



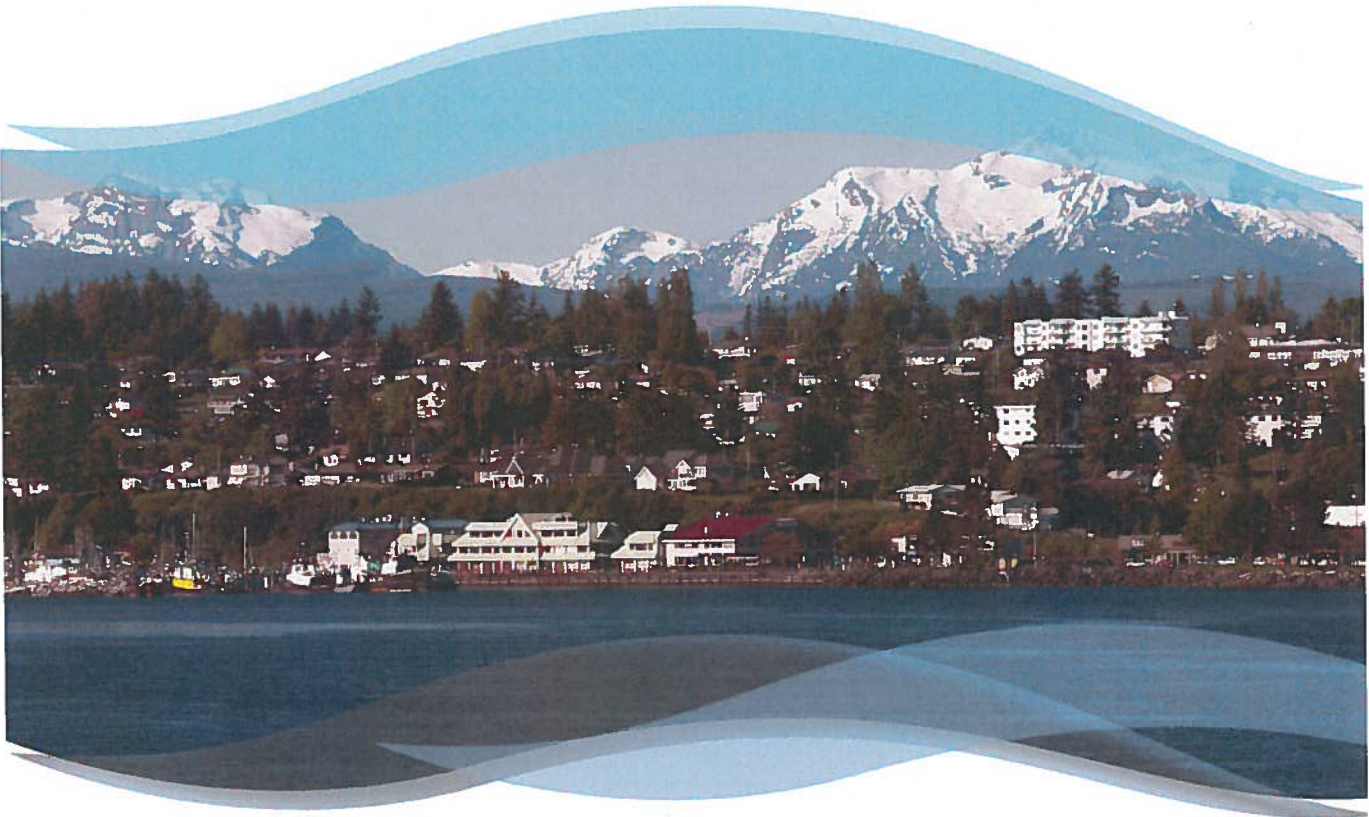
City of
**Campbell
River**

**SUBDIVISION AND DEVELOPMENT
SERVICING BYLAW**

BYLAW No. 3419, 2010

Consolidated Version

BYLAWS



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Cover photo by Toni Falk



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Subdivision and Development Servicing Bylaw No. 3419, 2010

Revised: March 23, 2015

Consolidated for Convenience Purposes to include Bylaw No. 3570, 2015

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PURPOSE

To provide regulations for the subdivision of land, requires the provision of works and services in the subdivision and development of land and prescribes the standards for infrastructure works and services.

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The Council of the City of Campbell River enacts as follows:

PART 1: Title

- 1.1 This bylaw may be cited for all purposes as **Subdivision and Development Servicing Bylaw No. 3419, 2010.**

PART 2: Definitions

- 2.1 In this bylaw unless the context otherwise requires:

Amd Bylaw 3570 Mar/15 Sec. 2 - Definitions
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Applicant	means the Owner or a representative of the Owner duly authorized to act on the Owner's behalf during processing of a Subdivision or Development application.
Application	means a written request by an Owner to Subdivide or develop land and includes an application for a Building Permit.
Approving Officer	means the person appointed by the City Council as Approving Officer pursuant to Section 77 of the <i>Land Title Act</i> .
Architect	means a registered member of the Architectural Institute of British Columbia under the <i>Architects Act</i> .
Area	means the total horizontal area within the boundaries of a parcel.
Authorized Person	means the Approving Officer or Deputy Approving Officer.
Bare Land Strata	means a bare land strata subdivision under the <i>Bare Land Strata Regulations</i> .
Official Community Plan	means the Official Community Plan of the City of Campbell River adopted by Bylaw.
Complete	when used with respect to Works and Services referred to herein, means full completion when all deficiencies have been corrected and Works and Services have been certified as complete by the Owner's Consulting Engineer and accepted by the Authorized Person.
Construct	when used with respect to Works and Services referred to herein, means build, erect, install, repair, alter, add, enlarge, move, locate, relocate, rebuild, upgrade, demolish, remove, excavate or shore.

Consulting Engineer	means a Professional Engineer responsible for the design and construction supervision and certification of all Works and Services on behalf of the Owner.
Contractor	means a person having a contract with an Owner or the City to construct Works and Services required by this Bylaw.
Council	mean the elected officials of the City of Campbell River.
Development	means the construction of any structure on a Parcel requiring, under the Building Bylaw of the City, a Building Permit issued by a Building Inspector, but excludes; <ul style="list-style-type: none"> (a) construction of single detached or two-unit housing, and detached garage, or other accessory structure on a parcel on which the zoning bylaw permits the construction of single detached or two-unit housing, and; (b) the construction of structures of all types on a parcel in respect of which Works and Services were fully provided in accordance with this Bylaw as part of a Subdivision Approval.
Development Site	means a Parcel or combination of Parcels developed by a single developer or combination of developers.
Development Cost Charge	means the sum of money payable by an Owner at the time of Subdivision or Development as established in the City's Development Cost Charge Bylaw as amended from time to time.
Drainage	means a system of pipes, manholes, catch basins, ditches, retention/detention facilities, outfalls and appurtenances for the collection and disposal of storm water by the City.
Final Acceptance	means the approval granted by the Authorized Person signifying the completion of the Subdivision or Development works and services to all relevant requirements of this Bylaw and other relevant Bylaws once the Maintenance Period is over and the works and services are, in the judgment of the Authorized Person, performing as originally intended.
Final Approval	of a subdivision means that stage of approval at which the Approving Officer affixes his or her signature to the plan of Subdivision.
Frontage	means the straight or arced distance along all Parcel lines of a Parcel where such line abuts a Highway.
Land Surveyor	means a person registered as British Columbia Land Surveyor, and who is engaged by the owner to perform work pursuant to this Bylaw.

Maintenance Period	means the one year period during which a maintenance agreement remains in force, as referred to in Appendix A of this Bylaw, during which the Owner is required to make repairs to any Work or Service that fails to perform as intended.
Minor Lot Line Adjustment	means a repositioning of Parcel boundaries between two or more Parcels where the resulting ratio of lot area (in square metres) to frontage (in metres) does not decrease for any one parcel by more than 15% of its initial value.
Natural Boundary	means the boundary of a Watercourse that is contiguous to the parcel being Developed, as ascertained from the plan attached to the application and certified in writing by a Qualified Environmental Professional.
Phased Subdivision	means a subdivision resulting in one or more parcels that retain the possibility of further subdivision, taking into account Zoning Bylaw requirements and Development Permit Area constraints.
Professional Engineer	means a person who is registered or licensed to practice professional engineering under the provisions of the <i>Engineers and Geoscientists Act</i> .
Provide	in relation to Works and Services, means: <ul style="list-style-type: none"> (a) doing all that is necessary to make the Works and Services available and functional in a proper manner to Completion and includes design, construction or installation, testing, inspecting and certifying the completion of the Works and Services; (b) providing financial security in a form acceptable to the City for the estimated costs of all items and activities in (a) above.
Road	means that portion of a Highway improved so as to provide the passage of vehicles and/or pedestrians.
Road Allowance	means lands dedicated for Highway purposes.
Security	means cash, a certified cheque, or a clean, unconditional and irrevocable stand-by letter-of-credit that provides for automatic renewals, drawn in favour of the City on a Canadian chartered bank or other institution acceptable to the Authorized Person, and in the form acceptable to the Authorized Person.
Sewerage	means a system of pipes, manholes, treatment plants, pump stations, valve stations, discharges and appurtenances for the collection and disposal of sewage by the City.

