN. COVER (m):

- 1.5
- 1.2
- 0.6
- PRIMARY 0.9 SECONDARY 0.6
- 0.75
- 0.75



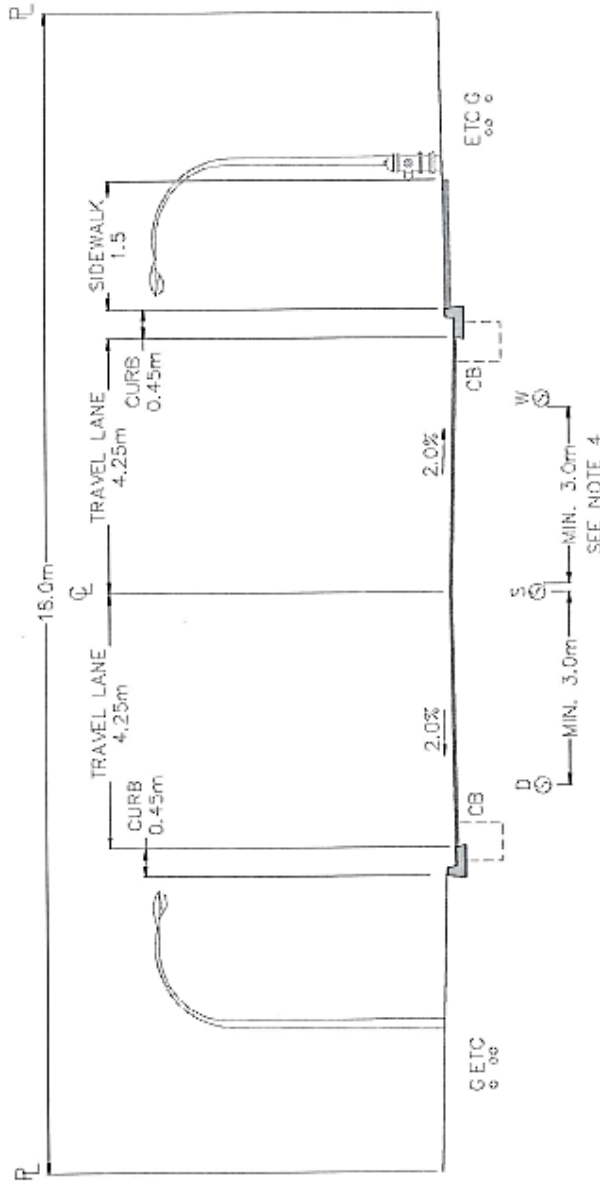
RURAL MINOR COLLECTOR ROAD - 18.0m ROW

Drawing Number

206

STANDARD DETAIL DRAWINGS

NOT TO SCALE



NOTES:

- 1) PATHWAY OPTIONAL FOR ROADS WITHIN 500m TRAVEL DISTANCE OF A SCHOOL, MAJOR PARK OR MAJOR FACILITY
- 2) FINAL LOCATIONS OF UTILITIES, SIDEWALK AND PATH MAY VARY, SUBJECT TO APPROVAL BY THE GENERAL MANAGER.
- 3) FOR FURTHER DETAILS ON UTILITY LOCATIONS SEE DWG 100.
- 4) MINIMUM SEPARATION MEASURED TO OUTSIDE OF PIPES.

LEGEND:

W - WATERMAIN	MIN. COVER (m)
S - SANITARY SEWER	1.5
D - STORM SEWER	1.2
G - GAS	1.2
E - ELECTRICAL	0.6
T - TELEPHONE	PRIMARY 0.9 SECONDARY 0.6
C - CABLEVISION	0.75
	0.75

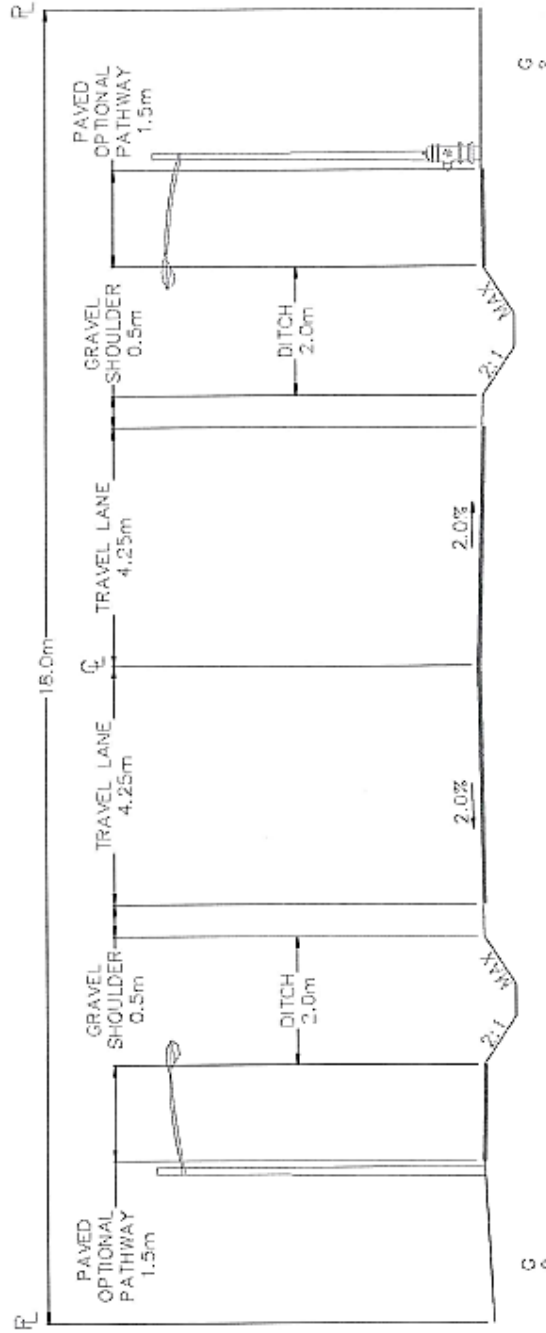


URBAN LOCAL ROAD - 18.0m ROW

Drawing Number
207

STANDARD DETAIL DRAWINGS

NOT TO SCALE



NOTES.

- 1) DITCH DEPTH AT ANY LOCATION TO BE AS REQUIRED TO CONVEY ALL CONTRIBUTING STORMWATER RUNOFF FROM THE 100 YEAR RETURN FREQUENCY STORM.
- 2) FINAL LOCATIONS OF UTILITIES OR PATH MAY VARY, SUBJECT TO APPROVAL BY THE GENERAL MANAGER.
- 3) FOR FURTHER DETAILS ON UTILITY LOCATIONS SEE DWG 100.
- 4) DAVIT TO BE PLACED ON EXISTING POLE WHERE NO UNDERGROUND UTILITIES ARE PRESENT.
- 5) PATHWAY OPTIONAL FOR ROADS WITHIN 500m TRAVEL DISTANCE OF A SCHOOL, MAJOR PARK OR MAJOR FACILITY

LEGEND:

- W – WATERMAIN
- S – SANITARY SEWER
- C – GAS
- E – ELECTRICAL
- T – TELEPHONE
- C – CABLEVISION

MIN. COVER (m)

- 1.5
- 1.2
- 0.6
- PRIMARY 0.9 SECONDARY 0.6
- 0.75
- 0.75

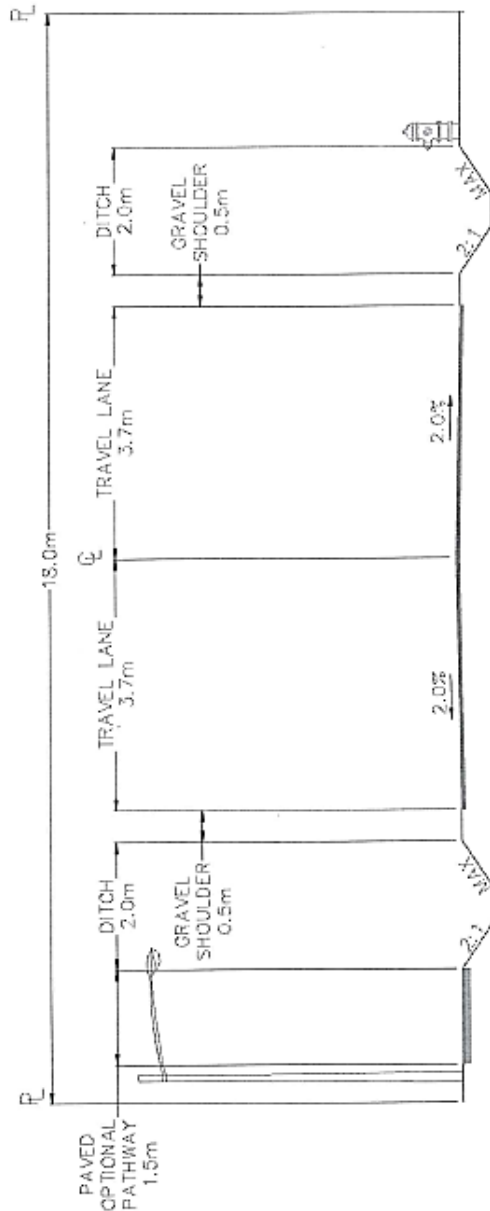


RURAL LOCAL ROAD - 18.0m ROW

Drawing Number
208

STANDARD DETAIL DRAWINGS

NOT TO SCALE



NOTES:

- 1) DITCH DEPTH AT ANY LOCATION TO BE AS REQUIRED TO CONVEY ALL CONTRIBUTING STORMWATER RUNOFF FROM THE 100 YEAR RETURN FREQUENCY STORM.
- 2) FINAL LOCATIONS OF UTILITIES OR PATH MAY VARY, SUBJECT TO APPROVAL BY THE GENERAL MANAGER.
- 3) FOR FURTHER DETAILS ON UTILITY LOCATIONS SEE DWG 100
- 4) DAVIT TO BE PLACED ON EXISTING POLE WHERE NO UNDERGROUND UTILITIES ARE PRESENT.
- 5) PATHWAY OPTION FOR ROADS WITHIN 500m TRAVEL DISTANCE OF A SCHOOL, MAJOR PARK OR MAJOR FACILITY
- 6) HYDRANTS REQUIRED IF MUNICIPAL WATER AVAILABLE.

LEGEND:

- W - WATERMAIN
- S - SANITARY SEWER
- G - GAS
- E - ELECTRICAL
- T - TELEPHONE
- C - CABLEVISION

MIN. COVER (m)

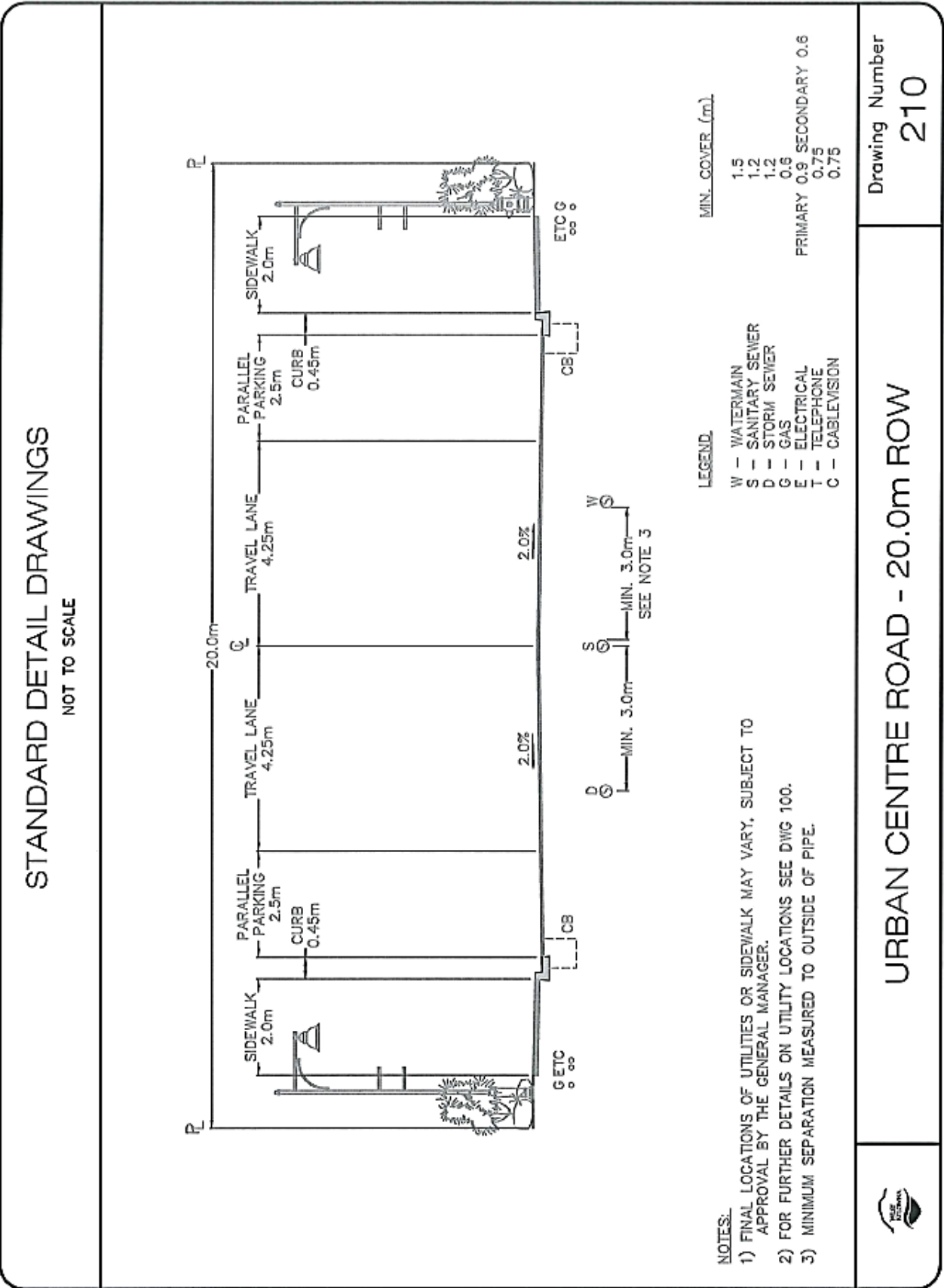
- 1.5
- 1.2
- 0.6
- PRIMARY 0.9 SECONDARY 0.6
- 0.75
- 0.75



RURAL RESERVE LOCAL ROAD - 18.0m ROW

Drawing Number

209

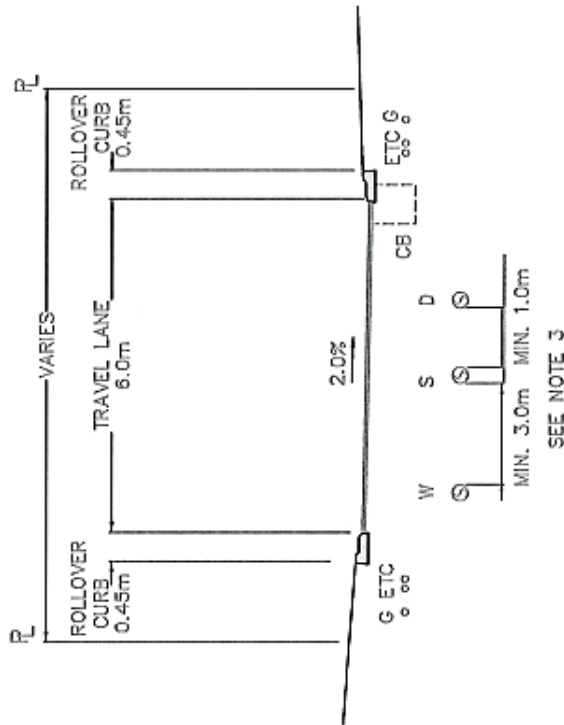


URBAN CENTRE ROAD - 20.0m ROW

Drawing Number
210

STANDARD DETAIL DRAWINGS

NOT TO SCALE



LEGEND

- W - WATERMAIN
- S - SANITARY SEWER
- D - STORM SEWER
- G - GAS
- E - ELECTRICAL
- T - TELEPHONE
- C - CABLEVISION

MIN. COVER (m)

- 1.5
- 1.2
- 1.2
- 0.6
- PRIMARY 0.9 SECONDARY 0.6
- 0.75
- 0.75

- NOTES:**
- 1) FINAL LOCATIONS OF UTILITIES MAY VARY, SUBJECT TO APPROVAL BY THE GENERAL MANAGER.
 - 2) FOR FURTHER DETAILS ON UTILITY LOCATIONS SEE DWG 100.
 - 3) MINIMUM SEPARATION MEASURED TO OUTSIDE OF PIPE.

SEE NOTE 3

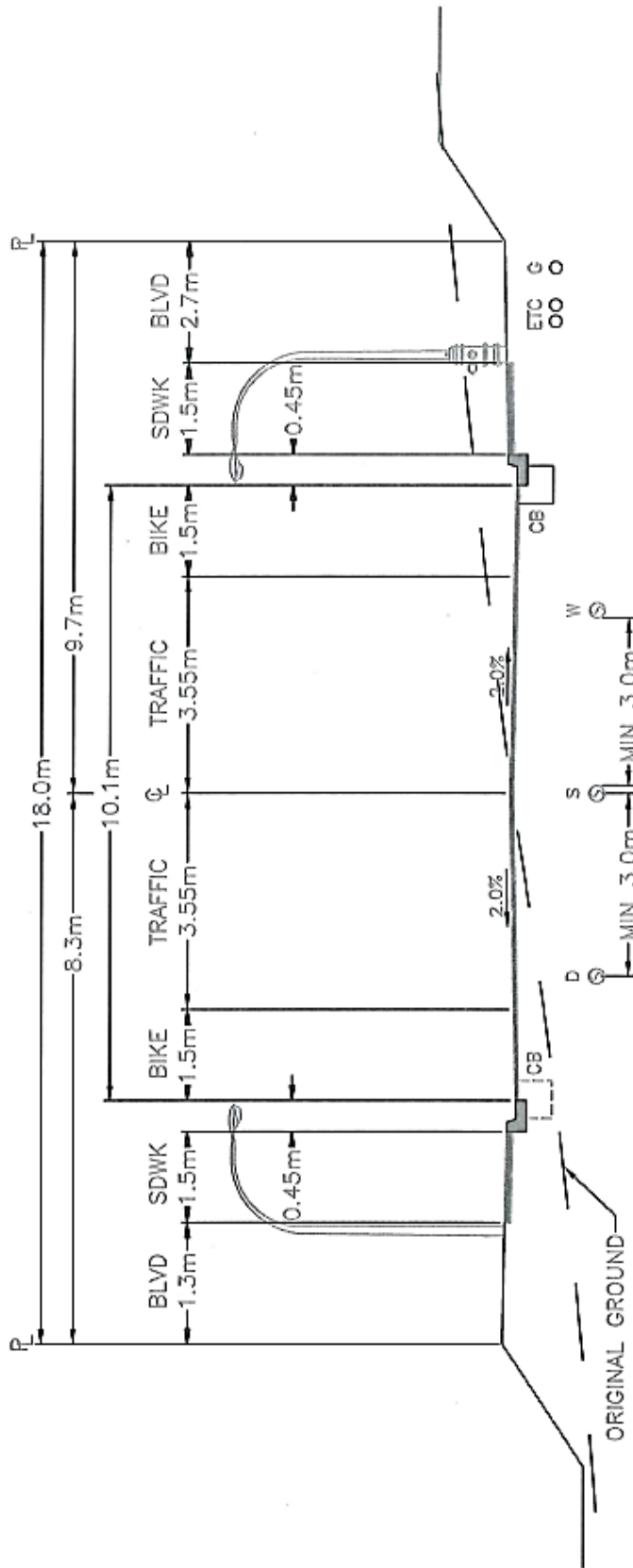


URBAN CENTRE PUBLIC LANE ROAD

Drawing Number
211

STANDARD DETAIL DRAWINGS

NOT TO SCALE



NOTES:

- 1) WHERE REQUIRED, ROW AND STREET WIDTHS WILL BE INCREASED AT MAJOR INTERSECTIONS TO PROVIDE SEPARATE TURNING LANES.
- 2) HILLSIDE COLLECTOR TO BE USED AT THE DISCRETION OF THE GENERAL MANAGER.
- 3) HILLSIDE COLLECTOR MAY TERMINATE AS A HILLSIDE LOCAL AT THE DISCRETION OF THE GENERAL MANAGER.
- 4) ROCK CUT CATCHMENT AREAS MUST HAVE A MINIMUM CATCHMENT WIDTH OF 3 METERS FOR SLOPES UP TO 8 METERS HIGH. GREATER CATCHMENT AREAS MAY BE REQUIRED AS DIRECTED BY THE GEOTECHNICAL STUDIES. ENTIRE CATCHMENT WIDTH TO BE LOCATED WITHIN ROAD RIGHT-OF-WAY.
- 5) MINIMUM SEPARATION MEASURED TO OUTSIDE OF PIPES.

LEGEND

- W - WATERMAIN
- S - SANITARY SEWER
- D - STORM SEWER
- G - GAS
- E - ELECTRICAL
- T - TELEPHONE
- C - CABLEVISION

MIN. COVER (m.)