Subdivision	Means; <ul style="list-style-type: none"> (a) a subdivision as defined in the Land Title Act; (b) a subdivision under the Strata Property Act; (c) repositioning of Parcel boundaries.
Waterworks	means a system of pipes, hydrants, pump stations, pressure reducing valve stations, reservoirs and appurtenances for the supply and distribution of water by the City.
Works and Services	means the Works and Services an Owner is required to Provide under this Bylaw, including all design, construction, installation and certification.
Works and Services Agreement	means an agreement between the Owner and the City for the construction and installation of Works and Services pursuant to section 940 of the Local Government Act.

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 including without limitation the definitions of Highway, Owner and Parcel.

PART 3: General

- 3.1** Words in this Bylaw directing or empowering any officer of the City to do any act or thing, or otherwise applying to him by name of office, include his successors in such office and his lawful deputy, and any person the Council may from time to time by Bylaw or resolution designate to act in his place. Headings for each section of this Bylaw are intended to organize the content and are to be used for reference purposes only.
- 3.2** Wherever the singular or masculine form of a word is used, it shall also mean the plural or feminine form of the word as the case may be. All words are intended to be gender neutral.
- 3.3** The provisions of this Bylaw shall apply to the whole of the City of Campbell River.
- 3.4** A reference in this Bylaw to any enactment is a reference to the enactment as amended, revised, consolidated or replaced from time to time, and a reference to any bylaw of the City is a reference to the bylaw as amended, revised, consolidated or replaced from time to time.
- 3.5** Subject to Section 16 of the *Community Charter*, the Approving Officer, the Authorized Person, and their authorized representatives, are authorized to enter on any property for the purpose of inspection and determining whether the regulations of this Bylaw are being met.

PART 4: Approving Officer

- 4.1 [deleted]
- 4.2 Pursuant to the provisions of the Community Charter and the Strata Property Act, Council delegates to the Approving Officer its authority to approve the conversion of previously occupied residential, commercial and industrial buildings to strata ownership.
- 4.3 Pursuant to the provisions of the Community Charter and the Local Government Act, Council delegates to the Approving Officer its authority to exempt a Parcel from the statutory minimum highway frontage of ten percent of the perimeter of the parcel.

Amd Bylaw 3570 Mar/15 Sec. 5.1 and 5.2

PART 5: Subdivision and Development Works and Services

An Applicant or Owner who intends to subdivide land or undertake Development within the City of Campbell River is required to Provide Works and Services in accordance with Section 6.

- 5.1 Application for Subdivision and Development Approval
 - a. It is an Owner's responsibility to Provide Works and Services as required by this Bylaw in relation to a Subdivision or Development.
 - b. The Owner shall retain a Consulting Engineer to design the Works and Services and certify that the Works and Services have been installed in accordance with this Bylaw. The Consulting Engineer shall submit a Letter of Assurance confirming that they are responsible for the design and has been retained by the Owner to provide enough resident supervision to enable him to certify that the Works and Services are constructed in accordance with this Bylaw and with the design, specifications and drawings accepted by the Authorized Person, and that they will immediately advise the Authorized Person if his retainer by the Owner is terminated.
 - c. The Consulting Engineer shall prepare design drawings and a construction schedule for the required Works and Services for review and approval by the Authorized Person prior to construction, in accordance with Appendix A.
 - d. When Works and Services are required within a Highway and the Authorized Person requires that the Works and Services be provided by the City at the Owner's cost, the Owner shall enter into an agreement with the City in a form acceptable to the Authorized Person to pay the cost of the Works and Services. The Authorized Person is delegated by Council to execute the agreement on behalf of the City.
 - e. Unless the Works and Services are provided by the City at the Owner's cost, the Owner shall, having provided the Works and Services, submit to the Authorized Person at the time of Subdivision Approval the following:

- (i) As-built drawings and documentation as required by the Authorized Person in accordance with Appendix A;
 - (ii) The Consulting Engineer's Certificate of Completion in accordance with Appendix A of this Bylaw;
 - (iii) Security for:
 - a. Any outstanding Works and Services, including the preparation of as-built drawings or documentation, in the amount of 125% of the cost of the outstanding Works and Services and preparation of documents, as estimated by the Consulting Engineer and accepted by the Authorized Person;
 - b. The repair of or remedying during the Maintenance Period of deficiencies in the Works and Services in accordance with Appendix A, in the amount of the greater of \$1,000 or 5% of the estimated cost of the Works and Services as estimated by the Authorized Person.
 - (iv) Where applicable, approvals from federal and provincial government agencies with respect to the potable water systems and onsite sanitary sewage disposal systems and the protection of streams.
 - (v) In the case of Development, if requested by the Building Inspector or Authorized Person, a site grading plan, storm water management plan, erosion control plan, sedimentation control plan and drawings showing provision for oil/water and sedimentation separators for Drainage systems, and water servicing drawings showing provision for water supply backflow prevention, all prepared by the Consulting Engineer.
- f. Unless the works and services are provided by the City at the Owner's cost, the Owner shall enter into a Maintenance Agreement Provide Security for Completion of the Works and Services (and in respect of) the Maintenance Period.
 - g. The Authorized Person may remedy any deficiencies in the Works and Services or carry out repairs during the Maintenance Period in the case of default or neglect on the part of the Owner or in the case of an emergency, as provided for in Appendix A, at the cost of the owner, and the City may draw upon the security provided for that purpose.
 - h. The Approving Officer may approve a plan of Subdivision or Development application where works and services are required to be installed, but are not fully Completed, provided that the Owner must first:
 - (i) In the case of Development, comply with the requirements of Sections 5.1(e)(ii) and 5.1(f);
 - (ii) in the case of Subdivision, apply for and receive a Certificate of Partial Completion issued by the Authorized Person in accordance with Appendix A to this Bylaw, stating the date on or before which the Owner undertakes to Complete all the Works and Services;
 - i. Should the Authorized Person cause the Works and Services to be Completed by the City upon the Owner's default, as provided for in Appendix A, the City may draw

upon the Security to recover its cost. The Security or remaining balance thereof shall be returned to the Owner upon satisfactory Completion of the Works and Services. If the City's cost of Completion is not reimbursed in full by the Security, the balance is a debt due and owing to the City by the Owner.

- j. Where an Owner has not provided Works and Services, the Approving Officer may approve a Subdivision plan having less than 100 metres of highway Frontage and not abutting a highway in which water and sewer mains are installed, if the Owner:
 - (i) deposits with the City a Security in a form and amount satisfactory to the Approving Officer having regard to the cost of the Works and Services required; and
 - (ii) enters into a Works and Services Agreement with the City, and registers the agreement under Section 219 of the *Land Title Act* in priority to all financial charges on the land.
- k. The Approving Officer may determine that Works and Services required by this bylaw are not required in full, or in part, **at the time of** Subdivision or issue of a Building Permit and may defer the provision of the requirements (or some elements thereof) to a future date, which may be specified or unspecified, and/or subject to one or more trigger conditions. In such cases, the Approving Officer may require registration of a restrictive covenant as appropriate, prior to Final Approval. Deferral of Works and Services will be assessed with reference to the policies and examples set out in Schedule B of this Bylaw.
- l. If a Phased Subdivision is proposed, the Approving Officer may agree to Works and Services required by this bylaw being provided in a phased manner, subject to registration on title of appropriate legal instruments securing provision of Works and Services in accordance with this Bylaw.

5.2 Excess and Extended Services

- a. Council delegates to the Approving Officer the authority under Section 939 of the *Local Government Act* to:
 - (i) require that the Owner of the land that is to be subdivided or developed Provide excess or extended services;
 - (ii) determine the proportion of the cost of providing the sanitary sewer, water, storm drain or highway facilities that constitutes the excess or extended services;
 - (iii) determine which part of the excess or extended services that will benefit each of the parcels of land that will be served by the excess or extended services; and
 - (iv) impose as a condition of an owner connecting to or using the excess or extended services a charge related to the benefit determined under paragraph 5.2 a)(iii).
- b. The Owner must Provide all information and reports reasonably necessary to allow the Authorized Person to determine the excess or extended services that are provided, the lands that are benefiting from the excess or extended services and their

Subdivision and Development potential under existing City bylaws, the costs of providing the excess or extended services, and the charge payable for any future connection.

- c. The Owner's Consulting Engineer shall certify actual costs for the excess or extended Services being provided, and may provide a recommendation on the term of a latecomer Agreement.
- d. An Applicant may have a decision of the Approving Officer under Section 5.4.(a) reconsidered by Council by applying in writing for such reconsideration specifying the decision which the Applicant wishes reconsidered and the reason supporting the request for reconsideration.
- e. Latecomer payments assessed under Section 939 of the *Local Government Act* shall bear interest at a rate prescribed by the Lieutenant Governor in Council under Section 11(3) of the *Taxation (Rural) Act*.

Amd Bylaw 3570 Mar/15 Sec. 6.1, 6.2 and 6.3

PART 6: Works and Services Requirements

6.1 General Provisions

- a. The Works and Services required by this bylaw shall:
 - (i) be connected to all Parcels created by Subdivision.
 - (ii) be fully completed on all Highways within the Subdivision or Development, and to the centerline of any adjacent Highway where the Works and Services are required within a Highway adjacent to the Subdivision or Development, to the standards prescribed in Appendix A.
 - (iii) be connected to any City or private utility works.
- b. The Approving Officer and Authorized Person are delegated by Council as follows:
 - (i) To execute all forms of agreement including restrictive covenants, Works and Services agreements, latecomer agreements, parkland provision agreements, easement agreements to which the City is a party or statutory right-of-way agreements; and
 - (ii) To update and maintain the Approved Products List as referenced within Appendix A.

6.2 Works and Services Exemptions

- a. Section 6.1 a) does not apply in the case of an Owner who applies for a Building Permit which authorizes:
 - (i) construction, alteration or extension of a residential building or structure containing less than four self contained dwelling units on a Development site;

- (ii) construction or alteration of a building for public assembly or a commercial or industrial building where the gross floor area of the building is not increased beyond that existing on the parcel before the Development was undertaken;
 - (iii) construction, alteration or extension of a building or part of a building that is, or will be, after the construction, alteration or extension, exempt from taxation under Section 220(1)(h) of the *Community Charter*.
- b. Where construction or alteration of a public assembly, commercial or industrial Development increases the gross floor area beyond that existing on the parcel before the Development was undertaken, the Owner may Provide a portion of the Works and Services, or Provide Security in accordance with Section 5.1.e)(iii) based on the percent of the increased gross floor area over the existing floor area. Where the Owner undertakes to Provide a portion of the Works and Services, the City may determine which Works and Services are to be provided.
- c. The Owner is not required to provide water works, sewerage, Drainage works, underground wiring, street lighting or Highway works where such works consistent with the requirements of this Bylaw already exist in accordance with the minimum standards prescribed in Appendix A of this Bylaw.
- d. Where a Parcel being subdivided or developed is located in more than one zone established by the zoning bylaw, the works and services shall comply with the more onerous standard prescribed in Appendix A for the zones applicable to the parcel. Where an application is made for a Minor Lot Line Adjustment, the Approving Officer may reduce or waive the requirements for Works & Services required by this bylaw in full or in part, in accordance with the policies set out in Schedule B of this Bylaw. This only applies to Parcels that were not themselves created by subdivision within five years of the date a lot line adjustment application is made.
- e. Where a Development Permit within the Official Community Plan required under s.919.1(1)(a) of the *Local Government Act* conflicts with Works and Services requirements under this bylaw:
- (i) a Qualified Environmental Professional shall provide a report to the Authorized Person stating the conflicts;
 - (ii) the Qualified Environmental Professional shall make recommendations for variances to the Works and Services requirements in this bylaw based on their recommendations to maintain and protect environmental features; and
 - (iii) through the Development Permit approval process, the Authorized Person or Council, as the case may be, may waive or vary the Works and Services requirements in this Bylaw based on the Qualified Environmental Professional's recommendations by the minimum amount necessary to maintain and protect environmental features.

6.3 Rights-Of-Way, Covenants and Easements

The Owner shall grant to the City all Statutory Rights of Way required for Works and Services and shall pay for the cost of legal surveys, legal fees and registration of all

Statutory Rights-of-Way, Covenants and Easements required by the Authorized Person for Subdivision or Development.

6.4 Parks Servicing Requirements

- a. Notwithstanding anything in Appendix A to the contrary, the Owner shall provide to a park land Parcel or Area dedicated as park on a subdivision plan connections to the property line for water, sanitary sewer, storm sewer and a single phase electrical service.

PART 7: Relative Residence Subdivision Outside the Agricultural Land Reserve

A parcel may not be subdivided under Section 946 (1) of the *Local Government Act* unless its Area is at least double the minimum lot area required under Zoning Bylaw No.3250, 2006 for the zone in which the parcel is located.

Amd Bylaw 3570 Mar/15

PART 8: 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, 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.

PART 9: Offence and Penalty

- 9.1 A person who violates any provision of this Bylaw commits an offence and upon conviction is subject to the penalties provided for under the *Offence Act*.
- 9.2 Each day that an offence under this bylaw constitutes a separate offence.

Amd Bylaw 3570 Mar/15 Sec. 10.2 and 10.3

PART 10: Incorporation of Appendices

- 10.1 Schedule A – Council Policy on Strata Conversions is attached to and forms part of this Bylaw
- 10.2 Schedule B – Council Policy on Exemption from, or Deferral of Works and Services requirements is attached to and forms part of this Bylaw.

10.3 Appendix A – City of Campbell River 2010 Design Standards dated April, 2010 is attached to and forms part of this Bylaw

PART 11: Repeal

11.1 "City of Campbell River Subdivision Bylaw No. 3538, 1981" is repealed.

11.2 "City of Campbell River Frontage Improvement Bylaw No. 2709, 2000" is repealed.

Read a first time on the	11th	day of	May,	2010.
Read a second time on the	11th	day of	May,	2010.
Read a third time on the	11th	day of	May,	2010.
Adopted on the	24th	day of	August,	2010.

Original signed by:

Charlie Cornfield
MAYOR

W. B. Halstead
CITY CLERK

SCHEDULE "A"

COUNCIL POLICY ON STRATA CONVERSIONS

Criteria for Approval

1. An Application for apartment conversion, other than a duplex, will not be considered unless the vacancy rate for rental accommodation within the City is in excess of 3%.
2. Any Applicant wishing to convert a rental residential project to condominiums shall meet all applicable condominium guidelines in force in the City at the time of the conversion application.
3. An independent Health Consultant must be retained by the Applicant (at the Applicant's expense) to determine that such premises are free of infestation and a certificate to this effect must be provided by such consultant.
4. A suitable plan of Development will be requested of all Applicants for conversions, detailing any provisions or improvements to the proposed project.
5. The Applicant must provide a certificate by a qualified engineer/architect (at the Applicant's expense) that the building or buildings conform to the standards of the B.C. Building Code.
6. The review process for conversions will include an opportunity for input by existing tenants. Written notice to each tenant will be provided by the City except in those cases where it is deemed more appropriate to hold a meeting.
7. Inclusion of landscaping improvements within reason.
8. Upgrading of off-site parking areas/access to City standards including buildings constructed to a 1-stall/unit ratio would be required to upgrade as close as possible to the current parking standards without seriously impacting open space needs on-site.
9. The Applicant must agree to pay the moving expenses of those tenants forced to vacate their apartments as a result of stratification to a maximum of \$1,500 per unit provided that appropriate documentation of all moving expenses be produced by the tenant.
10. In addition to the aforementioned guidelines, the Applicant may be required to provide special services or facilities as directed by Council, depending on the circumstances encountered on the individual Application.