- 1.5
- 1.2
- 1.2
- 0.6
- PRIMARY 0.9 SECONDARY 0.6
- 0.75
- 0.75

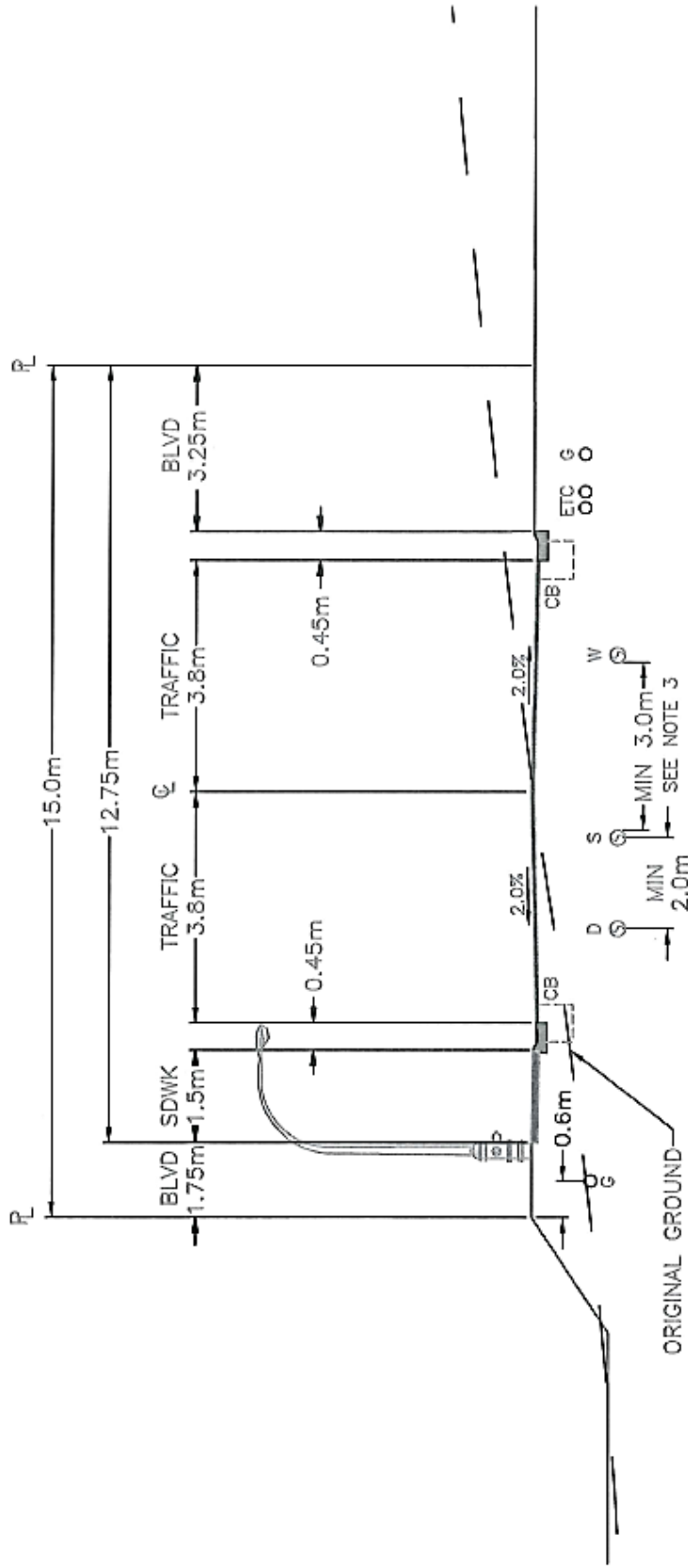


HILLSIDE COLLECTOR ROAD (HC-1)

Drawing Number
212

STANDARD DETAIL DRAWINGS

NOT TO SCALE



NOTES:

- 1) SIDEWALK LOCATION TO BE APPROVED BY GENERAL MANAGER.
- 2) ROCK CUT CATCHMENT AREAS MUST HAVE A MINIMUM CATCHMENT WIDTH OF 3 METERS FOR SLOPES UP TO 8 METERS HIGH. GREATER CATCHMENT AREAS MAY BE REQUIRED AS DIRECTED BY THE GEOTECHNICAL STUDIES. ENTIRE CATCHMENT WIDTH TO BE LOCATED WITHIN ROAD RIGHT-OF-WAY.
- 3) MINIMUM SEPARATION MEASURED TO OUTSIDE OF PIPES.

LEGEND:

- W - WATERMAIN
- S - SANITARY SEWER
- D - STORM SEWER
- G - GAS
- E - ELECTRICAL
- T - TELEPHONE
- C - CABLEVISION

MIN. COVER (m)

- 1.5
- 1.2
- 1.2
- 0.6
- PRIMARY 0.9 SECONDARY 0.6
- 0.75
- 0.75

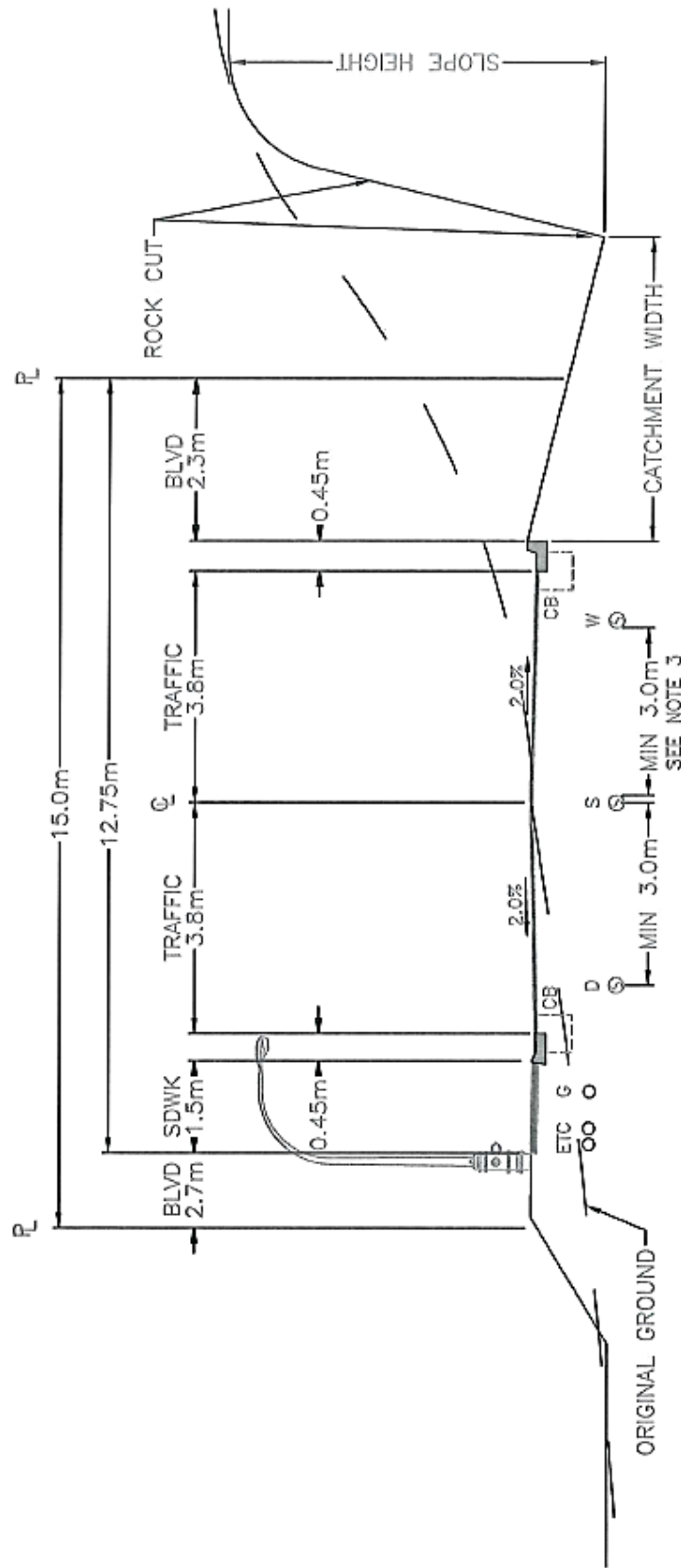


HILLSIDE LOCAL-ACCESS BOTH SIDES ROAD (HL-1)

Drawing Number
213

STANDARD DETAIL DRAWINGS

NOT TO SCALE



NOTES:

- 1) SIDEWALK LOCATION TO BE APPROVED BY GENERAL MANAGER.
- 2) ROCK CUT CATCHMENT AREAS MUST HAVE A MINIMUM CATCHMENT WIDTH OF 3 METERS FOR SLOPES UP TO 8 METERS HIGH. GREATER CATCHMENT AREAS MAY BE REQUIRED AS DIRECTED BY THE GEOTECHNICAL STUDIES. ENTIRE CATCHMENT WIDTH TO BE LOCATED WITHIN ROAD RIGHT-OF-WAY.
- 3) MINIMUM SEPARATION MEASURED TO OUTSIDE OF PIPES.

LEGEND:

- W - WATERMAIN
- S - SANITARY SEWER
- D - STORM SEWER
- G - GAS
- E - ELECTRICAL
- T - TELEPHONE
- C - CABLEVISION

MIN. COVER (m)

- 1.5
- 1.2
- 1.2
- 0.6
- PRIMARY 0.8 SECONDARY 0.6
- 0.75
- 0.75

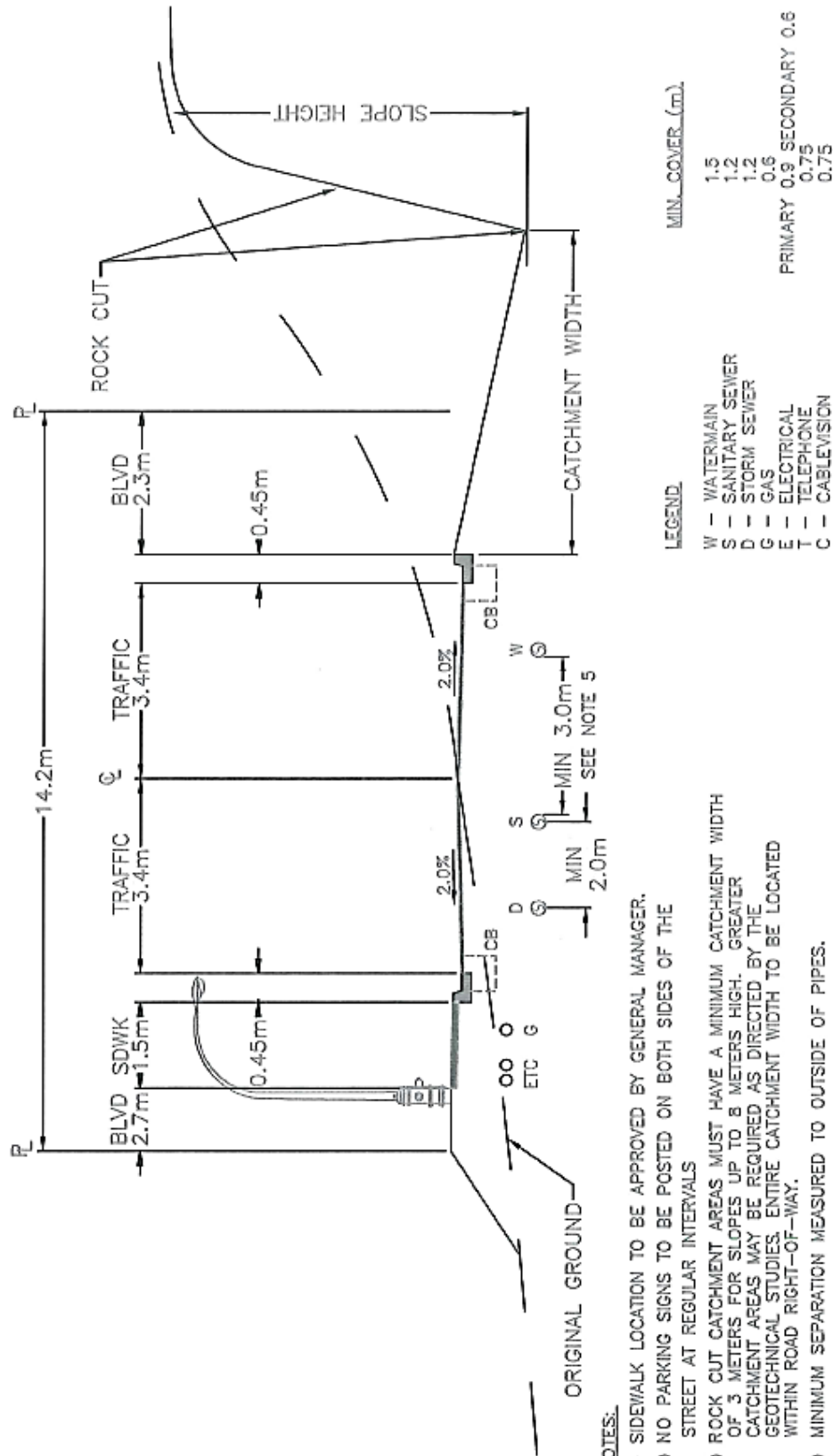


HILLSIDE LOCAL-ACCESS ONE SIDE ROAD (HL-2)

Drawing Number
214

STANDARD DETAIL DRAWINGS

NOT TO SCALE



NOTES:

- 1) SIDEWALK LOCATION TO BE APPROVED BY GENERAL MANAGER.
- 2) NO PARKING SIGNS TO BE POSTED ON BOTH SIDES OF THE STREET AT REGULAR INTERVALS
- 3) ROCK CUT CATCHMENT AREAS MUST HAVE A MINIMUM CATCHMENT WIDTH OF 3 METERS FOR SLOPES UP TO 8 METERS HIGH. GREATER CATCHMENT AREAS MAY BE REQUIRED AS DIRECTED BY THE GEOTECHNICAL STUDIES. ENTIRE CATCHMENT WIDTH TO BE LOCATED WITHIN ROAD RIGHT-OF-WAY.
- 4) MINIMUM SEPARATION MEASURED TO OUTSIDE OF PIPES.

LEGEND

W	WATERMAIN	1.5
S	SANITARY SEWER	1.2
D	STORM SEWER	1.2
G	GAS	0.6
E	ELECTRICAL	PRIMARY 0.9 SECONDARY 0.6
T	TELEPHONE	0.75
C	CABLEVISION	0.75

MIN. COVER (m.)

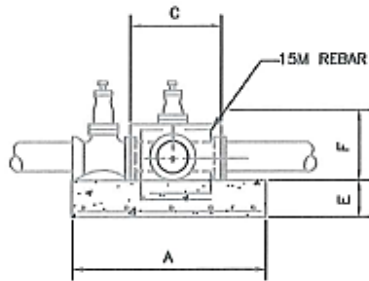


HILLSIDE LOCAL-NO ACCESS ROAD (HL-3)

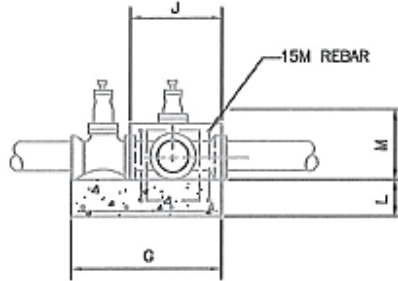
Drawing Number
215

STANDARD DETAIL DRAWINGS

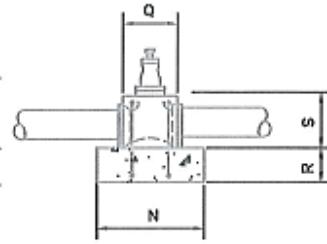
NOT TO SCALE



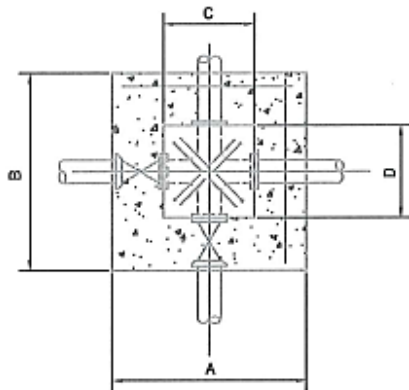
ELEVATION



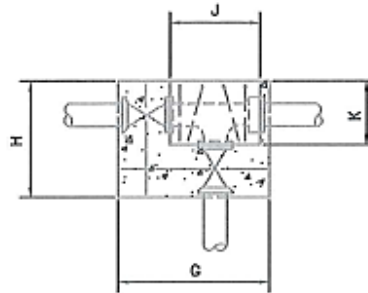
ELEVATION



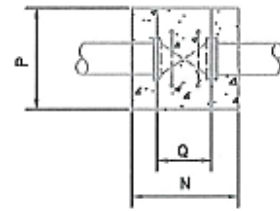
ELEVATION



PLAN VIEW



PLAN VIEW



PLAN VIEW

NOTES:

- 1) REFER TO DESIGN DRAWINGS, MMCD 33 11 01, 03 30 53 AND APPENDIX A FOR DETAILED SPECIFICATIONS.
- 2) PLACE 6 mil POLYETHYLENE BETWEEN CONCRETE AND FITTINGS.
- 3) THRUST BLOCK SIZING BASED ON SOIL BEARING TO BE DETERMINED BY OWNERS ENGINEER.

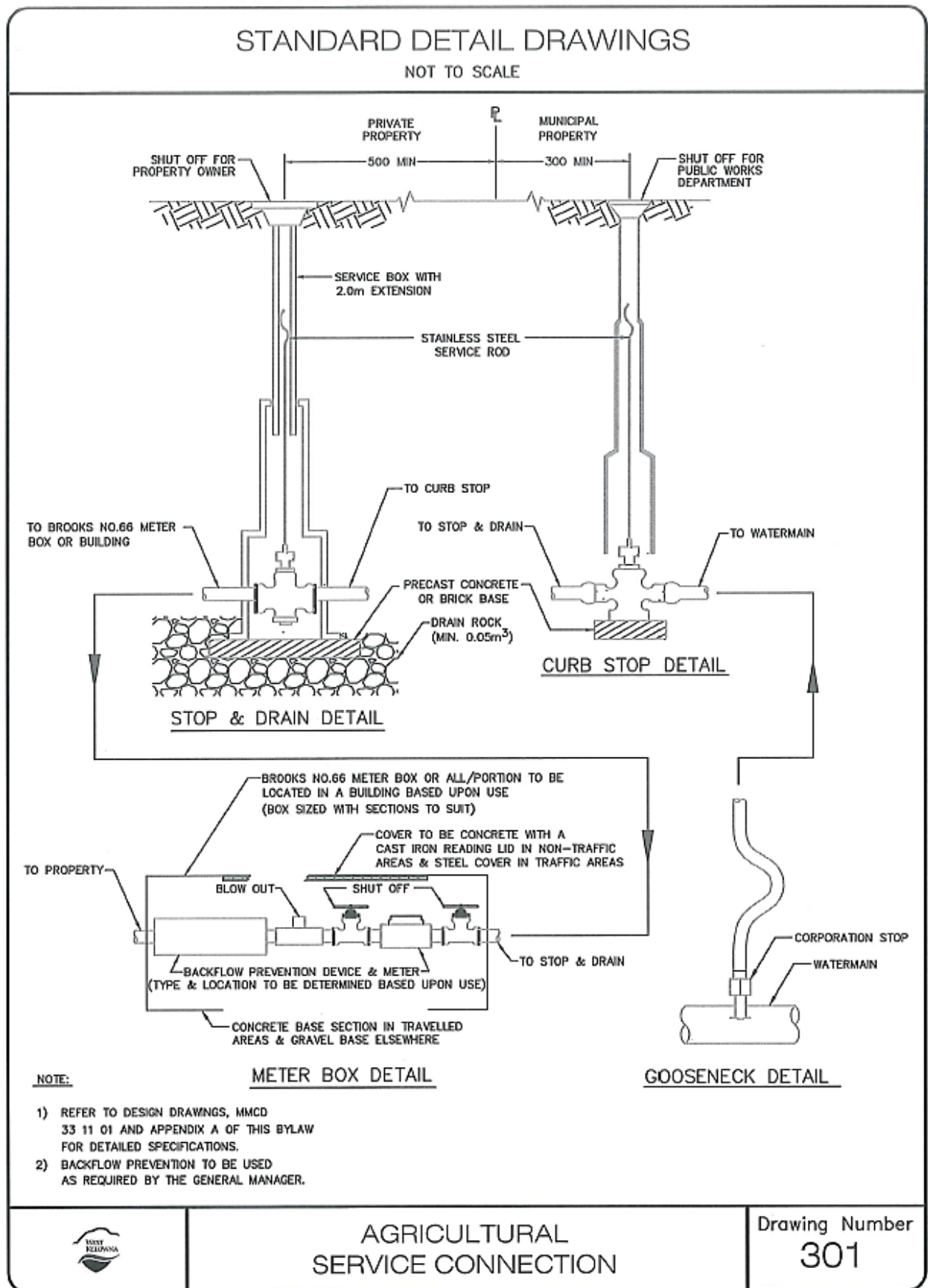
MINIMUM THRUST BLOCK DIMENSIONS (mm)

PIPE SIZE	CROSS WITH VALVES						TEE WITH VALVES						LINE VALVE				
	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S
100mm	800	800	320	320	200	300	600	600	320	300	200	300	300	400	300	250	300
150mm	1000	1000	400	400	200	350	700	700	400	400	300	350	400	600	300	350	350
200mm	1100	1100	450	450	300	400	800	800	450	450	400	400	500	800	320	400	400
250mm	1300	1300	550	550	400	450	1000	1000	550	500	500	450	500	1000	350	500	450
300mm	1400	1400	600	600	500	500	1200	1200	650	550	600	500	500	1200	400	600	500
350mm	1600	1600	700	700	700	600	1400	1400	650	600	800	600	600	1400	350	800	600
400mm	1800	1800	750	750	800	700	1600	1600	750	650	900	700	600	1600	400	900	700