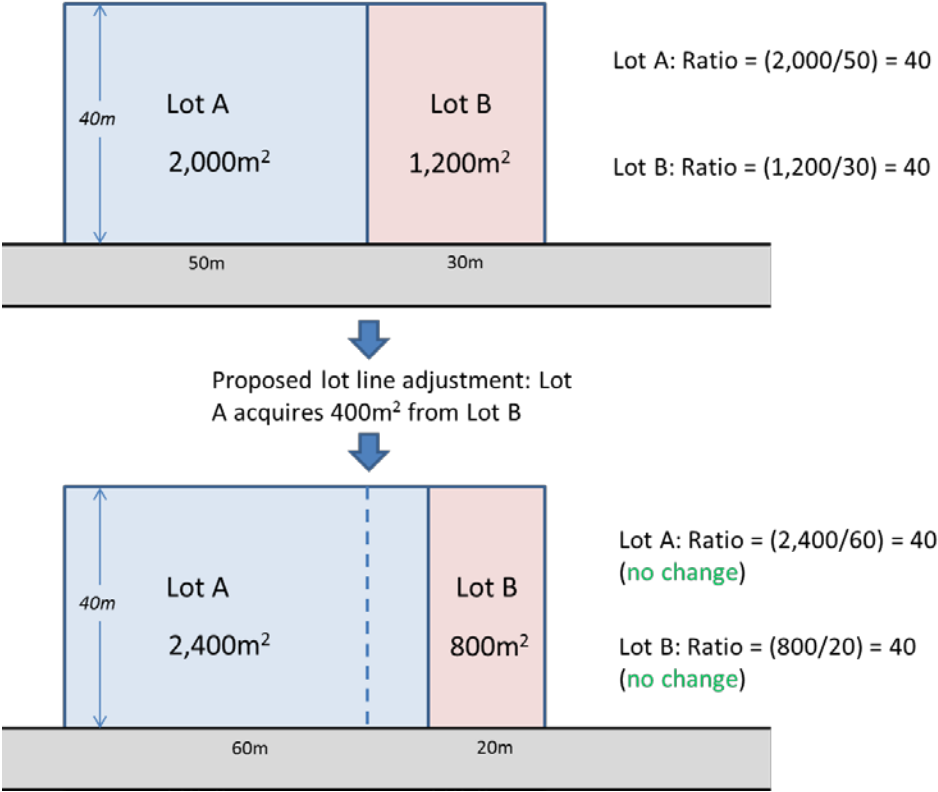
SCHEDULE "B" WORKS AND SERVICES- MINOR LOT LINE ADJUSTMENTS AND DEFERRALS

WORKS AND SERVICES EXEMPTIONS

The Approving Officer has the discretion not to require Works and Services under section 6.2 e) of this bylaw, in whole or in part, in situations where the application would not significantly reduce the developability of either parcel and is defined as a “minor” lot line adjustment. Reductions in developability are identified when the ratio of site area to eligible* site frontage is reduced by 15% of its initial value for any one of the affected parcels. The examples below illustrate how this is determined:

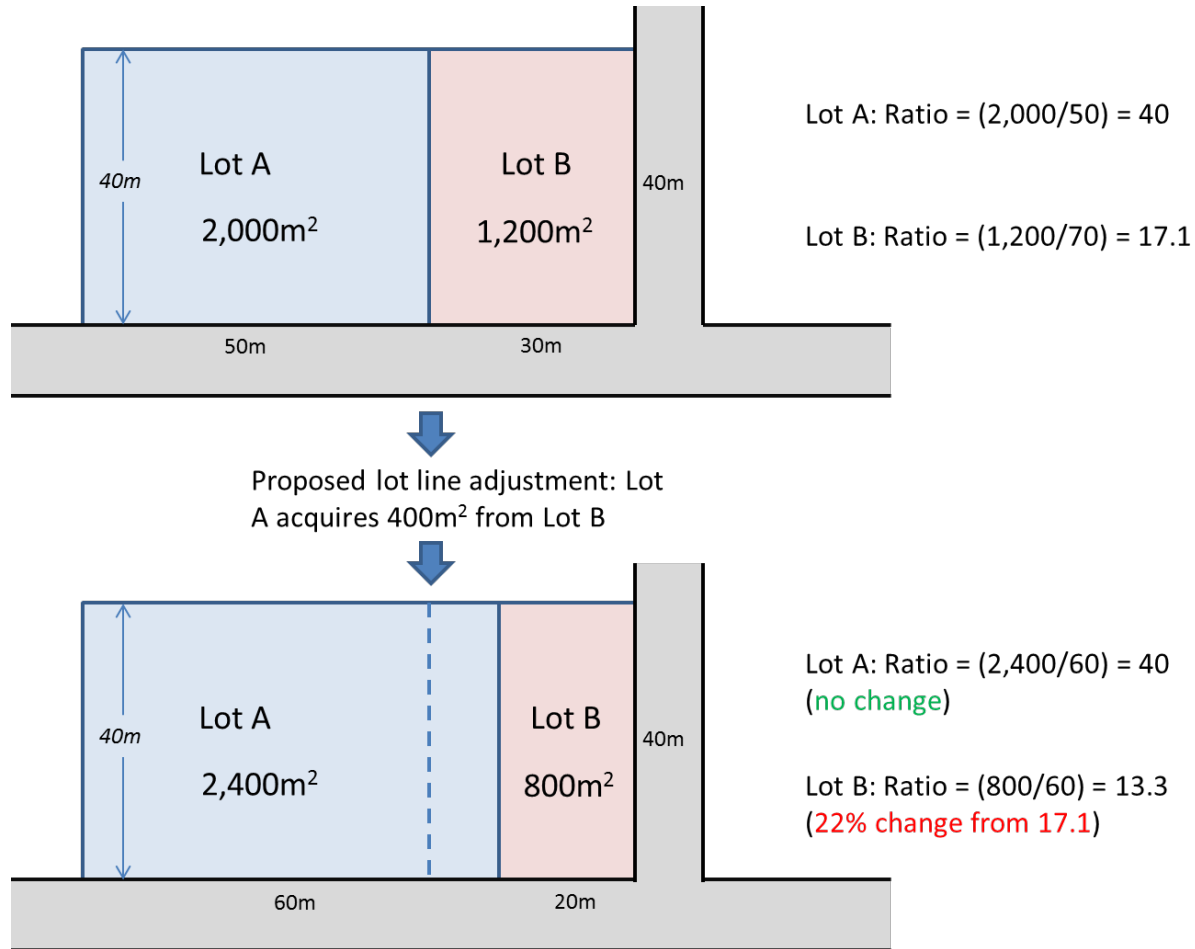
*eligible frontages are those that are not currently up to City standards and for which any works under s.6.1 would be required.

Example 1



Example 1: two lots with single road frontage. Adjusting the (perpendicular) lot line between them does not change the ratio of either parcel. Meets the definition of Minor Lot Line Adjustment.

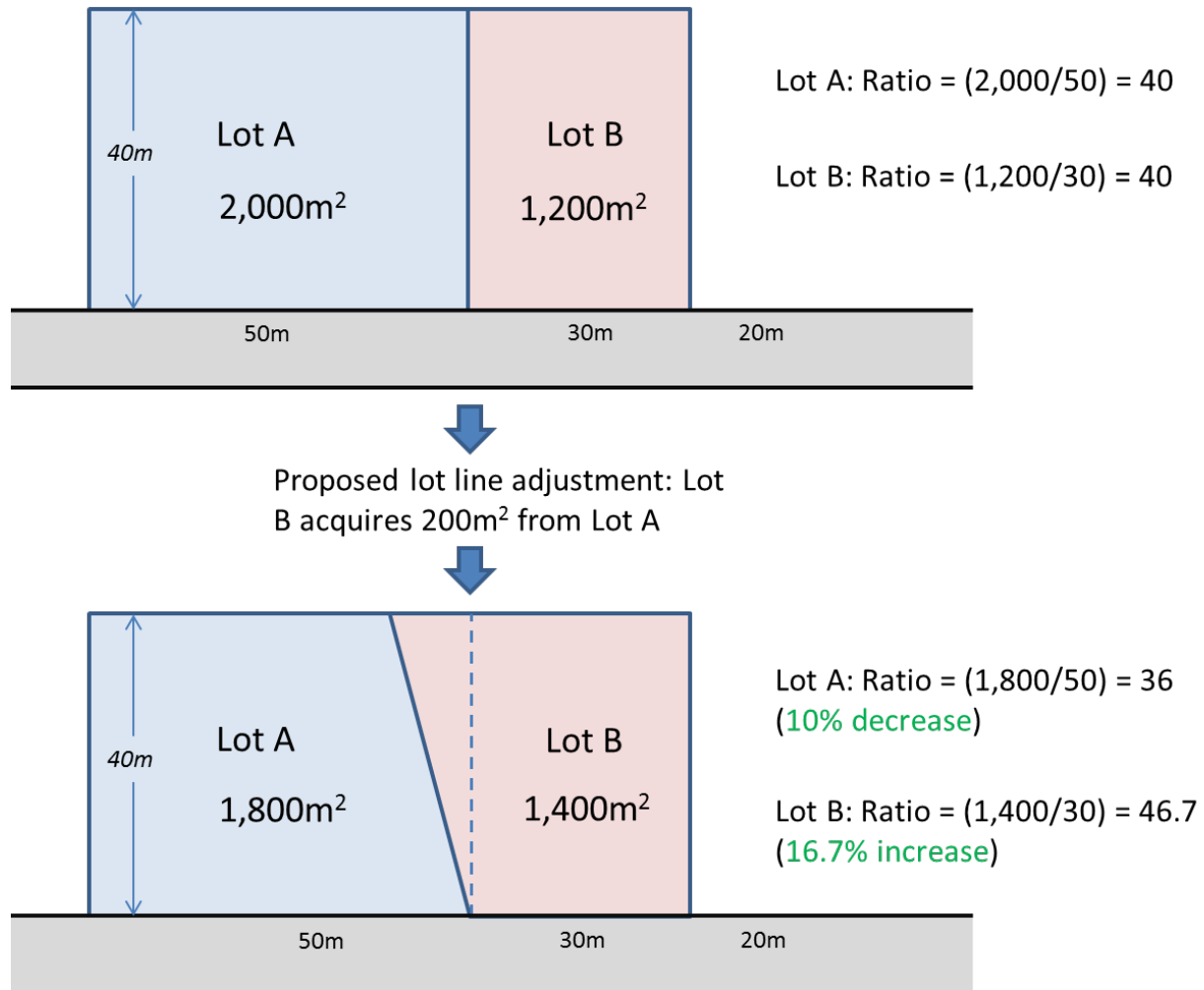
Example 2



Example 2: the same situation as for Example 1, except that Lot B is a corner lot with two frontages. Adjusting the (perpendicular) lot line between them negatively changes the ratio of lot B by more than 15%. This does not meet the definition of Minor Lot Line Adjustment.

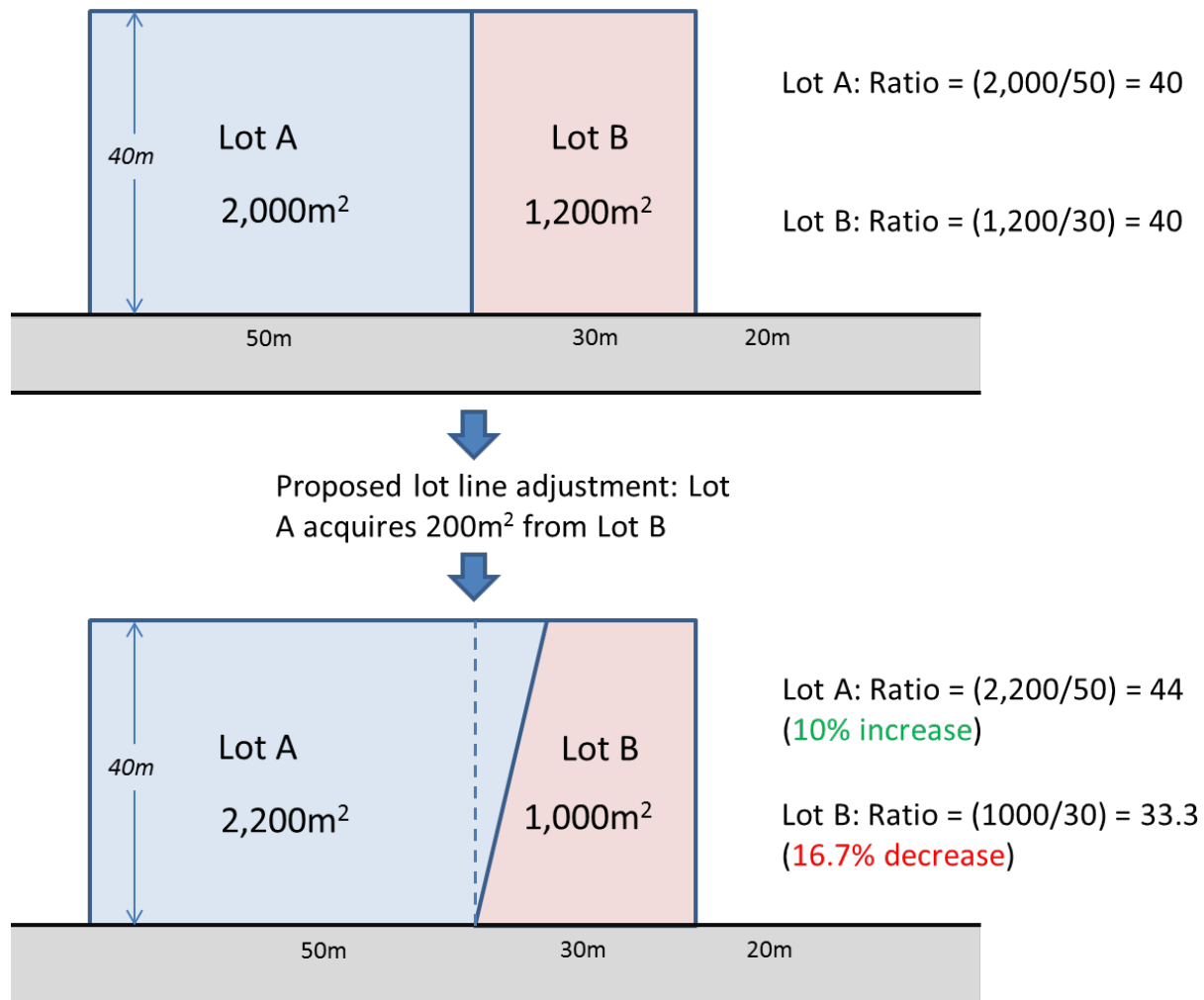
Note: if either road was currently at full City standards and therefore no frontage improvements were required to that road, frontage to that road would be excluded from calculations (i.e. it would not be “required” frontage).

Example 3



Example 3: Adjusting lot line between two parcels in an irregular fashion negatively changes the ratio of lot A by less than 15%. The change in Lot B, while in excess of 15% is an increase, rather than a decrease. This meets the definition of Minor Lot Line Adjustment.

Example 4



Example 4: Adjusting lot line between two parcels in an irregular fashion negatively changes the ratio of lot B by more than 15%. This does not meet the definition of Minor Lot Line Adjustment.

Exercise of Discretion

For Minor Lot Line Adjustments, the Approving Officer may waive the requirements of s.6.1 in whole or in part, if in the Approving Officer's opinion doing so would not materially prejudice the provision of these requirements in some future development, taking into account the following:

- Density, use and setbacks allowed by the Zoning and the implications on these arising from the proposed lot configuration
- The nature and approximate cost of Works and Services required on all frontages
- Programmed or anticipated City infrastructure projects on adjoining frontages
- The impact of any Statutory Rights of Way or Easements
- Environmental constraints

- Other site constraints
- OCP designations and policies
- The need for any restrictive covenants to protect the public interest
- Any other material considerations that affect the potential future development of any affected parcels, and the provision of required Works & Services.

If, in taking into account the above, the Approving Officer considers that the future development of any of the parcels (in a manner consistent with the OCP) is prejudiced by the waiving of Works & Services, then the Approving Officer would opt not to exercise the discretion granted in s6.2 e) of the Bylaw. For example, if in Example 3, despite its large size Lot A was subject to environmental or hazard constraints over the western half that limited its development potential, the impact of a 10% reduction in area: frontage ratio associated with the “minor” lot line adjustment may be too significant to justify waiving the required Works and Services.