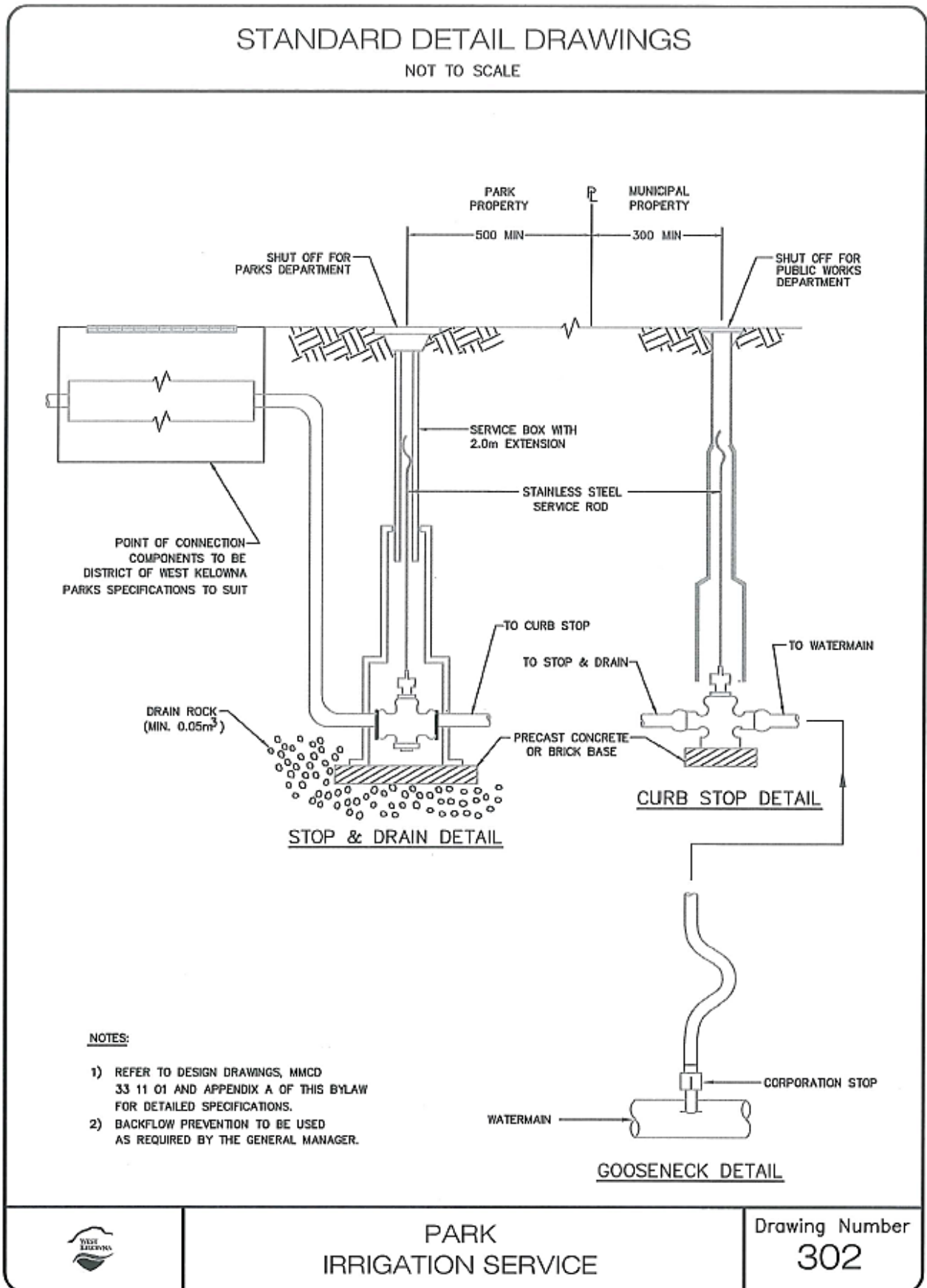
GATE VALVE THRUST BLOCKS

Drawing Number
300



AGRICULTURAL SERVICE CONNECTION

Drawing Number
301

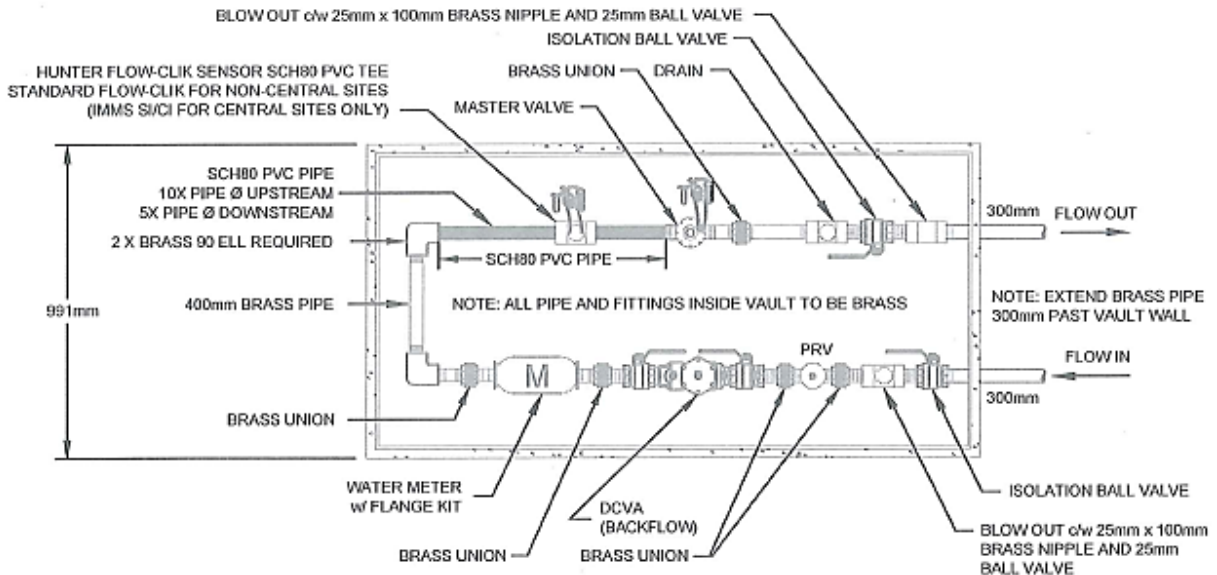


PARK
IRRIGATION SERVICE

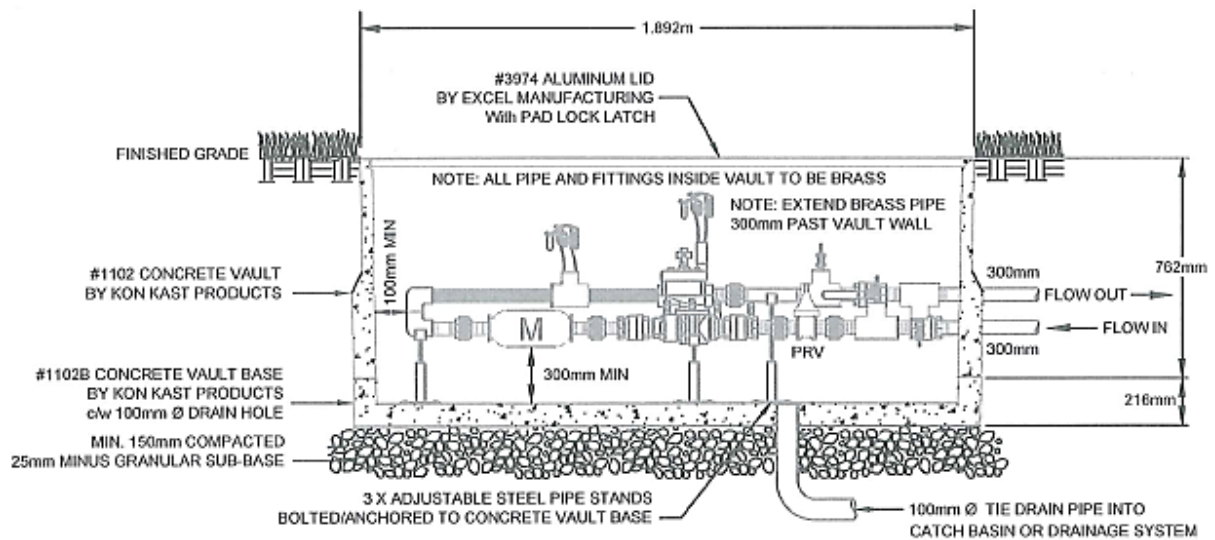
Drawing Number
302

STANDARD DETAIL DRAWINGS

NOT TO SCALE



PLAN VIEW



SECTION VIEW

NOTES:

- 1) IN SPORTS FIELD APPLICATIONS USE A HIGH FLOW CLA-VAL COMBINATION MASTER VALVE WITH PRESSURE REGULATING/SUSTAINING CAPABILITY TO PREVENT WATER HAMMER. REFER TO SPECIFICATIONS FOR TYPE AND MODEL(S).
- 2) WATER METER MAY BE PRE-INSTALLED OUTSIDE OF VAULT.
- 3) WHERE STATIC WATER PRESSURE IS LESS THAN 80PSI - REMOVE PRV FROM CONNECTION.

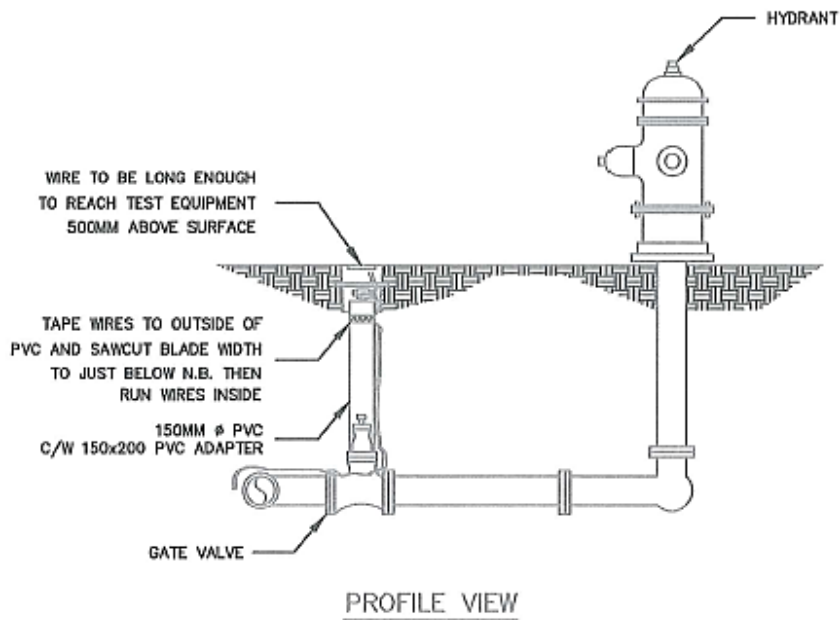
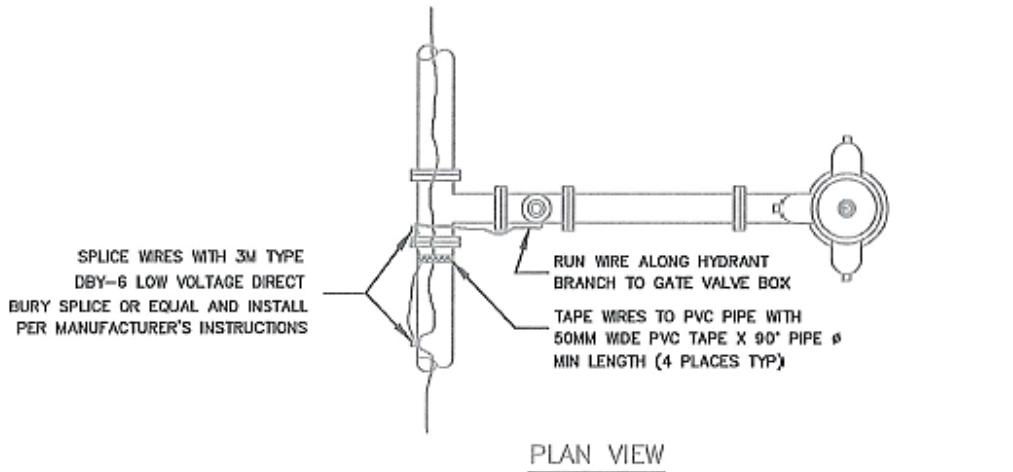


PARK POINT OF CONNECTION
25mm TO 50mm

Drawing Number
303

STANDARD DETAIL DRAWINGS

NOT TO SCALE



NOTES:

- 1) TRACER WIRE TO BE #10 AWG TYPE RWJ XLPE SINGLE OR STRANDED COPPER WIRE.

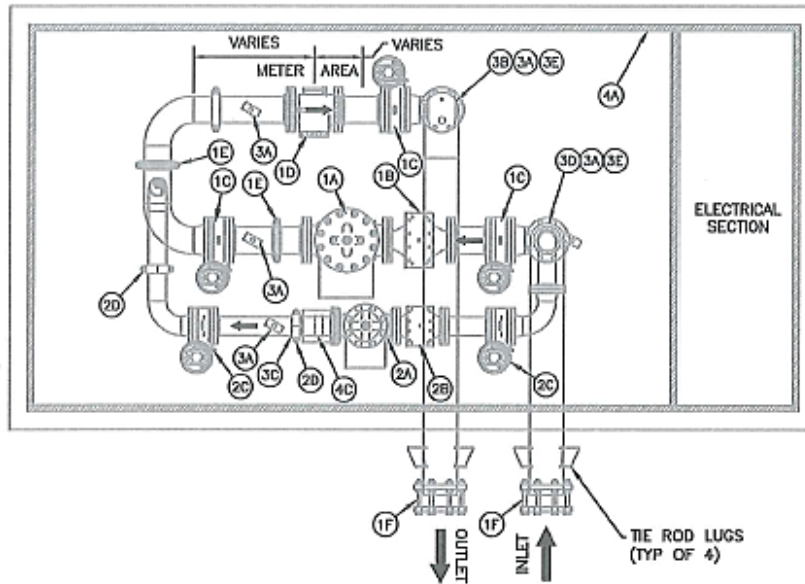


TRACER WIRE INSTALLATION
FOR WATERMAINS

Drawing Number
304

STANDARD DETAIL DRAWINGS

NOT TO SCALE



BILL OF MATERIALS

ITEM	QTY	DESCRIPTION
1A	1	PRESSURE REDUCING VALVE
1B	1	STRAINER W/ DRAIN VALVE
1C	3	FLANGED BUTTERFLY VALVE
1D	1	10W MAGNETIC FLOW METER
1E	5	RIGID COUPLING
1F	2	MANUFACTURED TRANSITION COUPLING, EPOXY COATED W/ STAINLESS STEEL HARDWARE
2A	1	PRESSURE REDUCING/SUSTAINING VALVE
2B	1	STRAINER W/ DRAIN VALVE
2C	2	FLANGED BUTTERFLY VALVE
2D	3	RIGID COUPLING
3A	5	DIAL PRESSURE GAUGE W/ ISOLATION VALVE (0-200PSI INLET, 0-100 PSI OUTLET)
3B	1	COMBINATION AIR/VACUUM VALVE W/ ISOLATION VALVE
3C	5	BALL VALVE W/ PLUG (DRAIN)
3D	1	AIR VALVE W/ ISOLATION VALVE
3E	2	PRESSURE TRANSMITTER (0-200PSI INLET, 0-100 PSI OUTLET)
4A	1	KIOSK ENCLOSURE W/ HEATERS & LIGHTS
4B	5	PIPE STAND FLANGE STYLE GALVANIZED
4C	2	PIPE STAND SADDLE STYLE GALVANIZED

NOTES:

- 1) ALL COMPONENTS AND METER SIZE TO BE DESIGNED BY A QUALIFIED PERSON.
- 2) CONCRETE SLAB, KIOSK AND ELECTRICAL BY OTHERS.

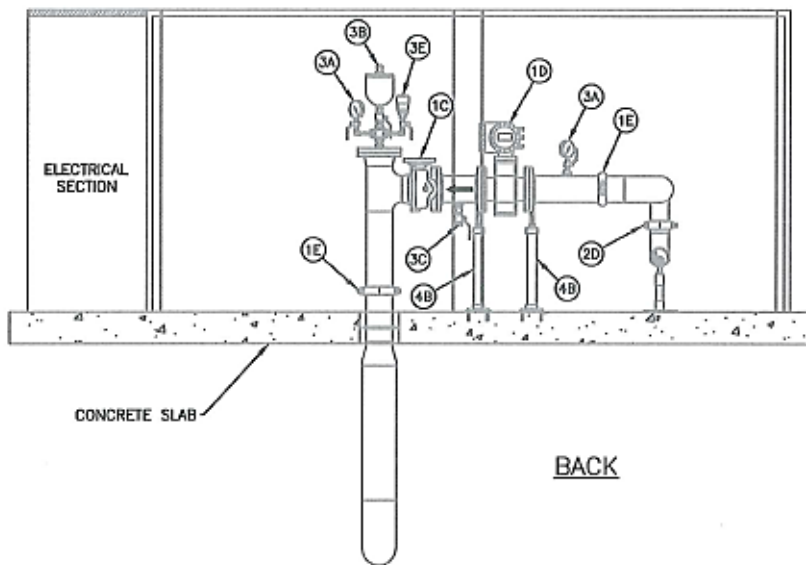
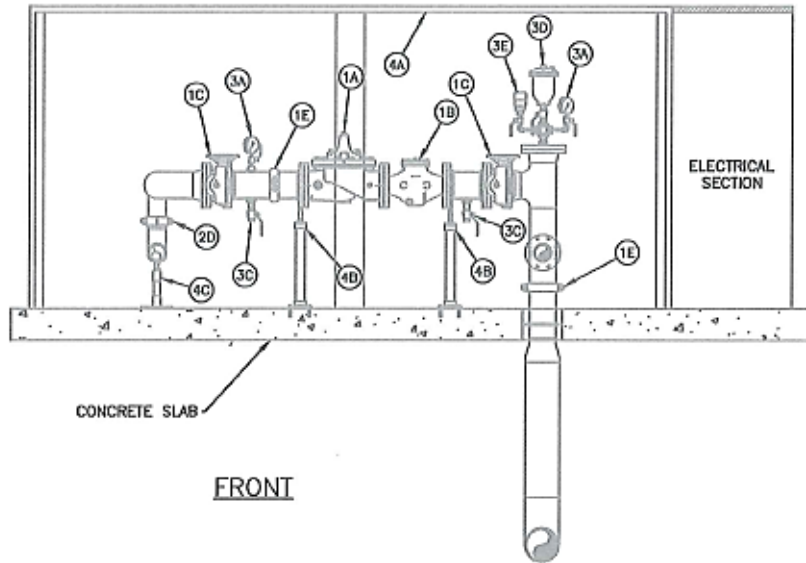


ABOVE GROUND PRESSURE REDUCING VALVES (PLAN VIEW)

Drawing Number
305

STANDARD DETAIL DRAWINGS

NOT TO SCALE



NOTES:

- 1) FABRICATED STEEL PIPE/FITTINGS ARE SCHEDULE 40 FOR SIZES UP TO 10" OR 3/8" WALL FOR 12" AND LARGER.
- 2) FLANGES ARE ANSI 125/150 AND FASTENED WITH 18-8 STAINLESS STEEL.
- 3) FOR ALL 2" AND SMALLER PIPE/FITTINGS TO BE THREADED 304 STAINLESS STEEL.
- 4) FOR ALL 3" AND LARGER PIPE THE INSIDE WETTED SURFACES ARE TO BE SANDBLASTED, FUSION EPOXY LINED AND COATED TO AWWA C-213/NSF-61 SPECIFICATIONS.
- 5) THE FINISHED COATING IS BE BLUE ENAMEL.
- 6) FACTORY BUILT WITH NO FIELD WELDING ALLOWED TO ASSEMBLE COMPONENTS.
- 7) ALL COMPONENTS SHIPPED LOOSE.
- 8) CONCRETE SLAB, KIOSK AND ELECTRICAL BY OTHERS.