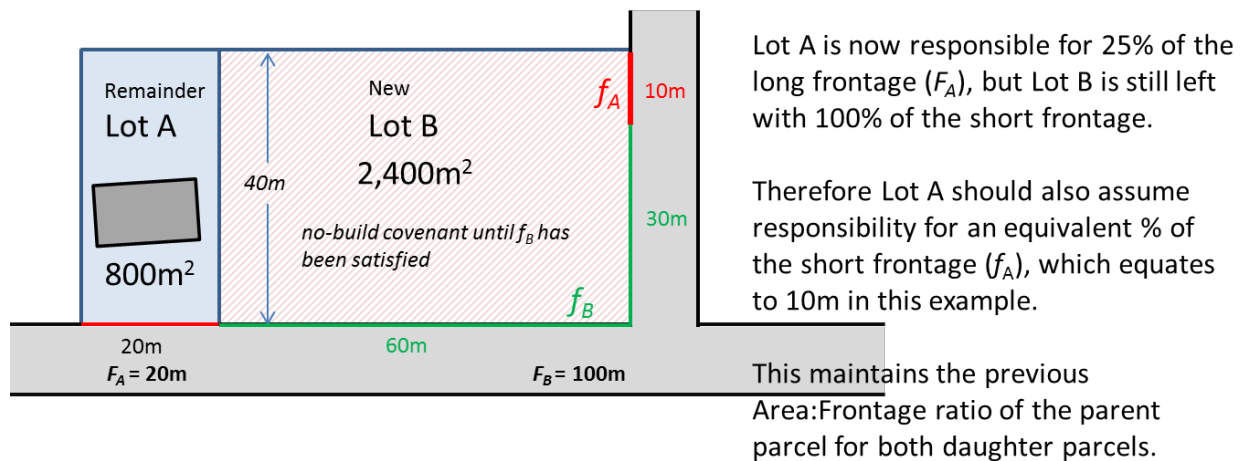
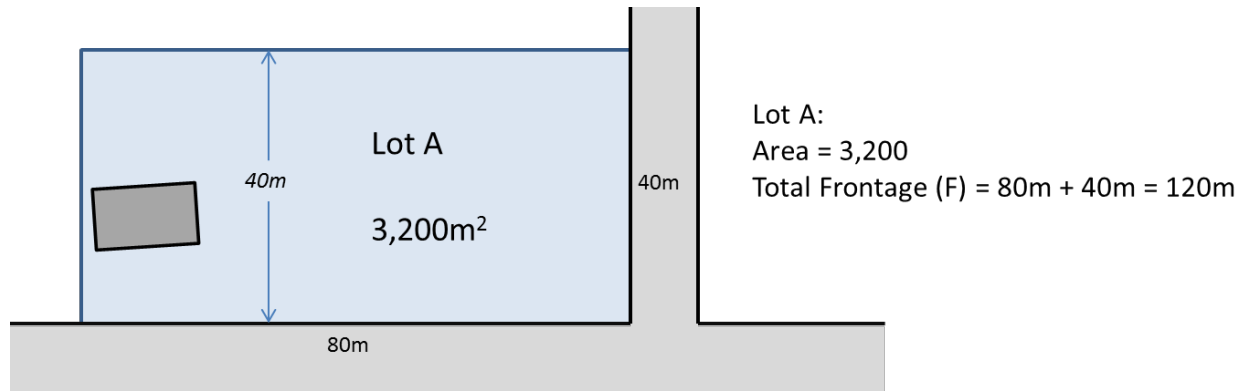
DEFERRAL

Under s.5.2 k) of this bylaw, the Approving Officer may defer the provision of Works and Services in whole or in part to some future time. Under s.6.2 b), where a portion of Works & Services is required based on a percentage increase in floor area, the City may determine which Works & Services are to be provided.

Where these sections (5.2 k) & 6.2 b)) are invoked, the following principles should be used to determine requirements:

- For phased development proposals (whether formally phased as per section 905.1 of the Local Government Act, or “informally phased – (see “Phased Subdivision” in the definitions section of this bylaw) each phase should “pay its fair share”.
- Obligations should not be back-loaded to some final phase, which may or may not ever be implemented.
- Where a percentage of frontage improvements are required, or where full frontage upgrades are not required at the time of application:
 - this may be to any of the affected frontages in whole, or part;
 - where practical, one element of frontage improvements in its entirety, (rather than a set percentage of all elements on all frontages) should be provided, where costs are approximately equivalent.
- Covenants should be used to secure the City’s interests and prevent future development being compromised in the absence of frontage improvements having been provided.
- Deferral should take into account all frontages as per Example 5 below, resting on the principle that the burden of Works and Services is not disproportionately shifted onto any one parcel.

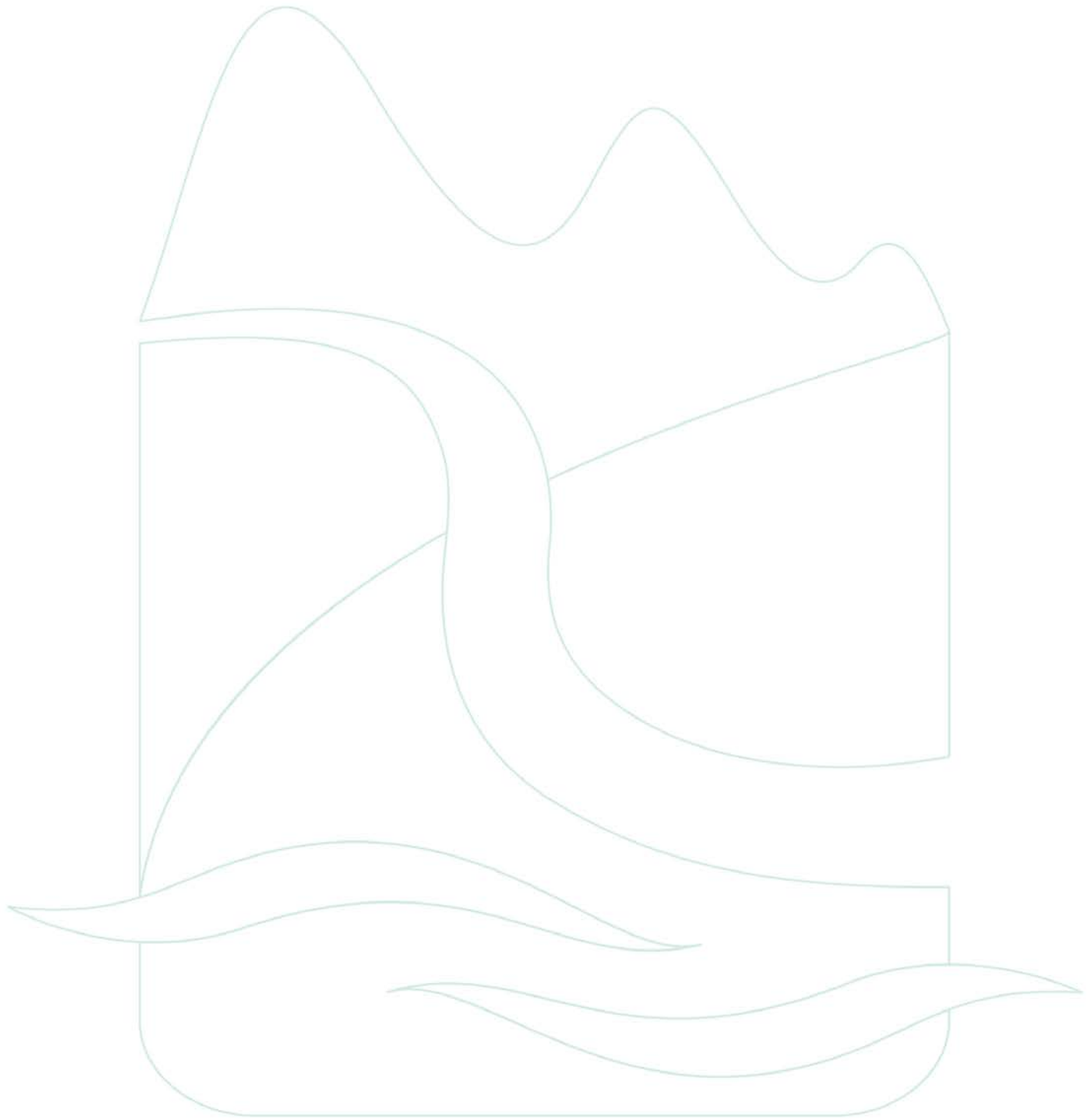
Example 5



Example 5: A house stands on a large lot. The owner wishes to subdivide off the house and sell the newly-created remainder parcel as a development site. However, in the absence of a firm development proposal for Lot B, it would be too expensive to address all 120m of site frontage, although the concept itself is sound, and in line with the OCP.

The Approving Officer could require the frontage improvements to be carried out (or addressed through cash-in-lieu) in proportion to the “phasing” of the development and defer some of the requirements from being provided. The example shows that simply addressing the frontages associated with each phase in isolation can result in an uneven distribution of the requirements. It is not hard to see how future applications could result in a small corner lot that had so much frontage relative to its area that it would forever be undevelopable, having “subsidized” earlier phases through shouldering an unfair share of the frontage obligations. The above mechanism avoids inappropriate back-loading, thus ensuring that Lot B (and its successors) remains a viable development prospect.

The Approving Officer must require registration of a “no-build” covenant on the future development parcel. Failure to do so could result in the construction of a building under the current zoning (e.g. a single family dwelling) that would not complete the frontage requirements and would “sterilize” the parcel from being viable to support the future development that could ensure the frontages are ultimately addressed. The imposition of the covenant is considered to “address” the requirements of s.6.1. Without it, it would be tantamount to a waiver, which lies beyond the Approving Officer’s discretion, save for the limited set of cases of a Minor Lot Line Adjustment.