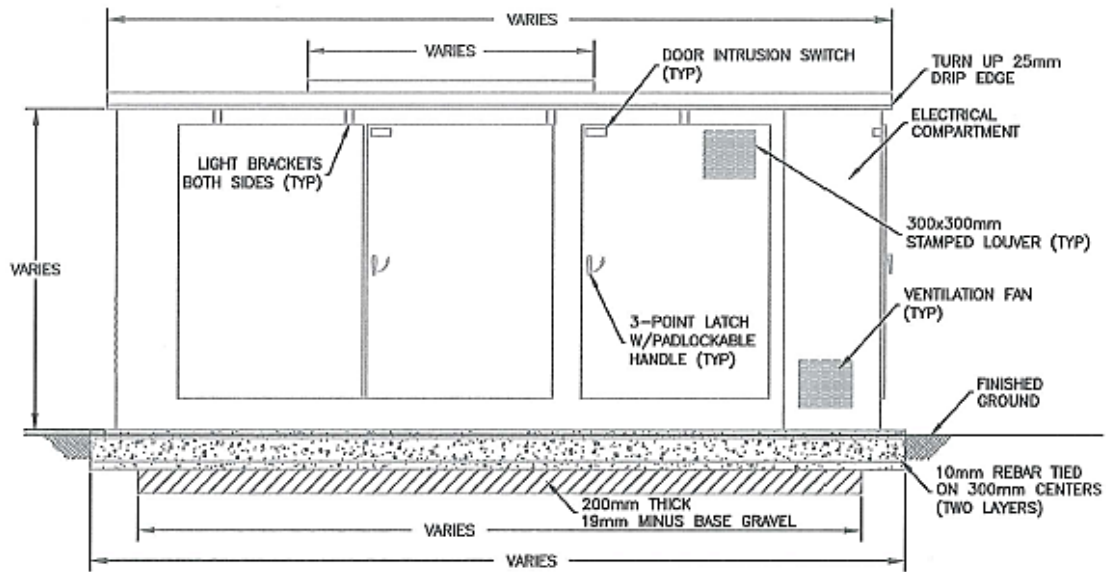


**ABOVE GROUND PRESSURE REDUCING
VALVES (FRONT AND BACK VIEWS)**

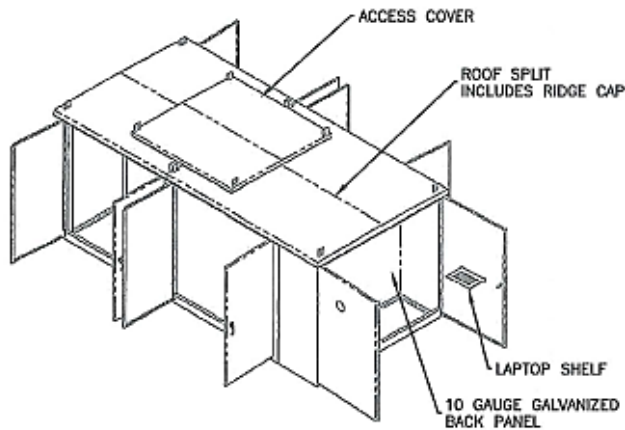
Drawing Number
306

STANDARD DETAIL DRAWINGS

NOT TO SCALE



FRONT (6 DOOR W/END CABINET)



ISOMETRIC OPEN (8 DOOR W/END CABINET)

BILL OF MATERIALS	
QTY	DESCRIPTION
1	4 JAW METER BASE
1	125A 24CCT LOAD CENTER C/W 100A MAIN
7	15A SINGLE POLE BREAKER
3	15A DOUBLE POLE BREAKER
1	SURGEBREAKER SURGE ARRESTOR
4	ALUMINIUM WIREWAY
2	ALUMINIUM WIREWAY END CAP
1	15A SINGLE POLE GFI BREAKER
3	15A 125V DUPLEX RECEPTACLE
3	DUPLEX RECEPTACLE COVER
6	DUPLEX RECEPTACLE BOX
1	6" FAN FINGER GUARD
1	CLOSE ON FALL THERMOSTAT
2	CLOSE ON RISE THERMOSTAT
1	TEMPERATURE TRANSMITTER (0-50C)
5	120VAC SINGLE LED STRIP LIGHT
1	1000W 240V WHITE BASEBOARD HEATER
2	2000W 240V WALL HEATER C/W BUILT-IN THERMOSTAT
2	10" KIOSK VENTILATION FAN
1	6" KIOSK VENTILATION FAN
5	SPDT LIMIT SWITCH BODY
5	SPDT LIMIT SWITCH ROLLER LEVER ARM

NOTES:

- UNLESS OTHERWISE NOTED ALL MATERIAL IS 1/8" THICK 5052-H32 ALUMINIUM POWDER COATED PC117 GREEN.
- INTERIOR BACK AND SIDE PANELS ARE 14GA GALVANIZED STEEL POWDER COATED PC107 WHITE.
- ALL DOORS WITH HANDLES HAVE A LOCKABLE 3-POINT LATCHING SYSTEM.
- ALL DOORS INCLUDE GAS SPRINGS AND INSULATED WITH 1" THICK FOIL-BACK INSULATION.
- ALL DOORS HAVE A DRIP LIP OVER THE OPENING.
- END CABINET TO HAVE METER WINDOW WITH FOLD DOWN SHELF.
- ACCESS OPENING TO BE REMOVEABLE WITH FIXED LIFTING LUGS ON ALL ROOF COMPONENTS.

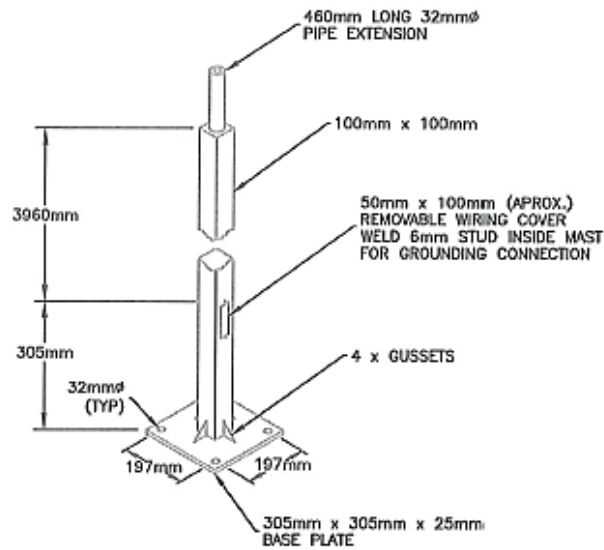


ABOVE GROUND PRESSURE
REDUCING VALVES KIOSK

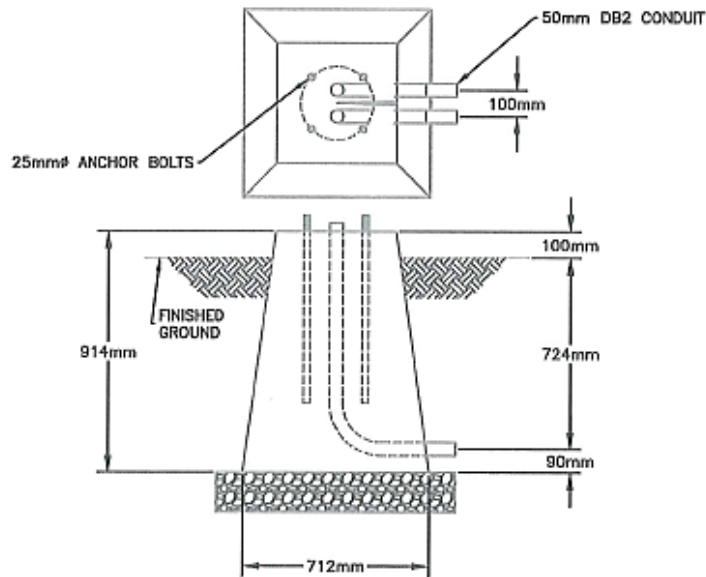
Drawing Number
307

STANDARD DETAIL DRAWINGS

NOT TO SCALE



RADIO ANTENNA POLE



BASE

NOTES:

- 1) POWDER COAT ANTENNA PC117 GREEN.
- 2) MOUNT ANTENNA ON KON KAST (KELOWNA BC) NUMBER 1045 STANDARD BASE.

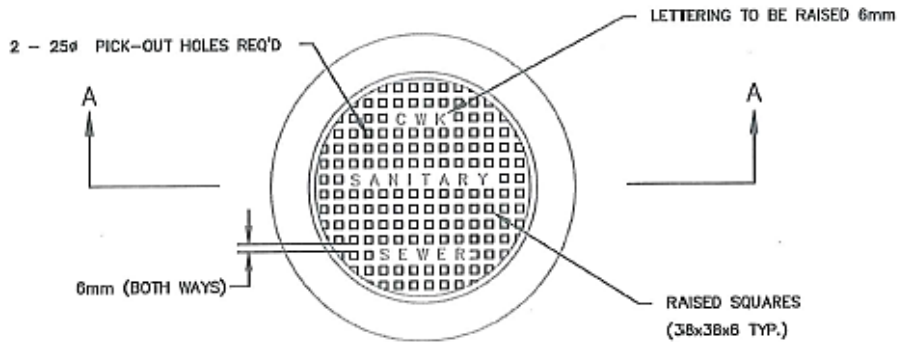


ABOVE GROUND PRESSURE REDUCING VALVES ANTENNA POLE AND BASE

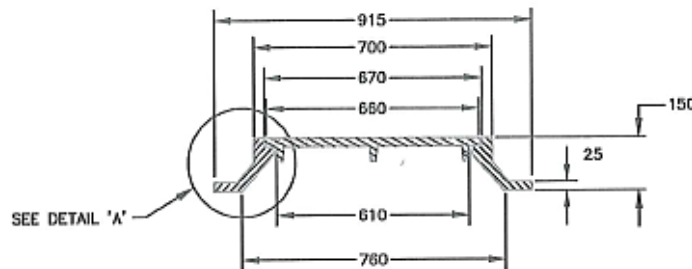
Drawing Number
308

STANDARD DETAIL DRAWINGS

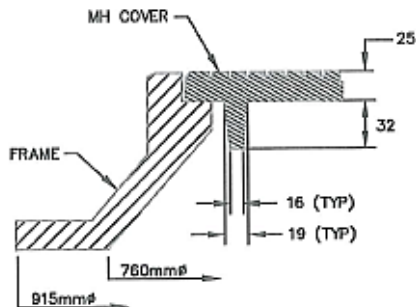
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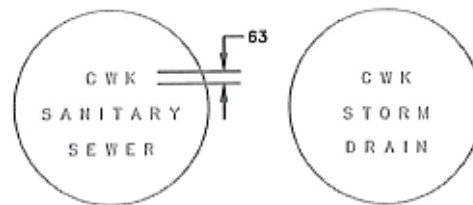
PLAN



SECTION A - A



DETAIL 'A'



STANDARD LETTERING ON COVER

NOTES:

- 1) REFER TO DESIGN DRAWINGS, MMCD SECTION 33 44 01 AND APPENDIX A OF THIS BYLAW FOR DETAILED SPECIFICATIONS.
- 2) FOR MANHOLE COVERS OTHER THAN SANITARY AND STORM, CONFIRM LETTERING WITH THE GENERAL MANAGER BEFORE ORDERING COVERS.

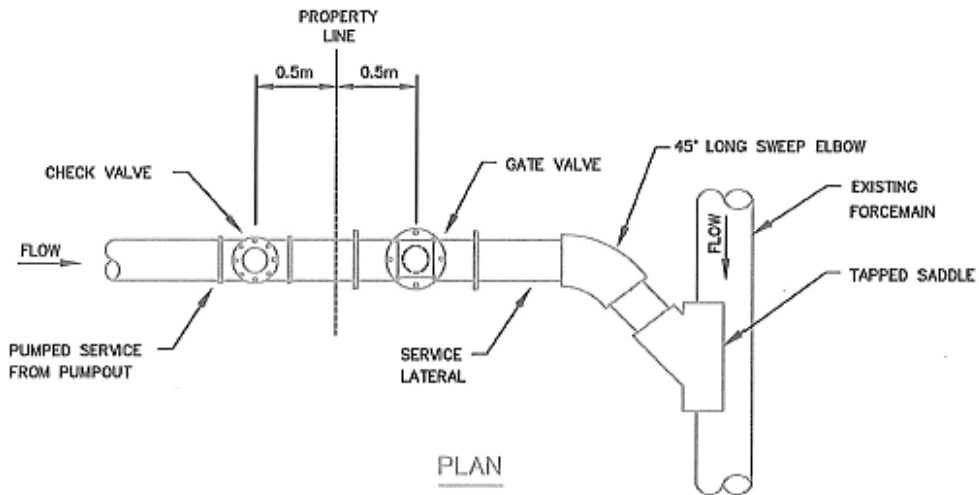


MANHOLE FRAME AND COVER

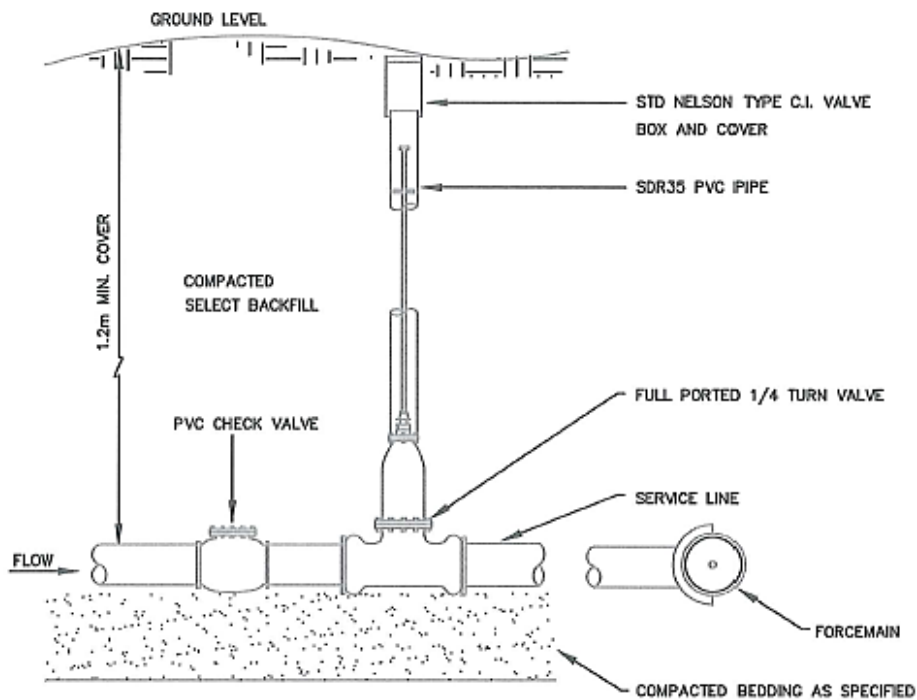
Drawing Number
400

STANDARD DETAIL DRAWINGS

NOT TO SCALE



PLAN



ELEVATION

NOTES:

- 1) REFER TO DESIGN DRAWINGS, MMCD SECTION 33 44 01 AND APPENDIX A OF THIS BYLAW FOR DETAILED SPECIFICATIONS.
- 2) CONNECTION TO FORCEMAIN ONLY

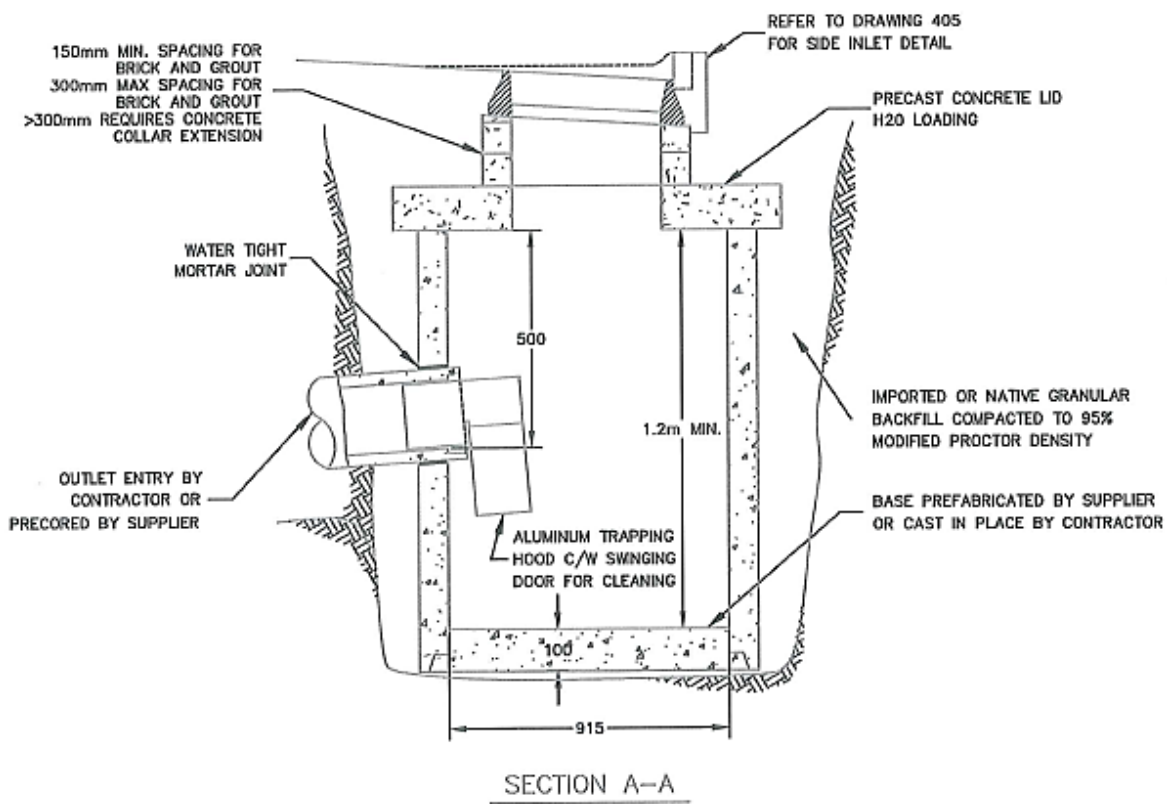
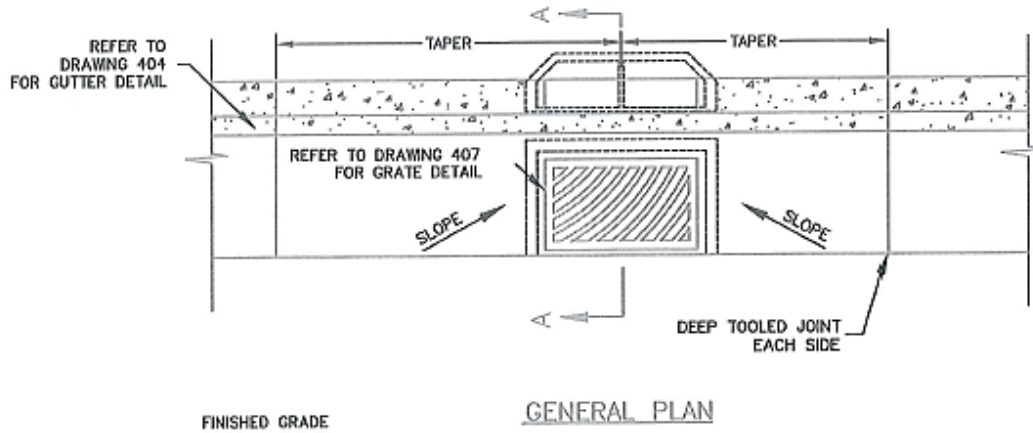


PRESSURE SERVICE
CONNECTION TO FORCEMAIN

Drawing Number
401

STANDARD DETAIL DRAWINGS

NOT TO SCALE



- NOTES:**
- REFER TO DESIGN DRAWINGS, MMCD SECTION 33 40 01 AND APPENDIX A FOR DETAILED SPECIFICATIONS.

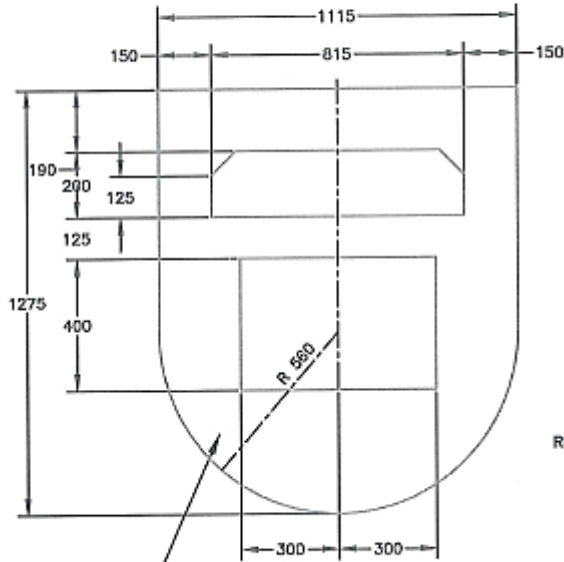


ROADWAY TYPE PRECAST CONCRETE CATCH BASIN

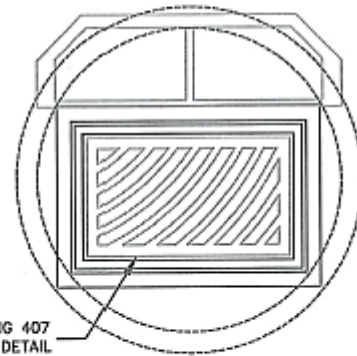
Drawing Number
402

STANDARD DETAIL DRAWINGS

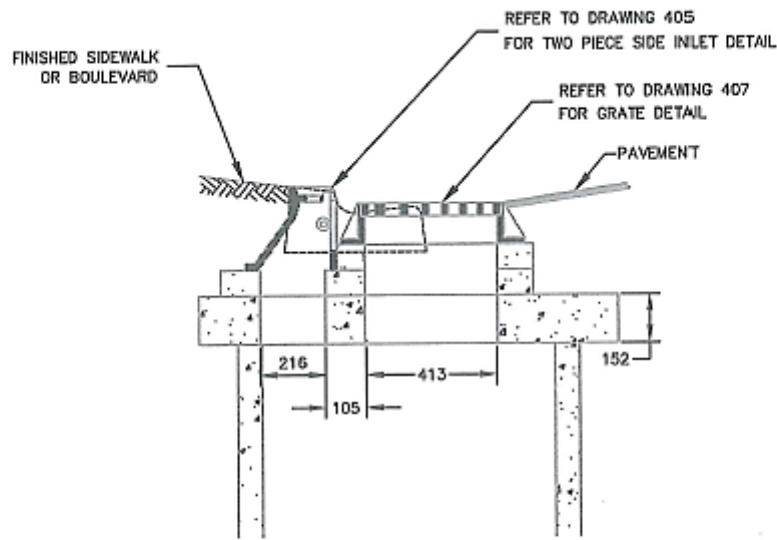
NOT TO SCALE



TOP SLAB PLAN



GRATE AND BARREL PLAN



SECTION

NOTES:

- 1) REFER TO DESIGN DRAWINGS, MMCD SECTION 33 40 01 AND APPENDIX A FOR DETAILED SPECIFICATIONS.

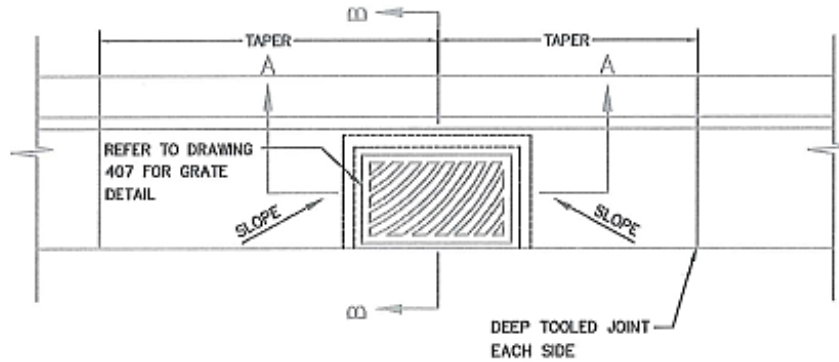


BARRIER CURB SIDE INLET
CATCH BASIN

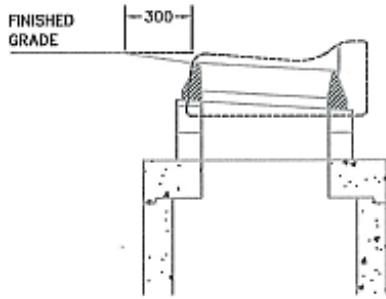
Drawing Number
403

STANDARD DETAIL DRAWINGS

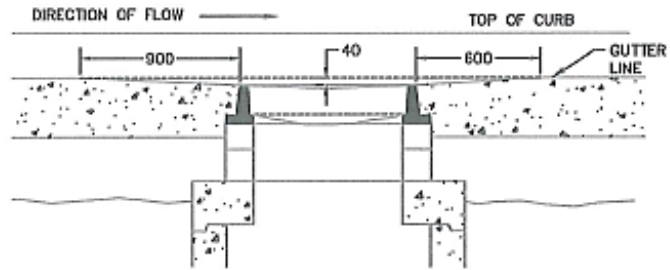
NOT TO SCALE



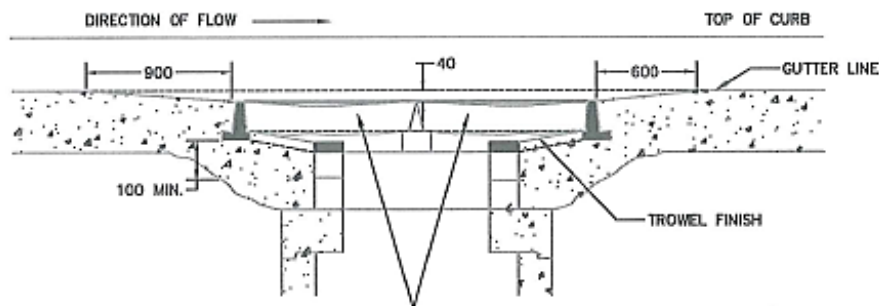
GENERAL PLAN



SECTION B-B



SECTION A-A



SECTION A-A
FOR TWIN INLET

NOTE:

- 1) REFER TO DESIGN DRAWINGS, MMCD SECTION 33 40 01 AND APPENDIX A FOR DETAILED SPECIFICATIONS.

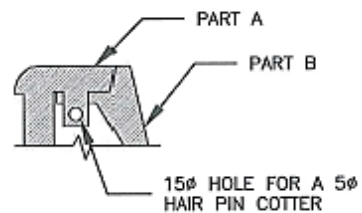
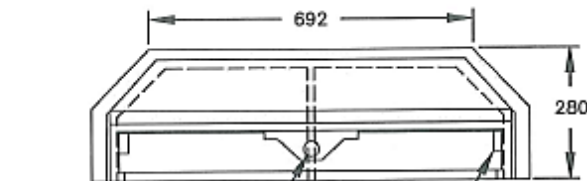
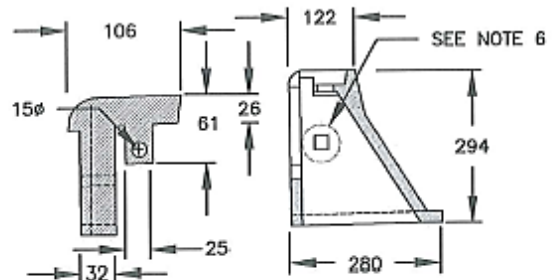
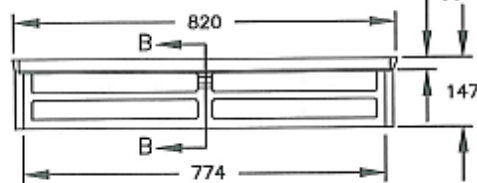
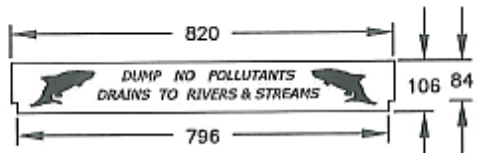
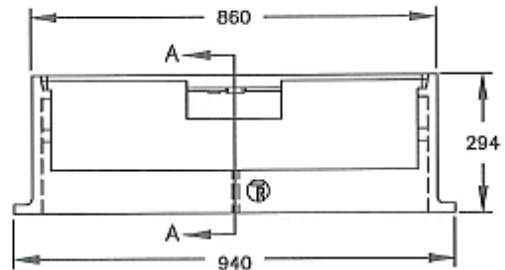
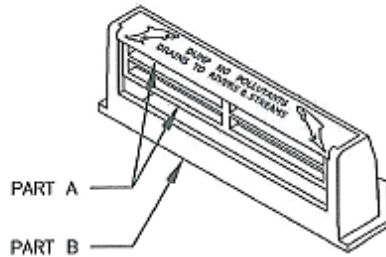


CATCH BASIN GUTTER DETAIL

Drawing Number
404

STANDARD DETAIL DRAWINGS

NOT TO SCALE



NOTES:

- 1) MATERIAL TO BE ASTM A536 DUCTILE IRON 80-55-06.
- 2) FINISH TO BE BITUMINOUS DIP.
- 3) MATERIAL TO MEET H2O LOADING.
- 4) REFER TO DRAWING 403 FOR INSTALLATION.
- 5) ALL MEASUREMENTS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.
- 6) FACE OF 25mmx25mm LOWER SUPPORT LUG TO PROVIDE A CLOSE FIT AGAINST THE GRATE.

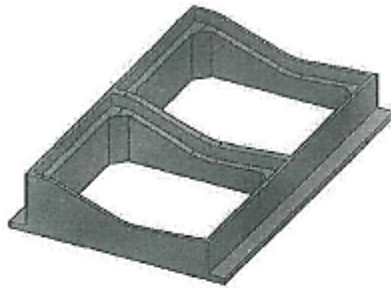


BARRIER CURB
TWO PIECE SIDE INLET

Drawing Number
405

STANDARD DETAIL DRAWINGS

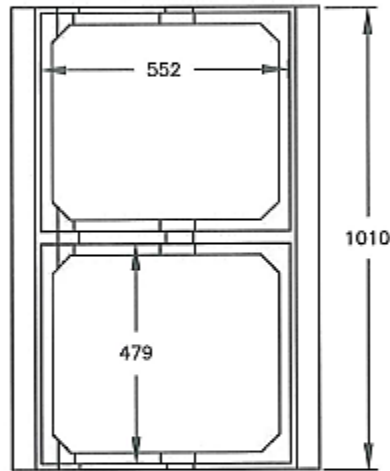
NOT TO SCALE



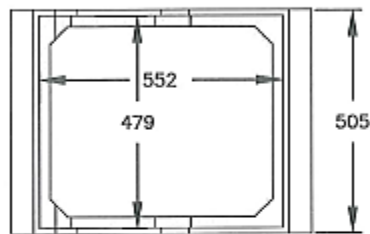
ISOMETRIC VIEW (TWIN)



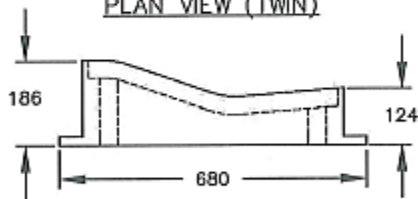
ISOMETRIC VIEW (SINGLE)



PLAN VIEW (TWIN)



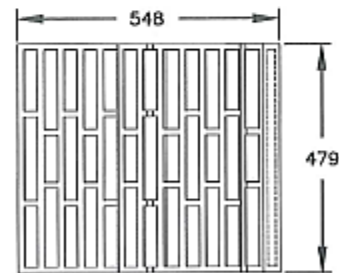
PLAN VIEW (SINGLE)



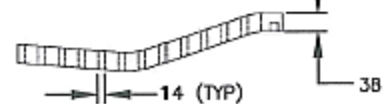
SIDE VIEW (TWIN AND SINGLE)



ISOMETRIC VIEW (GRATE)



PLAN VIEW (GRATE)



SIDE VIEW (GRATE)

NOTES:

- 1) FRAME MATERIAL TO BE ASTM A48 CLASS 25B GREY CAST IRON AND GRATE MATERIAL TO BE ASTM A536 GRADE 80-55-06 DUCTILE IRON.
- 2) ALL MATERIAL FINISH TO BE BITUMINOUS DIP.
- 3) ALL MATERIAL TO MEET H2O LOADING.
- 4) ALL MEASUREMENTS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.

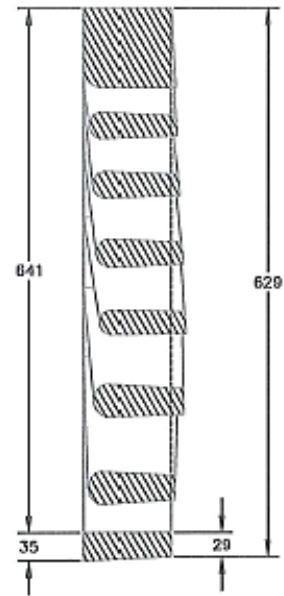
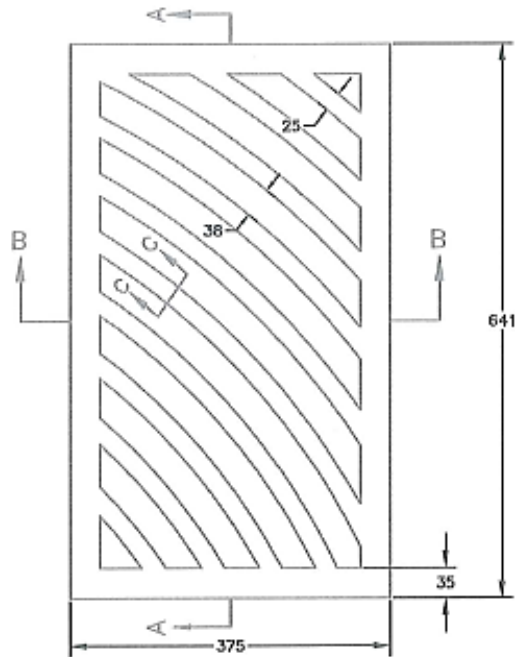


ROLLOVER CURB SINGLE AND TWIN
FRAMES WITH GRATE

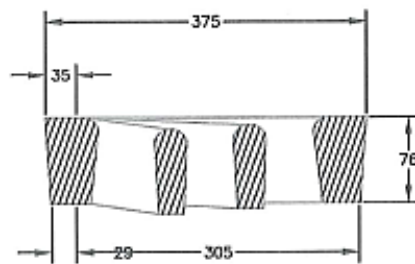
Drawing Number
406

STANDARD DETAIL DRAWINGS

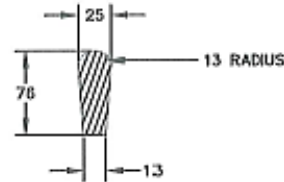
NOT TO SCALE



SECTION A-A



SECTION B-B



SECTION C-C

NOTES:

- 1) REFER TO DESIGN DRAWINGS, MMCD SECTION 33 42 13 AND APPENDIX A FOR DETAILED SPECIFICATIONS.

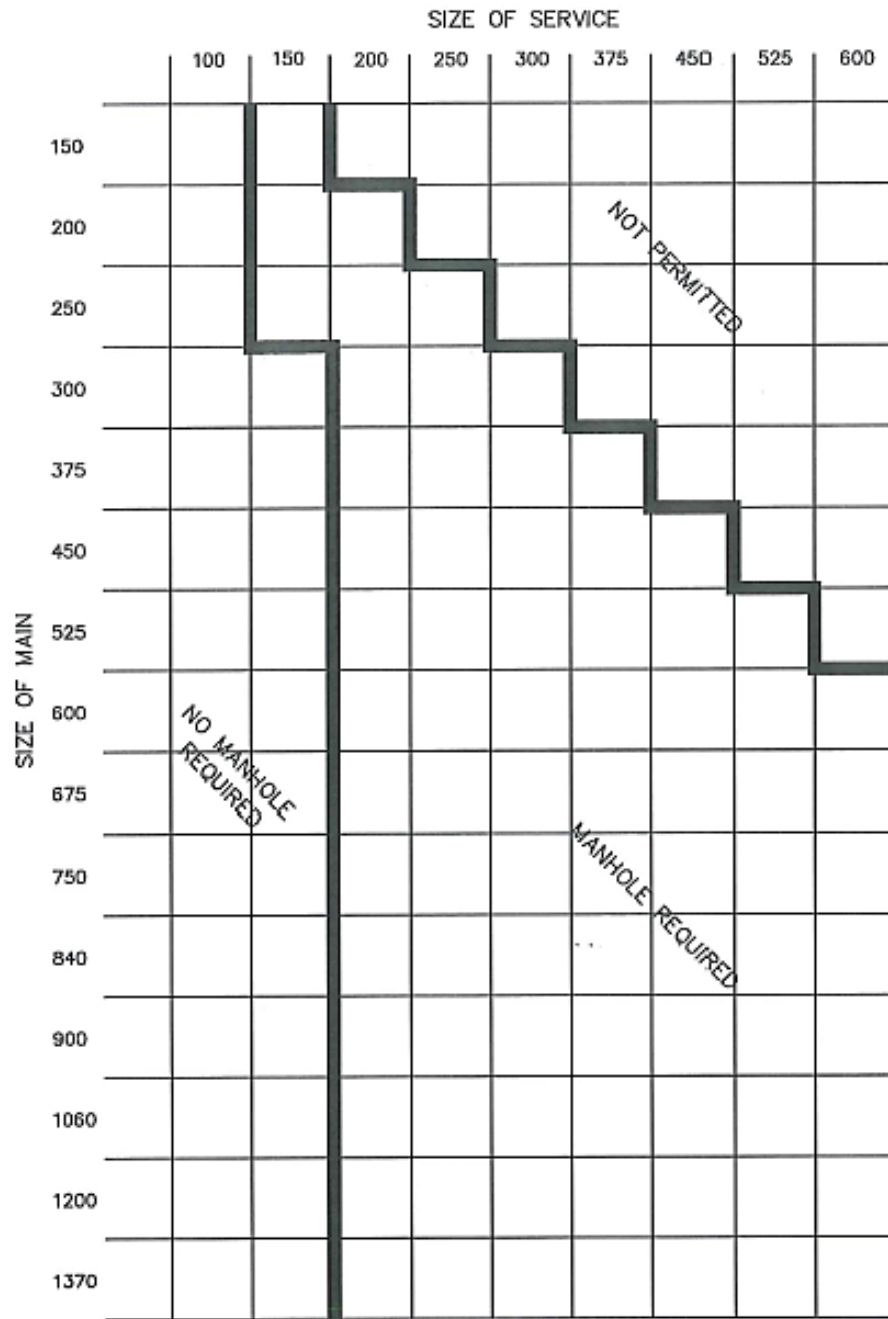


BICYCLE SAFE CATCH BASIN GRATE

Drawing Number
407

STANDARD DETAIL DRAWINGS

NOT TO SCALE

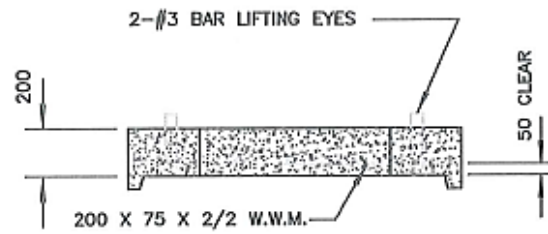
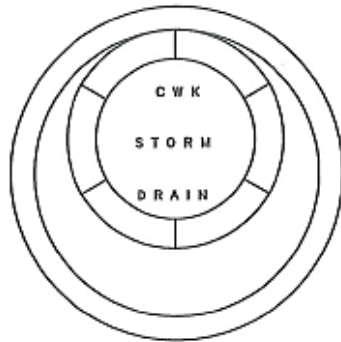


MANHOLE REQUIREMENT
FOR SERVICES

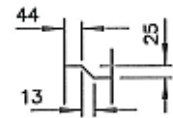
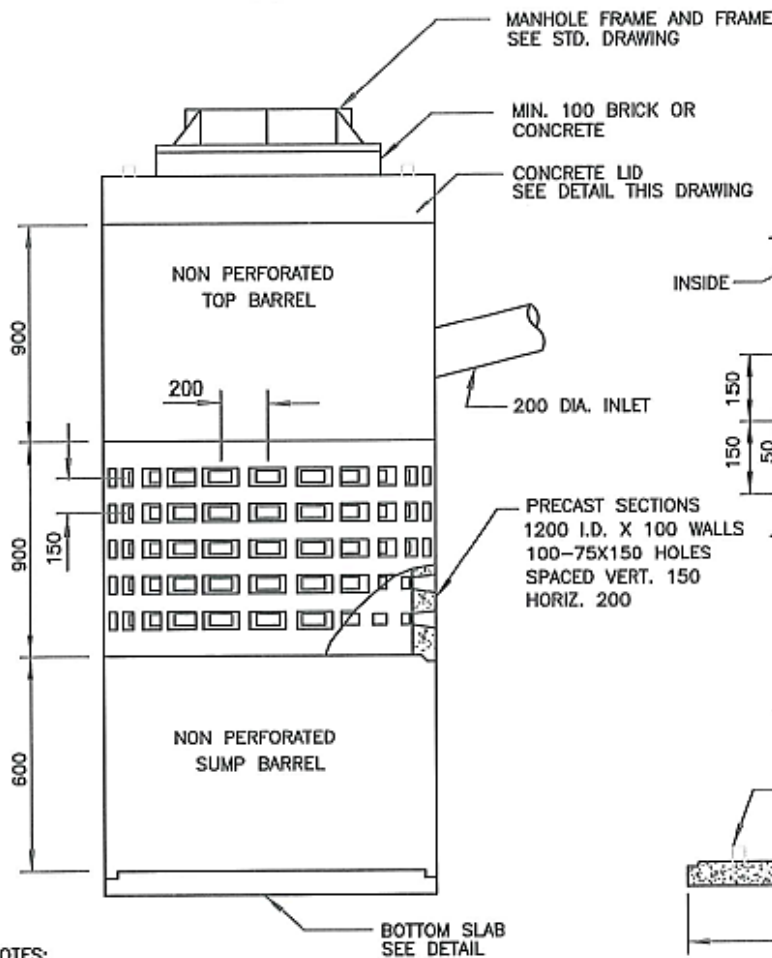
Drawing Number
408

STANDARD DETAIL DRAWINGS

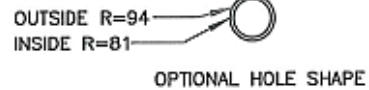
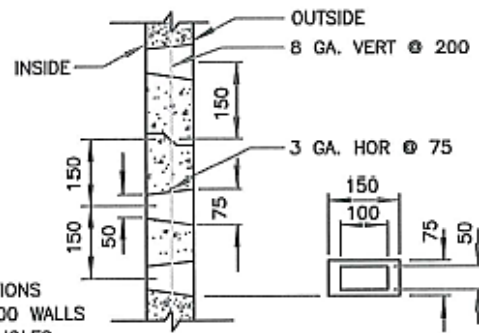
NOT TO SCALE



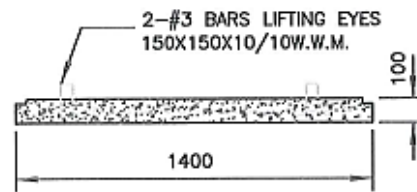
CONCRETE LID DETAIL



JOINT DETAIL



SECTION-BARREL



BOTTOM SLAB DETAIL

NOTES:

- 1) LADDER RUNGS ARE REQUIRED.
- 2) SEE MMCD MANHOLE STD. DWG. FOR DETAILS.
- 3) SEE DRAINAGE DRYWELL INSTALLATION STANDARD FOR DETAILS.
- 4) THE NUMBER OF PERFORATED BARRELS TO BE DETERMINED BY GEOTECHNICAL STUDIES.