City of
**Campbell
River**

301 St. Ann's Road
Campbell River, BC V9W 4C7

Phone (250) 286-5700

Fax (250) 286-5763

www.campbellriver.ca

**APPENDIX A
BYLAW 3419, 2010**



City of
**Campbell
River**

2010 DESIGN STANDARDS

April, 2010

**City of Campbell River
2010 Design Standards**

FORWARD

- 1.1 The City of Campbell River Design Standards 2010 shall apply to the design and installation of services in new subdivisions and the servicing of and within existing lots within the boundaries of the City of Campbell River. They apply to the design and installation of storm drains, sanitary sewers, waterworks, roadways, curbs, gutters, sidewalks, underground power, telephone, gas, cable television, street lighting, irrigation, landscape and other services or structures required to be installed.
- 1.2 The City of Campbell River Design Standards 2010 includes:

Section I	Master Municipal Construction Documents Platinum Edition Volume 2: Specifications and Standard Detail Drawings Printed 2009
Section II	Design Standards
Section III	Supplementary Specifications
Section IV	Supplementary Standard Detail Drawings
- 1.3 The Master Municipal Construction Specifications and Standard Detail Drawings are available from: Support Services Unlimited, telephone (604) 681-0295.
- 1.4 Only products and materials specified in the Approved Products List shall be used in the City of Campbell River.
- 1.5 If any conflict occurs between the written specifications and standard detail drawings and/or another code or regulation enforceable in the City of Campbell River, the City shall determine the standard to be used.
- 1.6 Throughout this document the words "shall" and "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.

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INTRODUCTION

- i. This document comprises of the following sections;

Design Standards

- Section 1 Street Systems
- Section 2 Waterworks
- Section 3 Sanitary Sewer Systems
- Section 4 Stormwater Systems & Management
- Section 5 Erosion and Sediment Control
- Section 6 Overhead & Underground Wiring
- Section 7 Street Lighting
- Section 8 Landscape
- Section 9 Irrigation
- Section 10 Signage, Handrail, Furniture, Fences, Noise Barrier
- Section 11 General Procedures
- Section 12 Engineering Drawing Requirements

- ii. For each design standard, applicants may choose between one of two approaches: a 'Performance Standard' or a 'Prescriptive Standard':

Performance Standards

Intended for large, complex, unusual and innovative developments, Performance Standards set out general guidelines that designs must meet, but allow qualified professionals to determine the methods to meet the guidelines, subject to the written approval of the City.

Prescriptive Standards

Intended for small or simple developments, Prescriptive Standards set out both specific rules and design details that if used with good professional practice are pre-approved by the City.

- iii. References are made throughout to Drawings, these can be found in the City of Campbell River Supplementary Standard Detail Drawings. References to MMCD Standard Detail Drawings can be found within the Master Municipal Construction Documents.
- iv. The headings and sub-headings are for the convenience of the reader only. The intent of each part shall be as stated in the text.
- v. The words "shall" and "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.
- vi. No departure from these standards shall be permitted without the prior written approval of the City. Any questions with regard to these Design Standards should be addressed to:

Land Use Services
City of Campbell River
301 St Ann's Road
Campbell River, BC
V9W 4C7
Phone: 250-286-5745

1 STREET SYSTEMS

- 1.1 Streets within the City of Campbell River shall be designated as Lane, Local, Collector, Minor or Major Arterial, in accordance with the Master Transportation Plan and the Road Classification Network in the Official Community Plan.
- 1.2 Street design shall meet the following minimum standards in accordance with the Development Standard designation for the parcel on Map A:

Rural Standards: roadway pavement, ditch or infiltration swale drainage, public water system or proven water source, sanitary sewer or approved septic disposal (where a municipal sanitary sewer extension is determined not feasible by the City); with wiring and street lighting to rural standards. Commercial, Industrial and Institutional land uses, other than home occupations, shall be developed to 'Urban Standards', even if situated within a 'Rural Standard' area.

Urban Standards: roadway pavement, curb, storm drains and stormwater source controls, sanitary sewer, sidewalks, public water system, underground wiring and ornamental street lighting (with exceptions in accordance with 'Part 6 - Underground and Overhead Wiring '), street trees and landscape.

Streetscape Detail Areas: custom design of a neighbourhood that may include a mix of urban and rural standards on a block by block basis, all designed to meet the Performance Standards set out in this document. Determination of the acceptable standard for each block in Streetscape Detail Areas shall relate to the adjacent land use, shall be consistent within a given block, and shall be decided by the City.

- 1.3 Street functional requirements and related widths shall vary based on the zoning of the parcels adjacent to the road. In relation to zoning, streets shall be classified as one of:

Urban Standards

- Urban Local Low Density - Limited Parking
- Urban Local Low Density - Full Parking
- Urban Local High Density
- Urban Local Commercial
- Urban Local Industrial
- Urban Collector – Minor
- Urban Collector – Major
- Urban Arterial –3 Lane
- Urban Arterial –4 Lane

Rural Standards

- Rural Local Residential
- Rural Local Commercial / Industrial
- Rural Collector

Performance Standards – Street Systems

- 1.4 Intended for large, complex, unusual and innovative developments, Performance Standards set out general guidelines that designs must meet, but allow qualified professionals to determine the methods to meet the guidelines, subject to the written approval of the City. The prescriptive standards described in the following section should be a starting point for the development of any performance standards.

Performance Standards for Street Systems are:

- Accommodate motor vehicle traffic in a manner compatible with the environment in which the street is located.
- Employ traffic calming measures as appropriate to maximize road safety.
- Avoid excessive road widths, which can otherwise create speeding problems and increase stormwater runoff.
- Minimize impervious area.
- Allow space for stormwater infiltration and water quality treatment.
- Provide emergency access for fire, police and ambulance vehicles.
- Minimize crossing distances and maximize safety of pedestrians at intersections.
- Minimize curb radii at intersections – while recognizing that larger radii may be required on specific corners on bus routes and in commercial areas.
- Provide for safe and efficient bicycle use – on the roadway, and optionally on off-street multi-use pathways – and provide continuity of connection to the bicycle network.
- Provide sidewalks on at least one side of local streets and both sides of arterial and collector roads, and provide continuity of connections in the pedestrian network.
- Design street, bicycle and pedestrian networks to avoid indirect and lengthy travel paths, and to encourage walking to school, business, commercial or recreation areas.
- Include street trees and street landscape as a part of the street design.
- Design utility alignments and surface fixtures to avoid conflict points with vehicles, pedestrians and cyclists.
- Locate utilities in common trench where practical.

- Avoid slopes that exceed 3:1 in the cross section, or provide shrub/groundcover landscape treatments to slopes steeper than 3:1.
 - Minimize right of way width commensurate with meeting the above guidelines.
 - The proposed street system shall be 'equivalent' or better to the Prescriptive Standards.
- 1.5 Required Professional Qualifications for applicants using the Performance Standards approach for Street Design:
- Professional Engineer with a minimum of 10 years experience in Transportation Engineering and desirably Professional Transportation Operations Engineer.

Prescriptive Standards – Street Systems

- 1.6 Intended for small or simple developments, Prescriptive Standards set out both specific rules and design details that if used with good professional practice are pre-approved by the City.
- 1.7 Required Professional Qualifications for applicants using the Prescriptive Standards approach for Street Design:
- Professional Engineer with experience in Civil Engineering

Road Classification

- 1.8 Where a road passes through more than one zone, the zone having the most significant impact on the road as judged by the City will dictate the applicable road standard. Where a road separates areas of different zoning the higher standard should normally apply.

Geometric Design

- 1.9 Unless otherwise specified in these standards, the geometric design of roadways should be in accordance with the most recent version of the "Manual of Geometric Design Standards for Canadian Roads, TAC" and amendments thereto, the geometric requirements for roadway design within and adjacent to the subdivision may differ according to the predominant adjacent land use and topography, but should generally be those set out in Table 1-1.
- 1.10 The absolute maximum grades shown in Table 1-1 may only be used where:
- the desirable grade cannot be obtained due to topographic constraints, or
- the geometric design of an intersection can be improved by increasing the grade on the minor roadway to avoid compromising the design of the major roadway.
- 1.11 The preferred minimum longitudinal grade is 0.5%. The absolute minimum is 0.4% which may be used only for short distances. This applies to all roadways.

1.12 When infiltration swales parallel the road on one side only, or where extreme topography exists, roadways may be designed with cross-falls from 1% to 4%. Cross-falls shall be considered only when other designs are impractical.

1.13 Horizontal curves should be avoided coincident with sharp vertical curves. Vertical curves may be omitted if the algebraic difference in grades does not exceed 1.0%.