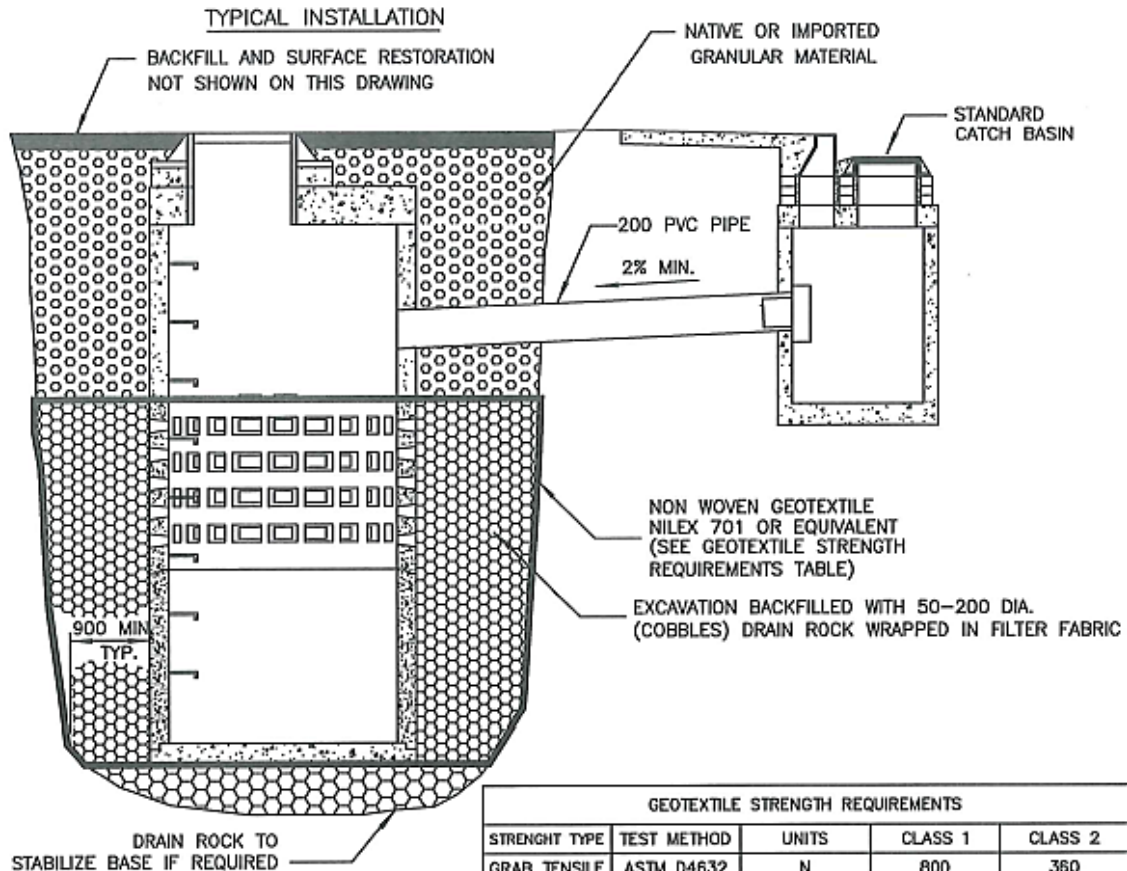


DRAINAGE DRYWELL
WITH SUMP

Drawing Number
409

STANDARD DETAIL DRAWINGS

NOT TO SCALE



GEOTEXTILE STRENGTH REQUIREMENTS				
STRENGTH TYPE	TEST METHOD	UNITS	CLASS 1	CLASS 2
GRAB TENSILE	ASTM D4632	N	800	360
PUNCTURE	ASTM D4833	N	370	200
BURST	ASTM D3786	kPa	1950	1030
TRAPEZOIDAL	ASTM D4533	N	260	130

CLASS 1: GEOTEXTILE INSTALLATION WHERE VERY COARSE SHAPE ANGULAR AGGREGATE IS USED.

COMPACTION >95% STANDARD PROCTOR MAXIMUM DRY DENSITY (SPMDD).

DEPTH OF TRENCH > 3.0m.

CLASS 2: GEOTEXTILE INSTALLATION ON SMOOTH GRADED SURFACES HAVING NO SHARP ANGULAR AGGREGATE.

COMPACTION < 95% SPMDD.

NOTES:

- 1) THE NUMBER AND SPACING OF DRAINAGE DRYWELLS MUST BE CALCULATED IN ACCORDANCE WITH APPENDIX A.
- 2) CRITERIA WILL DEPEND UPON THE AREA DRAINED AND GROUND CONDITIONS. (SEE ALSO PIPE PERFORATION AND BEDDING DETAIL STANDARD DRAWING 409).
- 3) FILTER FABRIC TO BE STRETCHED BELOW TOP BARREL SECTION AND REMOVED BY THE CONTRACTOR DURING THE FINAL INSPECTION.
- 4) DEPTH TO BE SPECIFIED WILL VARY DEPENDING UPON DRAINAGE REQUIREMENTS AND GROUND CONDITIONS. DEPTH TO WATER TABLE MUST BE SHOWN IF LESS THAN 3.6m. THERE IS NO NEED TO PLACE DRYWELLS BELOW LOW WATER TABLE.

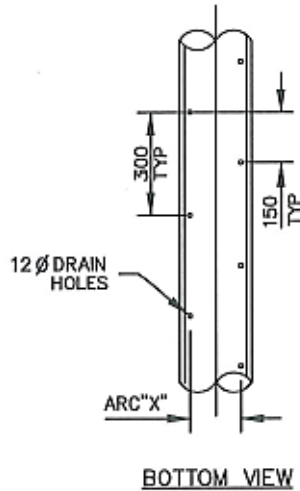
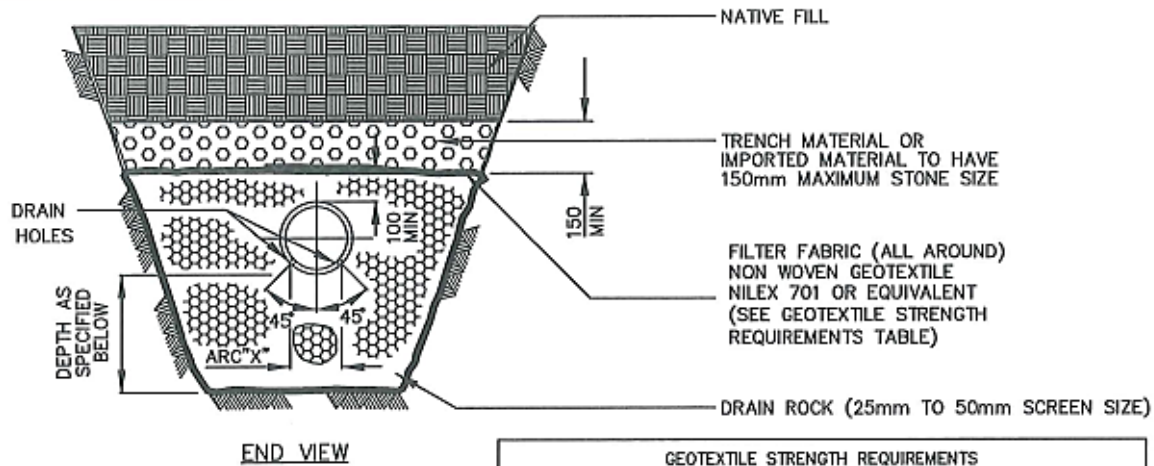


DRAINAGE DRYWELL INSTALLATION

Drawing Number
410

STANDARD DETAIL DRAWINGS

NOT TO SCALE



GEOTEXTILE STRENGTH REQUIREMENTS				
STRENGTH TYPE	TEST METHOD	UNITS	CLASS 1	CLASS 2
GRAB TENSILE	ASTM D4632	N	800	360
PUNCTURE	ASTM D4833	N	370	200
BURST	ASTM D3786	kPa	1950	1030
TRAPEZOIDAL	ASTM D4533	N	260	130

CLASS 1: GEOTEXTILE INSTALLATION WHERE VERY COARSE SHAPE ANGULAR AGGREGATE IS USED.
 COMPACTION >95% STANDARD PROCTOR MAXIMUM DRY DENSITY (SPMDD).
 DEPTH OF TRENCH > 3.0m.

CLASS 2: GEOTEXTILE INSTALLATION ON SMOOTH GRADED SURFACES HAVING NO SHARP ANGULAR AGGREGATE.
 COMPACTION < 95% SPMDD.

NOMINAL PIPE DIAMETER	ARC "X" (BASED UPON AVERAGE O.D.)
200	160
250	200
300	240
375	290
450	350

NOTES:

- 1) PERFORATION SECTION APPLIES TO USE OF PVC PIPE.
- 2) FIELD PERFORATION OF PIPE SHALL BE TO THIS STANDARD. FACTORY PERFORATED PIPE MUST BE APPROVED BY THE GENERAL MANAGER.
- 3) PROVIDE 0.5m MIN. FABRIC OVERLAP FOR LONGITUDINAL OR TRANSVERSE JOINTS IN FABRIC.
- 4) NUMBER OF DRYWELLS AND DEPTH OF DRAIN ROCK TO BE AS FOLLOWS:
 - A) FOR PERCOLATION RATE OF 0-15 MIN. PER 25mm
 - USE 5 PER HA.
 - USE 200mm DEPTH OF DRAIN ROCK UNDER PERF. PIPE
 - B) FOR PERCOLATION RATE OF 15-30 MIN. PER 25mm
 - USE 10 DRYWELLS PER HA.
 - USE 300mm DEPTH OF DRAIN ROCK UNDER PERF. PIPE
 - C) FOR PERCOLATION RATE OVER 30 MIN. PER 25mm, PERF. PIPE & DRYWELLS ARE NOT RECOMMENDED.

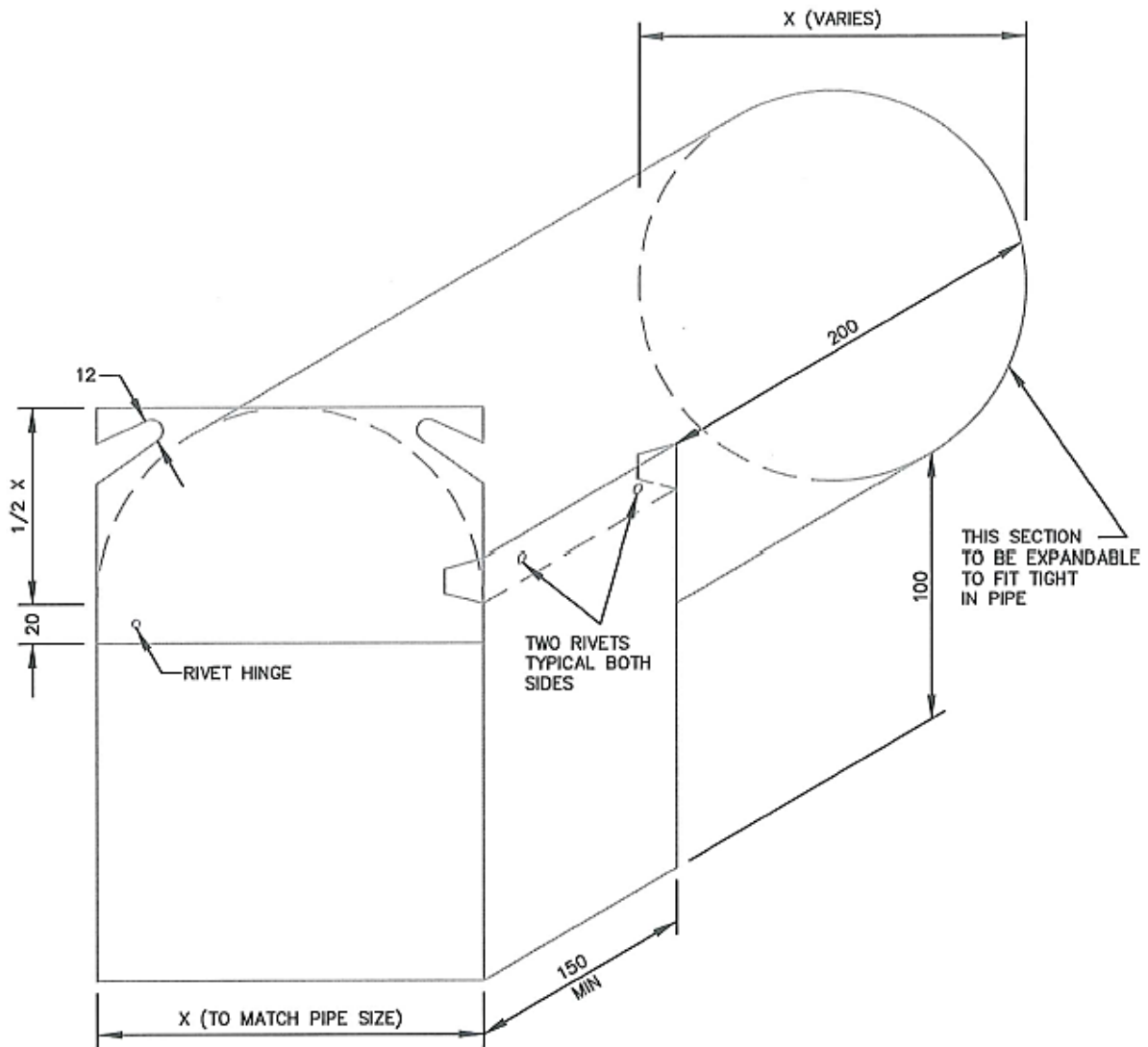


PIPE BED PERFORATION AND BEDDING
 DETAIL FOR GROUND WATER RECHARGE

Drawing Number
 411

STANDARD DETAIL DRAWINGS

NOT TO SCALE



NOTES:

- 1) SEWER TRAPS SHALL BE MANUFACTURED FROM 16 GAUGE ALUMINUM.
- 2) BLIND RIVETS ONLY SHALL BE USED. RIVETS SHALL BE ALUMINUM EQUAL TO POP #AD64ABS.

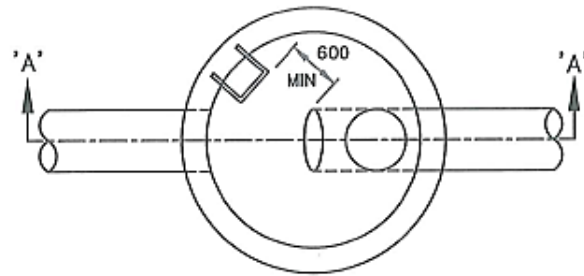


CATCH BASIN TRAPPING HOOD

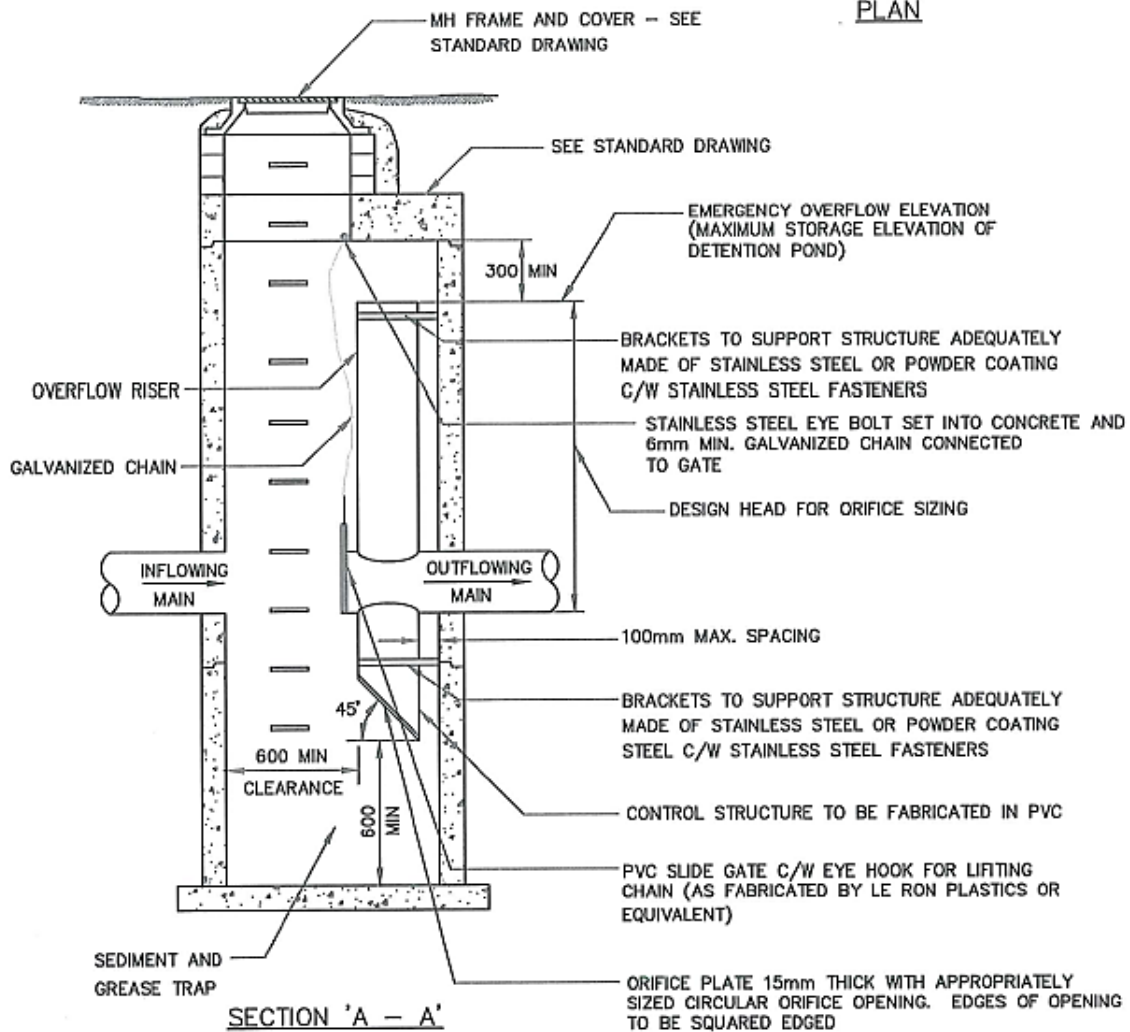
Drawing Number
412

STANDARD DETAIL DRAWINGS

NOT TO SCALE



PLAN



NOTES:
1) ALL DIMENSIONS IN MILLIMETRES.

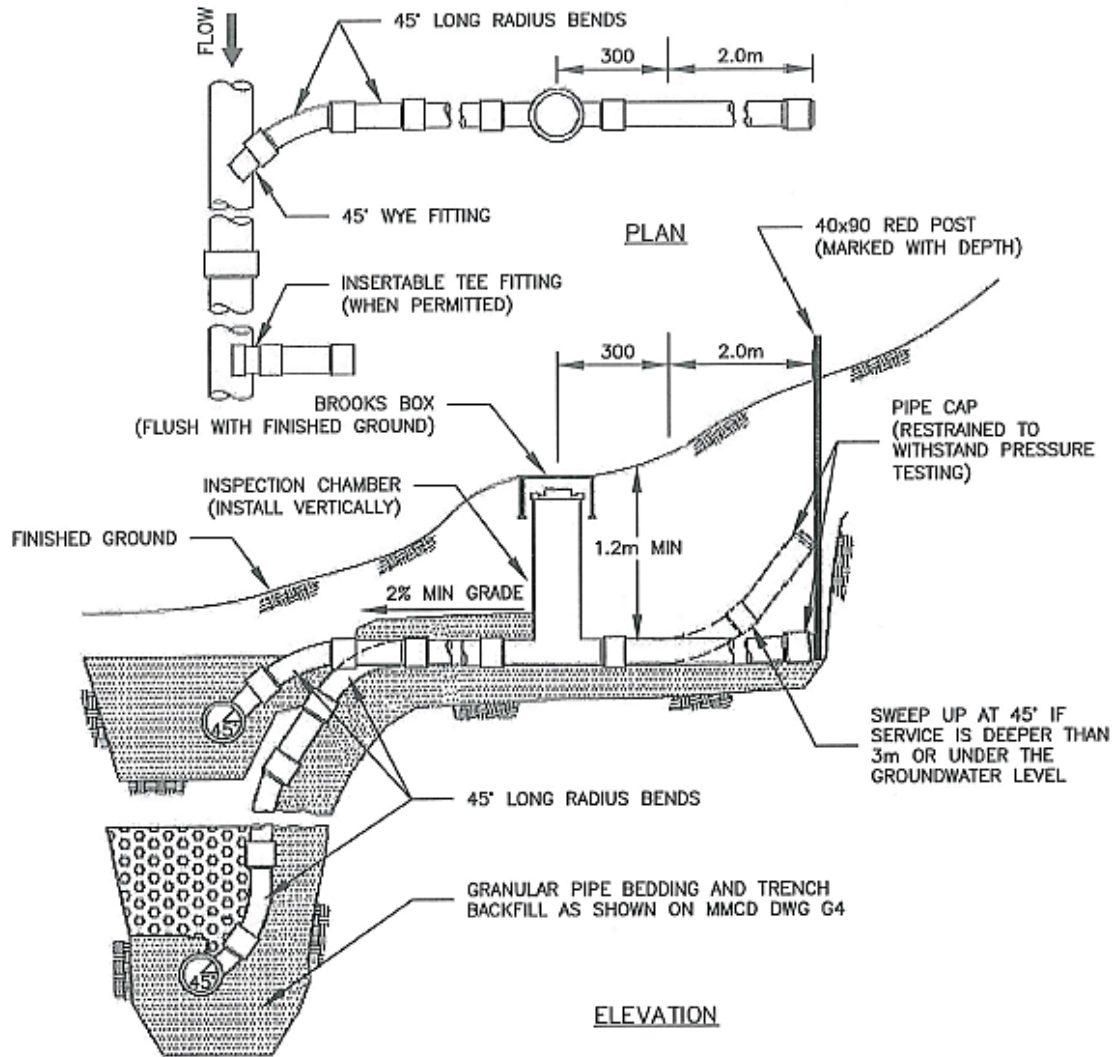


FLOW CONTROL CHAMBER
(WITH SEDIMENT AND GREASE TRAP)

Drawing Number
413

STANDARD DETAIL DRAWINGS

NOT TO SCALE



NOTES:

- 1) CONNECTIONS TO BE 100mm DIAMETER OR AS SPECIFIED IN THE CONTRACT DRAWINGS.
- 2) RISER TYPE SERVICE (FROM MAIN) TO BE USED ONLY WHEN SERVICE IS MORE THAN 2.4m ABOVE WYE INVERT.
- 3) LOCATION OF SERVICE AND MARKER AS SHOWN ON CONTRACT DRAWINGS.
- 4) SEE DRAWING 415 FOR DETAILS OF INSPECTION CHAMBER, BROOKS BOX AND INSTALLATION REQUIREMENTS.

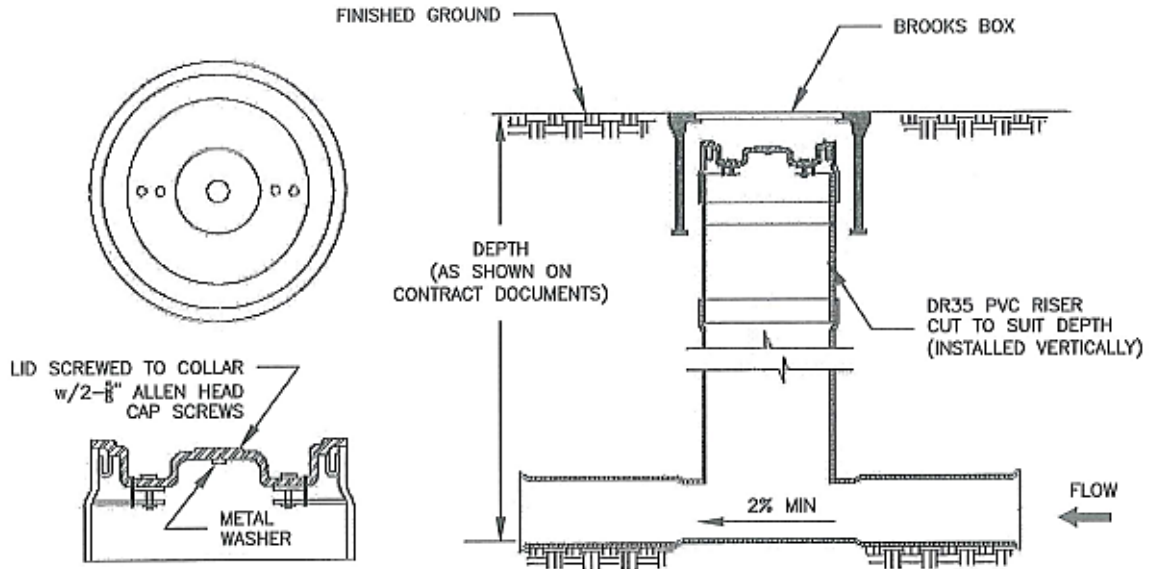


**SANITARY SEWER
SERVICE CONNECTION**

Drawing Number
414

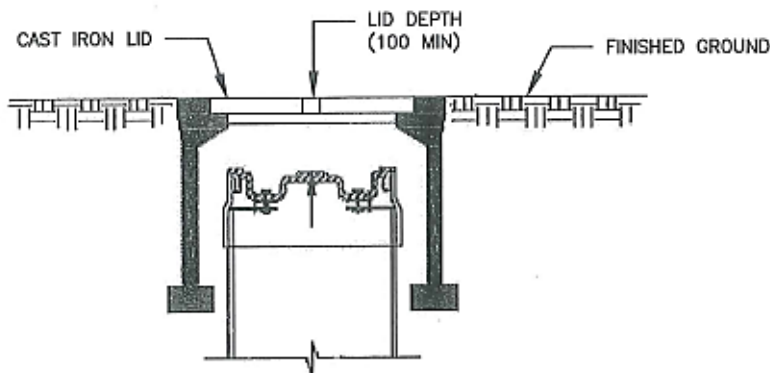
STANDARD DETAIL DRAWINGS

NOT TO SCALE



LID DETAIL

PROFILE VIEW



BROOKS BOX DETAIL

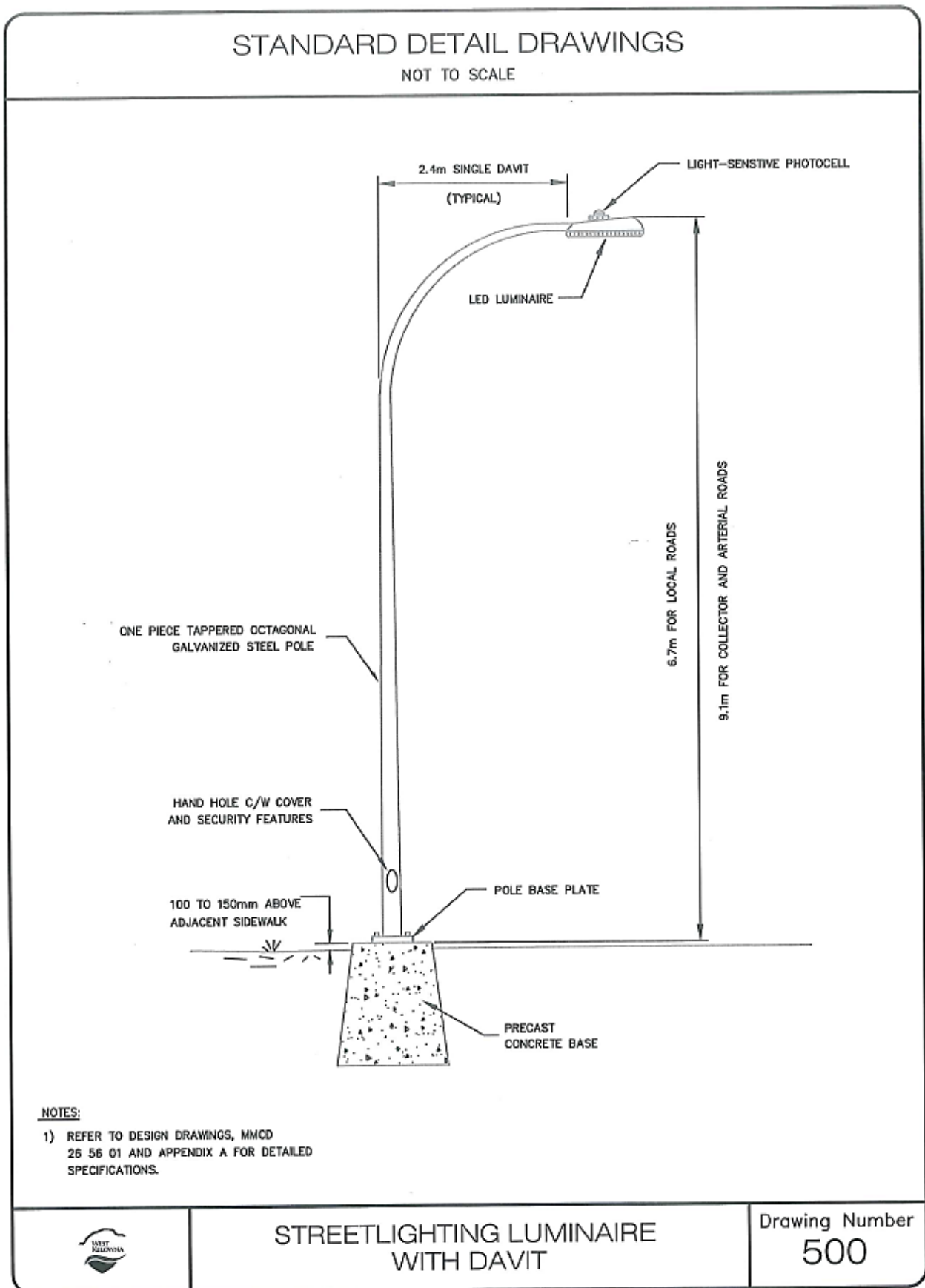
NOTES:

- 1) REFER TO DWG 414 FOR INSTALLATION REQUIREMENTS.
- 2) INSPECTION CHAMBER TO BE AN APPROVED MANUFACTURED FITTING.
- 3) REFER TO CONTRACT DRAWINGS FOR SITE SPECIFIC DIMENSIONS.
- 4) REFER TO MMCD SECTION 33 30 01 FOR DETAILED SPECIFICATIONS.



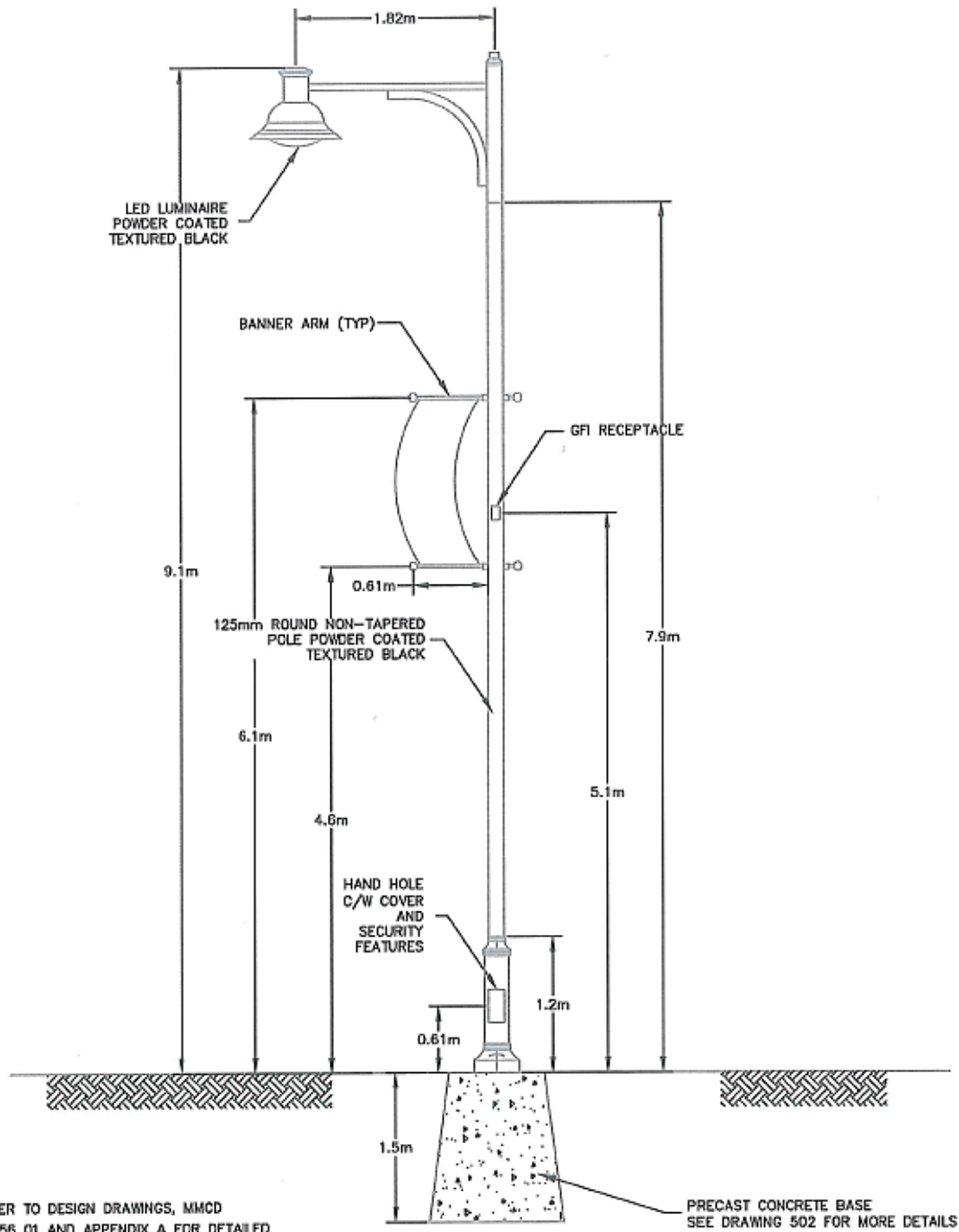
INSPECTION CHAMBER FOR 100 TO 200
SANITARY SEWER CONNECTION

Drawing Number
415



STANDARD DETAIL DRAWINGS

NOT TO SCALE



NOTES:

- 1) REFER TO DESIGN DRAWINGS, MMCD 26 56 01 AND APPENDIX A FOR DETAILED SPECIFICATIONS.

PRECAST CONCRETE BASE
SEE DRAWING 502 FOR MORE DETAILS

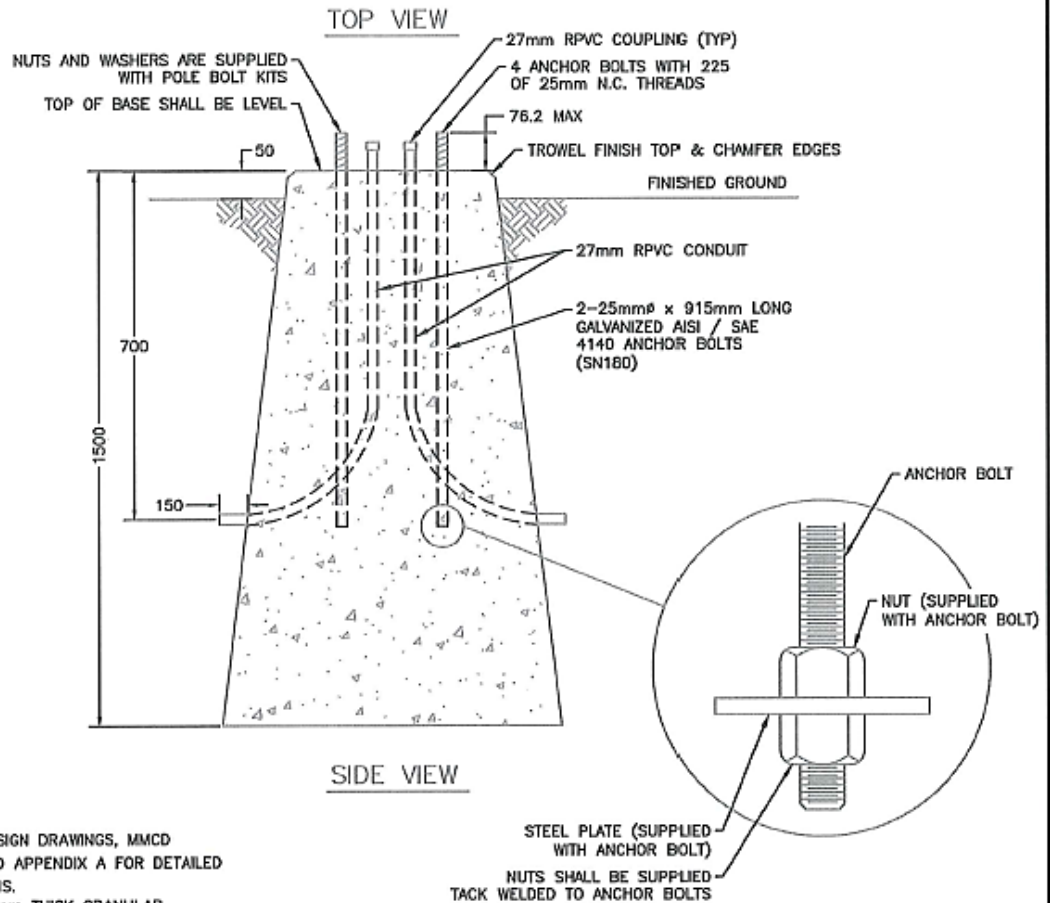
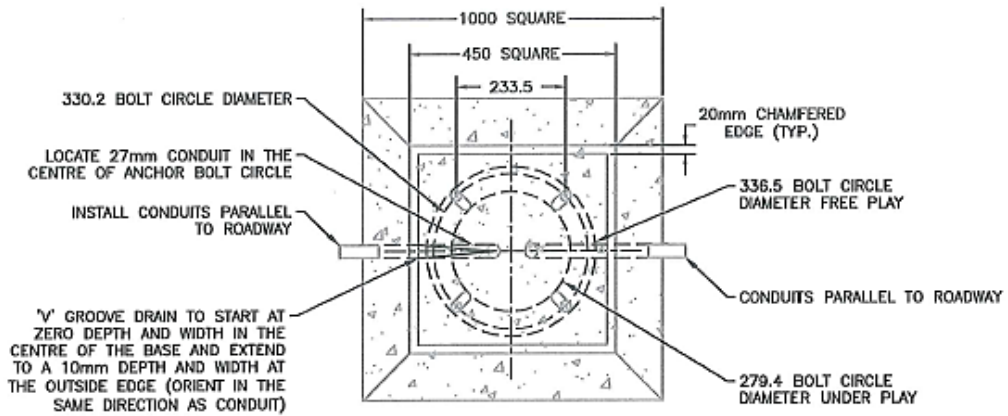


DECORATIVE STREET LIGHTING

Drawing Number
501

STANDARD DETAIL DRAWINGS

NOT TO SCALE



NOTES:

- 1) REFER TO DESIGN DRAWINGS, MMCD 34 41 13 AND APPENDIX A FOR DETAILED SPECIFICATIONS.
- 2) MINIMUM 150mm THICK GRANULAR BASE COMPACTED TO 100% STANDARD PROCTOR DENSITY.
- 3) THIS DRAWING REPLACES MMCD E1.4
- 4) ALL NUTS, WASHERS, BOLTS MUST BE MADE OF GALVANIZED STEEL



DECORATIVE STREET LIGHT POLE BASE

Drawing Number
502



Engineering Services
2760 Cameron Road
West Kelowna, BC V1Z 2T6
Tel (778) 797-8830
Fax (778) 797-1001

WORKS AND SERVICES BYLAW NO. 0249

APPENDIX B

WORKS AND SERVICES CONSTRUCTION AGREEMENT



WORKS AND SERVICES CONSTRUCTION AGREEMENT
(SECTION 509, LOCAL GOVERNMENT ACT)

THIS AGREEMENT made this _____ day of _____, 20__

BETWEEN:

CITY OF WEST KELOWNA,

2760 Cameron Road,

West Kelowna, B.C. V1Z 2T6.

(hereinafter called the "City")

OF THE FIRST PART

AND:

(hereinafter called the "Owner")

OF THE SECOND PART

WHEREAS:

A) The Owner is the registered owner of lands and premises situate, lying and being in the City of West Kelowna, Province of British Columbia, and more particularly known and described as:

(hereinafter called the "Lands")

B) The Owner is desirous of entering into this Agreement with the City pursuant to Section 509 of the *Local Government Act* in order to obtain approval of a subdivision plan of the Lands, or issuance of a building permit in respect of the Lands prior to the completion of the construction and installation of all works required under the provisions of the City's Works and Services Bylaw to be constructed and installed by the Owner.

The Owner has provided to the City as security for the engineering, construction and installation of the works and services required by the Works and Services Bylaw and this Agreement, an unconditional, irrevocable and automatically renewing letter of credit or bank draft in the amount of \$_____ (the "Letter of Credit"), being 125% of the Owner's estimate of the cost and design of the works and services as approved by the City's General Manager and a copy of which is attached to this Agreement as Attachment "A";

NOW THIS AGREEMENT WITNESSETH that in consideration of the premises and of the mutual covenants and agreements herein contained, the parties hereto covenant and agree as follows:

1. In this Agreement, unless the context otherwise requires all words and expressions shall have the same meaning assigned to them as the like word or expressions contained in the General Provisions Section of the Works and Services Bylaw.
2. The Owner covenants and agrees to construct and install on the Lands and on highways adjacent to and in the vicinity of the Lands, as the case may be, in accordance with the plans and specifications marked "Approved For Construction" by the General Manager and initialled by each of the parties for identification, the following work:

(Owner and City must initial those items listed below that apply to this Agreement. All types will not necessarily be involved in every subdivision or development.)

____ roads

____ drainage works

____ sewerage works

____ water works

____ sidewalks

____ boulevards

____ curbs and gutters

____ street lighting

____ underground electrical, telephone, and cable works

____ [specify any other types of works]

Each of the parties hereto acknowledge having in its possession a true copy of the aforesaid plans and specifications, hereinafter called the "Approved Engineering Plans", and acknowledge and agree that the Approved Engineering Plans are hereby incorporated into and made part of this Agreement and are attached as Attachment "B".

3. The Owner shall cause all work herein to be carried out and completed no later than the ____ day of _____, 20__ (the "Completion Date").
4. All work must be carried out by the Owner in accordance with the Approved Engineering Plans, and in accordance with the provisions of the Works and Services Bylaw and any approved variances of that bylaw.

5. The cost of all work herein shall be at the expense of the Owner. The Owner must employ only bondable contractors to carry out and complete the work.
6. The Owner must obtain and provide to the City upon request and free of charge true copies of all contracts and sub-contracts entered into by the Owner or its contractors and relating to the works.
7. The Owner covenants and agrees that upon substantial completion of the work as certified by the Owner's Engineer and approved by the General Manager, the Owner will repair the work and correct defects and deficiencies in the work for a period of twelve months (the "Warranty Period"), provided that the General Manager may, in respect of portions of the works and services specified in writing by the General Manager, stipulate a more lengthy period of repair not exceeding eighteen months, if the General Manager has reason to believe based on inspection of that portion by the General Manager or the Owner's Engineer, that a period in excess of twelve months is required to permit the City to determine that the portion of the works and services has been constructed and installed satisfactorily and will perform as intended. In the case of landscaping works, the General Manager may stipulate a period encompassing two full growing seasons.
8. The Owner's Engineer shall not provide the certification referred to in the preceding section unless the works are ready for use or are being used for their intended purpose, and any incomplete, defective or otherwise deficient works can be completed, repaired or otherwise brought into compliance with this Agreement at a cost not exceeding 3% of the original amount of the Letter of Credit, and shall provide with the certification a list of all deficiencies with associated cost estimates.
9. The Owner covenants and agrees to repair any defects or deficiencies in the works and services of which the General Manager may give notice to the Owner in writing, within 10 working days of the date of the notice.
10. The cost of all work required to repair any defects or deficiencies shall be at the expense of the Owner. The Owner shall employ only bondable contractors to carry out and complete the work.
11. The City covenants and agrees to schedule with the Owner a site visit at least forty five (45) days prior to the relevant expiry date of this Agreement to inspect the works and services and determine what deficiencies or defects, if any, exist. Upon completion of the site visit the City will notify the Owner, in writing, at least thirty (30) days prior to the relevant expiry date, what deficiencies or defects, if any, exist.
12. The Owner covenants and agrees that it shall cause all deficiencies and defects identified during the site visit to be repaired to the satisfaction of the General Manager no later than seven days prior to the relevant expiry date of this Agreement (the "Completion Date").

13. The decision of the General Manager shall be final and binding on the parties in determining whether or not the work or any part thereof has been repaired and completed in accordance with the provisions of this Agreement.
14. The Owner agrees that if the required repairs, or any part thereof, are not completed in accordance with the provisions of this Agreement, the City may draw funds from the Letter of Credit and may complete the work at the expense of the Owner. If there is insufficient security, then the Owner will pay such deficiency to the City immediately upon receipt of an invoice from the City. It is understood and agreed that the City may do such work either by itself, or by contractors employed by the City.
15. The Owner agrees that it shall submit registered copies of all applicable plans, agreements and documentation for all statutory rights-of-way, covenants, and easements for the works and services to the City prior to the Completion Date and that the City shall not be required to release the balance of the security, if any, until such time as the City is in receipt of these plans, agreements, and documentation as required.
16. If the Owner has failed to submit as-constructed drawings of the works and services in accordance with this Agreement, the City may retain from the Letter of Credit such amounts as the General Manager considers will be required to fully document the construction and installation of the works and services.
17. Upon the satisfactory performance of all of the Owner's obligations under this agreement to repair all defects and deficiencies in the works, the General Manager will notify them of final acceptance of the works and services.
18. Prior to final acceptance of the works and services by the General Manager, the Owner shall submit to the General Manager in accordance with the Works and Services Bylaw:
 - a) Final as-constructed drawings of all work constructed hereunder, sealed by an Engineer; and
 - b) An electronic copy of the as-constructed drawings in a format compatible with AutoCAD 14.
19. The Owner agrees that if the work, or any part thereof, is not completed in accordance with the provisions of this Agreement by the Completion Date, or if the Owner shall be in default of any of its covenants herein contained, and such default shall continue for a period of fourteen (14) days after notice thereof has been given by the City to the Owner, the City may call for and receive funds secured by the Letter of Credit and may complete the work at the expense of the Owner and deduct from any fund held by the City as security hereunder, the cost of such completion. If the Letter of Credit is insufficient, then the Owner will pay such deficiency to the City immediately upon receipt of an invoice from the City. It is

understood and agreed that the City may do such work either by itself, or by contractors employed by the City.

20. The City will consent to a reduction in the amount secured by the Letter of Credit, or cash, from time to time in accordance with the following:
 - a) The credit reduction will be equal to the cost of work completed, minus a 10% holdback, as submitted by the Owner's Engineer and as approved by the General Manager;
 - b) No reduction will be allowed for an amount which represents less than 10% of the total cost of construction and installation of the work; and
 - c) No reduction to the Letter of Credit will be allowed which reduces its value to less than the sum of the amounts required in respect of the Warranty Service Agreement.
21. The City shall return the Letter of Credit or any unexpended funds that the City has obtained by drawing on the Letter of Credit, upon the final acceptance of the works and services.
22. The decision of the General Manager shall be final and binding on all parties hereto in determining whether or not the work or any part thereof has been carried out and completed in accordance with the provisions of this Agreement.
23. The Owner covenants and agrees to indemnify and save harmless the City, its Council, officers, agents, and employees from and against all actions, proceedings, costs, damages, expenses, claims and demands whatsoever and whomever brought or made against the City or its Council, officers, agents and employees, resulting directly or indirectly from the design, construction, or installation of the work.
24. The Owner acknowledges and agrees, in the case of works and services required as a condition of approval of a subdivision of the Lands, that the City is under no obligation to issue building permits in respect of any of the parcels created by the subdivision, and no building shall occur on the Lands until the Certificate of Substantial Completion has been accepted by the General Manager.
25. The Owner covenants and agrees that the Owner shall give all prospective purchasers of parcels created by subdivision of the Lands a copy of this agreement and bring their attention to Section 25 of this Agreement.
26. The Owner acknowledges that no portion of the works and services described in Attachment "A" constitutes excess or extended services for the purposes of s. 507 of the *Local Government Act* and that no portion of those works and services is included in the calculations used to determine the amount of a development cost charge.

27. In consideration of due and proper performance by the Owner of its covenants herein contained, the City covenants and agrees to permit the Owner to carry out and perform the work, including such portions of the work as are located on City highways and in City rights-of-way in accordance to a City approved Municipal Highway Permit.
28. Any demand or notice required or permitted to be given under the provisions of this Agreement must be in writing and may be given by mailing such notice by prepaid registered post to the party concerned at the address for such party first above recited, and any such notice or demand mailed as aforesaid must be deemed to have been received by the party to whom it is addressed on the second business day after the date of posting thereof.
29. The Owner acknowledges and agrees that the works become the property of the City subject to no encumbrances upon final acceptance of the works and services by the General Manager.
30. It is understood and agreed that the City has made no representations, covenants, warranties, guarantees, promises or agreements, oral or otherwise, with the Owner other than those contained in this Agreement.
31. Wherever the singular is used herein, the same must be construed as meaning the plural, and vice versa, and "its" includes "his", "her" and "their".
32. This Agreement and the terms, covenants, and conditions herein contained shall ensure to the benefit of and be binding upon the parties hereto and their respective heirs, executors, administrators, successors and assigns.

IN WITNESS WHEREOF the parties have executed this Agreement at the City of West Kelowna, Province of British Columbia, the day and year above written.

SIGNED by the **City** in the presence of:) **CITY OF WEST KELOWNA** by its
) authorized signatories:
_____) _____
) _____
_____) _____
) _____
_____) _____
) _____
_____) _____
) _____
Name of Witness, Signature & Occupation

If Owner is an individual:

SIGNED by the **Owner** in the presence)
of:)
)
)
_____) _____
Name of Witness:) Owner's Name:
)
)
_____) _____
Signature of Witness:) Owner's Signature:
)
_____) _____
Occupation of Witness:

If Owner is a company:

SIGNED by the **Owner** in the presence of:) **{Company Name}** by its authorized
) signatories:
_____) _____
Name of Witness:) _____
)
_____) _____
Signature of Witness:) _____
)
_____) _____
Occupation of Witness:) _____
)

ATTACHMENT "A"

Attach copy of Letter of Credit

ATTACHMENT "B"

Attach a copy of the Approved Engineering Plans initialed by the owner.



Engineering Services
2760 Cameron Road
West Kelowna, BC V1Z 2T6
Tel (778) 797-8830
Fax (778) 797-1001

**WORKS AND SERVICES
BYLAW NO. 0249**

APPENDIX C

WARRANTY SECURITY AGREEMENT



WARRANTY SECURITY AGREEMENT

THIS AGREEMENT made this _____ day of _____, 20____

BETWEEN:

CITY OF WEST KELOWNA, 2760 Cameron Road, West
Kelowna, B.C. V1Z 2T6.

(hereinafter called the "City")

OF THE FIRST PART

AND:

(hereinafter called the "Owner")

OF THE SECOND PART

WHEREAS:

- A. The Owner is the registered owner of lands and premises situate, lying and being in the City of West Kelowna, Province of British Columbia, and more particularly known and described as:

(hereinafter called the "Lands")

- B. The Owner is required by City of West Kelowna Works and Services Bylaw to construct certain works and services in respect of the Owner's subdivision of the Lands or the construction of a building or structure on the Lands;
- C. The City's General Manager has received a Certificate of Substantial Completion in respect of the works and services;
- D. The Owner is required to enter into this Agreement with the City pursuant to the Works and Services Bylaw for the period stipulated in this Agreement to ensure that the works and services have been satisfactorily constructed and will operate as intended;

The Owner has provided to the City as security for the repair of the works and services and the correction of any defects or deficiencies that become apparent in the works and services during the term of this Agreement, an unconditional, irrevocable and automatically renewing letter of credit in the amount of \$_____ (the "Letter of Credit"), which is equal to the amount required pursuant to the Consolidated Fees and Charges Bylaw, including \$1,000 per sheet for record drawings, and a copy of which is attached to this Agreement as Attachment A;

NOW THIS AGREEMENT WITNESSETH that in consideration of the premises and of the mutual covenants and agreements herein contained, the parties hereto covenant and agree as follows:

1. In this Agreement, unless the context otherwise requires all words and expressions shall have the same meaning assigned to them as the like word or expressions contained in the General Provisions Section of the Works and Services Bylaw.
2. The Owner covenants and agrees for a period of twelve (12) months from the date of substantial completion of this agreement to repair any defects or deficiencies in any works or services which were installed or constructed as a requirement of the provisions of the Works and Services Bylaw in relation to the subdivision or development of the Lands, except that the term of this agreement shall for the portions or components of the works and services described below be the number of months specified in respect of such portions or components:

_____ -- _____ months
_____ -- _____ months
_____ -- _____ months

3. The Owner covenants and agrees to repair any defects or deficiencies in the works and services that appear prior to the expiration of this agreement within 10 working days after the date of written notification by the General Manager.
4. The Owner agrees that the works to which this agreement applies are those works listed below and initialled by the Owner and the City:

(Initial those items listed below that apply to this agreement. All types will not necessarily be involved on every subdivision or development.)

____ roads
____ curb and gutter, sidewalks and boulevards
____ sanitary sewer system
____ water works
____ storm drainage system
____ street lighting, electrical and communication wiring
____ geotechnical – temporary
____ geotechnical – permanent
____ sediment and erosion control

5. The cost of all work required to repair any defects or deficiencies shall be at the expense of the Owner. The Owner shall employ only bondable contractors to carry out and complete the work.

6. The Owner must obtain and provide to the City upon request and free of charge true copies of all contracts and sub-contracts entered into by the Owner or its contractors and relating to the works.
7. The City covenants and agrees to schedule with the Owner a site visit at least forty five (45) days prior to the relevant expiry date of this Agreement to inspect the works and services and determine what deficiencies or defects, if any, exist. Upon completion of the site visit the City will notify the Owner, in writing, at least thirty (30) days prior to the relevant expiry date, what deficiencies or defects, if any, exist.
8. The Owner covenants and agrees that it shall cause all deficiencies and defects identified during the site visit to be repaired to the satisfaction of the General Manager no later than seven days prior to the relevant expiry date of this Agreement (the "Completion Date").
9. The decision of the General Manager shall be final and binding on the parties in determining whether or not the work or any part thereof has been repaired and completed in accordance with the provisions of this Agreement.
10. The Owner agrees that if the required repairs, or any part thereof, are not completed in accordance with the provisions of this Agreement, the City may draw funds from the Letter of Credit and may complete the work at the expense of the Owner. The cost of the repair shall be deducted from security held by the City and the balance of the security will be returned to the Owner at the date of expiration of this Agreement. If there is insufficient security, then the Owner will pay such deficiency to the City immediately upon receipt of an invoice from the City. It is understood and agreed that the City may do such work either by itself, or by contractors employed by the City.
11. The Owner agrees that it shall submit registered copies of all applicable plans, agreements and documentation for all statutory right- of-ways, covenants, and easements for the works and services to the City prior to the Completion Date and that the City shall not be required to release the balance of the security, if any, until such time as the City is in receipt of these plans, agreements, and documentation as required.
12. If the Owner has failed to submit as-constructed drawings of the works and services in accordance with the Works and Services Bylaw, the City may retain from the Letter of Credit such amounts as the General Manager considers will be required to fully document the construction and installation of the works and services.
13. The Owner covenants and agrees to indemnify and save harmless the City, its Council, officers, agents, and employees from and against all actions, proceedings, costs, damages, expenses, claims and demands whatsoever and whomever brought or made against the City or its Council, officers, agents and

employees, resulting directly or indirectly from the maintenance, construction, installation, or repair of the works and services.

14. In consideration of due and proper performance by the Owner of his covenants herein contained, the City covenants and agrees to permit the Owner to carry out and perform the work, including such portions of the work as are located on City highways and in City right- of-ways in accordance to a City approved Highway Permit.
15. Any demand or notice required or permitted to be given under the provisions of this Agreement must be in writing and may be given by mailing such notice by prepaid registered post to the party concerned at the address for such party first above recited, and any such notice or demand mailed as aforesaid must be deemed to have been received by the party to whom it is addressed on the second business day after the date of posting thereof.
16. It is understood and agreed that the City has made no representations, covenants, warranties, guaranties, promises or agreements, oral or otherwise, with the Owner other than those contained in this Agreement.
17. Wherever the singular is used herein, the same must be construed as meaning the plural and vice versa, and "it" and "its" include gender-specific terms.
18. This Agreement and the terms, covenants, and conditions herein contained shall enure to the benefit of and be binding upon the parties hereto and their respective heirs, executors, administrators, successors and assigns.

IN WITNESS WHEREOF the parties have executed this Agreement at the City of West Kelowna, Province of British Columbia, the day and year above written.

SIGNED by the **City** in the presence of:) **CITY OF WEST KELOWNA** by its
) authorized signatories:
)
_____)
) _____
_____)
) _____
_____)
) _____
Name of Witness, Signature & Occupation)

If Owner is an individual:

SIGNED by the **Owner** in the presence of:)
)
_____) **Owner's Name:** _____
Name of Witness:)
)
_____) **Owner's Signature:** _____
Signature of Witness:)
)
_____)
Occupation of Witness:)
)

If Owner is a company:

SIGNED by the **Owner** in the presence of:) **{Company Name}** by its authorized
) signatories:
)
_____) _____
Name of Witness:)
)
_____) _____
Signature of Witness:)
)
_____) _____
Occupation of Witness:)
)

ATTACHMENT "A"

Attach Letter of Credit



Engineering Services
2760 Cameron Road
West Kelowna, BC V1Z 2T6
Tel (778) 797-8830
Fax (778) 797-1001

WORKS AND SERVICES BYLAW NO. 0249

APPENDIX D

COMMITMENT TO DESIGN AND FIELD REVIEW BY OWNER'S ENGINEER





Engineering Services
2760 Cameron Road
West Kelowna, BC V1Z 2T6
Tel (778) 797-8830
Fax (778) 797-1001

**WORKS AND SERVICES
BYLAW NO. 0249**

APPENDIX E

CERTIFICATION OF BYLAW COMPLIANCE BY OWNER'S ENGINEER



APPENDIX E – CERTIFICATION OF BYLAW COMPLIANCE BY OWNER’S ENGINEER

(This form must be submitted after Substantial Completion of the work and before the final acceptance of the works and services by the General Manager. A separate form must be submitted by each Engineer.)

General Manager of Development Services/
Engineering and Public Works
City of West Kelowna
2760 Cameron Road
West Kelowna, BC V1Z 2T6

Date: _____

Dear Sir or Madam:

Re:
(Legal Description and Address of Subdivision or Development)

I hereby certify that:

- (a) I have fulfilled my obligations for field reviews as outlined in City of West Kelowna Works and Services Bylaw and the previously submitted “Commitment to Design and Field Review by Owner’s Engineer”,
- (b) those works of the subdivision or development opposite my initials in the previously submitted “Commitment to Design and Field Review” substantially comply in all material respects with:
 - i) the applicable provisions and requirements of the Works and Services Bylaw; and
 - ii) the design drawings and supporting documents submitted in support of the application for subdivision or development and approved by the General Manager.
- (c) I have enclosed the final as-constructed drawings and supporting documents prepared by me for this subdivision or development.
- (d) I am an Engineer in good standing licensed to practice in the Province of British Columbia.

Signed this day of , 20 .)

By the Owner’s Engineer in the presence of:)

Name of Witness)

Address of Witness)

Occupation of Witness)

Engineer’s name, seal & signature

(If the Owner’s Engineer is a member of a firm, complete the following)

I am a member of the firm.....
and I sign this letter on its behalf.



Engineering Services
2760 Cameron Road
West Kelowna, BC V1Z 2T6
Tel (778) 797-8830
Fax (778) 797-1001

WORKS AND SERVICES BYLAW NO. 0249

APPENDIX F

COMMITMENT BY OWNER AND ENGINEER



APPENDIX F - COMMITMENT BY OWNER AND ENGINEER

(This form must be submitted before the General Manager will issue a certificate to commence construction. A separate form must be submitted by each Engineer.)

General Manager of Development Services/
Engineering and Public Works
City of West Kelowna
2760 Cameron Road
West Kelowna, B.C.
V1Z 2T6

Date: _____

Dear Sir or Madam:

RE:
(Legal Description and Address of Subdivision or Development)

The undersigned Owner has retained as the Owner's Engineer to coordinate and review all associated design criteria and field reviews of all works required for this subdivision or development. The Owner's Engineer shall take all such steps as regulated under the Provincial Statute for his or her profession and by definition of field reviews hereinafter set forth, to ascertain that the design will comply with and construction will substantially conform in all material respects with the provisions of the Works and Services Bylaw and other applicable Permits, Bylaws, Acts, and Regulations which apply to the subdivision or development. The Owner's Engineer will ensure that only qualified personnel are retained to carry out tests, inspect or carry out design work, detailing, or field reviews.

"field reviews" mean such reviews of the work:

- (a) at the site of subdivision or development to which the subdivision application or building permit relates, and;
- (b) where applicable, at the fabrication site where components of the required works are fabricated,

that the Owner's Engineer, in his or her professional discretion, considers to be necessary in order to ascertain that the work substantially conforms in all material respects to the design drawings and supporting documents prepared by the Owner's Engineer and as marked, "Approved for Construction" by the General Manager. This will include keeping record of all site visits and any corrective actions taken as a result thereof.

The undersigned Owner has given a contractual mandate to the Owner's Engineer to review reports of other testing and inspection agencies and disciplines where necessary, comment on their acceptability, determine the corrective action to take if unacceptable, and maintain a detailed record of every such report and comment. The Owner's Engineer will submit summary progress reports to the General Manager on request.

The Owner and the Owner's Engineer acknowledge their responsibility to each notify the General Manager in writing thirty (30) days prior to any intended termination of or by the Owner's Engineer. The Owner and the Owner's Engineer understand that where the Owner's Engineer ceases to be retained at any time during construction of the works, work on the above subdivision or development shall cease until such time as

- (a) a new engineer has been retained, and;
- (b) new documentation as contained in Appendices D and E of the Works and Services Bylaw are submitted to the General Manager.

The undersigned Engineer certifies that he/she is an Engineer in good standing licensed to practice in the Province of British Columbia and has been retained to ensure that the design will comply with and construction of the subdivision or development will substantially conform in all material respects with the Subdivision Bylaw and will submit letters of Certification of Bylaw Compliance as needed, for the approval of the above subdivision or development.

If Owner is an individual:

Signed this..... day of20

by the **Owner** in the presence of:

_____)	_____
Name of Witness:)	Owner's Name:
_____)	
Signature of Witness:)	_____
_____)	Owner's Signature:
Occupation of Witness:)	
)	

If Owner is a company:

Signed this..... day of20

by the **Owner** in the presence of:

_____)	Company Name
Name of Witness:)	by its authorities signatories
_____)	
Signature of Witness:)	_____
_____)	
Occupation of Witness:)	_____
)	

Signed this..... day of20

by the **Owner's Engineer** in the presence of:

_____)	
Name of Witness:)	
_____)	
Signature of Witness:)	
_____)	
Occupation of Witness:)	Engineer's name, seal & signature
)	

(If the Owner's Engineer is a member of a firm, complete the following)

I am a member of the firm
and I sign this letter on their behalf.