Table 1-1 - Geometric Design Limits

	Road Classification	Minimum Design Speed (km/h)	Desired Maximum Gradient (%)	Absolute Maximum Gradient (%)	Minimum Stopping Distance (m)	Minimum 'K' Value		Minimum Horizontal CL Radius (m)
						Crest	Sag	
Rural Zones	Local	60	12	12	85	13	20	120
Residential Zones	Local	50	12	15	45	4	11	35
Residential Zones (Multiple Family), Commercial, Industrial and Public Assembly Zones	Local	50	10	12	65	7	11	90
All Zones	Collector	TAC*	TAC*	TAC*	TAC*	TAC*	TAC*	TAC*
All Zones	Arterial	TAC*	TAC*	TAC*	TAC*	TAC*	TAC*	TAC*
All	Lane	30	12	12	45	4	7	35
All	Walkway	--	15	20	--	--	--	--

***Refer to TAC Guidelines for Design of all Arterial and Collector Roads**

Note: The posted speed limit for vehicles at any time may be much slower than the design speed to which the road is built, but should not be faster. "Designs must anticipate future vehicle characteristics and operational patterns", (Transportation and Traffic Engineering Handbook, I.T.E. 1976, pp 599 et seq.)

Curbs

- 1.14 The pavement and the requirements for curbs shall be those shown in Table 1-2, and as illustrated in CR-R101 through CR- R122. Works and services infill projects less than 1 block in length may use a cross section similar to the existing roadway context with the written approval of the City.
- 1.15 Upright and Rollover Curbs shall conform to MMCD Standard Detail Drawing C4. Use of rollover curbs is to be avoided, and is restricted to single family subdivisions where driveway locations are not known in advance of curb construction.
- 1.16 At infiltration swales or similar facilities, water from pavement shall be passed into the swale across concrete curbs – either Flush Curb, Drop Curb, Reverse Curb, or Side Inlet Curb. Precast Parking Curbs may be used in off-street parking areas only. Installation of such curbs shall conform to Drawing CR-R113.

Sidewalks

- 1.17 The pavement and the requirements for sidewalks shall be those shown in Table IA and Table 1-3, and as illustrated in CR-R101 through CR- R122. Works and services infill projects less than 1 block in length may use a cross section similar to the existing roadway context with the written approval of the City.
- 1.18 Sidewalks shall be required as outlined in Table 1-2 and Table 1-3. They should be separated from the curb with a boulevard where possible; however, in cases where this is not physically possible, the City may allow the sidewalk to be adjacent to the curb. Sidewalks should normally cross-fall towards the roadway or infiltration swale at 2%.
- 1.19 Table 1-2 and Table 1-3 show the general requirement for sidewalks. Where necessary, to meet existing sidewalk arrangements or heavier pedestrian flow, the City may require more sidewalk be constructed.
- 1.20 Sidewalks should be at least 1.5 m wide in single-family residential areas, at least 1.8 m wide in multi-family residential areas, and at least 2.5 m wide in commercial areas. Sidewalks in all other land uses should be at least 1.5 m wide. Where railings are required, the sidewalk may be required to be widened to retain 1.5 m clear.
- 1.21 Sidewalks shall conform to MMCD Standard Detail Drawings C2 or C3.
- 1.22 Pedestrian ramps shall be provided in curbs and sidewalks at all intersections and crosswalks and shall be in accordance with the MMCD Standard Detail Drawing C8 or C9.

Table 1-2 – Minimum Requirements – Urban Standards

Classification	ROW Width	Pavement Width	Pavement Configuration	Sidewalk	Parking
Urban Local Low Density	20	6.0 + parking bay	V + 0.3 G + 6.0 + 1.7 P + 0.3 G + V	1 side	1 side
Urban Local High Density	20	10.0	V + 0.3 G + 1.7 P + 6.0 + 1.7 P + 0.3 G + V	2 sides	2 sides
Urban Local Commercial	20	10.8	V + 0.3 G + 2.1 P + 6.0 + 2.1 P + 0.3 G + V	2 sides	2 sides
Urban Local Industrial	20	10.8	V + 0.3 G + 10.2 + 0.3 G + V	1 side	2 sides
Urban Collector – Minor	20	11.3	V + 0.3 G + 2.1 P + (4.3 MWTL X 2) + 0.3 G + V	2 sides	1 side
Urban Collector – Major	23	14.4	V + 0.3 G + 2.1 P + 1.5 BL + (3.3 TL X 2) + 1.5 BL + 2.1 P + 0.3 G + V	2 sides	2 sides
Urban Arterial –3 Lane	25	14.0	V + 0.3 G + 1.4 BL + 3.3 TL + 4.0 TWLTL + 3.3 TL + 1.4 BL + 0.3 G + V	2 sides	none
Urban Arterial –4 Lane	28	16.6	V + 0.3 G + 1.4 BL + (3.3 TL X 4) + 1.4 BL + 0.3 G + V	2 sides	none

Legend: TL = Travel lane, MWTL = Marked wide travel lane, BL = Bicycle lane, P = Parking lane with curb extensions, TWLTL = Two-way left turn lane, V = Vertical curb, G = Gutter

Table 1-3 – Minimum Requirements – Rural Standards

Classification	ROW Width	Pavement Width	Pavement Configuration	Sidewalk	Parking
Rural Local Residential	20	7.5	1.5 S + 6.0	Shoulder 1 side	1 side
Rural Local Commercial / Industrial	20	9.0	1.5 S + 7.5	Shoulder 1 side	1 side
Rural Collector	20	9.6	1.5 S + (3.3 TL X 2) + 1.5 S	Shoulder 2 sides	2 sides

Legend: TL = Travel lane, S = Shoulder

Intersections

- 1.23 Roads should normally intersect at right angles. The angle of intersection may be reduced to a minimum of 75 degrees where no other alternative exists due to site characteristics.
- 1.24 The minimum spacing between intersections along an arterial or collector road should be 60 m measured from the intersection centre lines. A shorter distance may be approved by the City where no other alternative exists due to site characteristics.
- 1.25 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%.
- 1.26 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.
- 1.27 When cross-fall occurs at an intersection, the variation in the crown of the major roadway shall be made by smooth transition over 15 m minimum 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.
- 1.28 Intersections should be avoided near the crests of hills.
- 1.29 All intersection centre lines shall be referenced to the centre line station chainage.

Corner Radii at Intersections

- 1.30 Table 1-4 provides recommended and minimum corner radii — larger radii may be used on specific corners to accommodate right-turning buses and large trucks.

Table 1-4 – Corner Radii at Intersections

	Local	Collector — Residential	Collector — Commercial/Industrial	Arterial	Right-Turning Large Vehicle
Local	3 m	5 m/3 m	8 m	8 m/5 m	11 m/8 m
Collector — Residential		5 m	8 m/5 m	8 m/5 m	11 m/8 m
Collector — Commercial/Industrial			11 m/8 m	11 m/8 m	11 m/8 m
Arterial				8 m	11 m/8 m
Right-Turning Bus					11 m/8 m

Legend: X/Y, where X = no on-street parking, Y = on-street parking

Cul-de-sacs

- 1.31 The road network should be designed to avoid or minimize the number of cul-de-sacs, so as to maximize network redundancy.
- 1.32 Cul-de-sacs should be avoided, and typically should only be used only in single family residential areas.
- 1.33 Permanent cul-de-sacs shall conform to the minimum standards stated in these standards and shown on Drawing CR-R119. The dimensions may be increased to meet traffic and vehicular requirements where the cul-de-sac is eccentric.
- 1.34 Temporary cul-de-sacs that are more than 150 m long and are to be extended in the future shall be designed with an asphalt apron beyond the right-of-way dedication. This requirement may be waived when the tentative construction schedule indicates that the next phase of development will commence within nine months from the date on which the current construction drawings are submitted to the City for approval. If the owner also owns the adjacent property a gravel turn-around shall be constructed in accordance with Drawing CR-R120. If the owner does not own the adjacent property into which the cul-de-sac will be extended, a turnaround shall be provided on his own land in the interim, constructed in accordance with Drawing CR-R120.
- 1.35 Barricades and appropriate signage must be located at the ends of the temporary cul-de-sacs where required for safety or where physical access to the future road is possible. Where there is no other access to the subdivision a "No Thru Road" sign shall be placed at the entrance.
- 1.36 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 0.4% nor greater than 5%. Cul-de-sacs shall be designed so that the grade between the bulb centre-point and the end shall not exceed 7%. 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%.

Driveways

- 1.37 Driveway and lane crossings shall conform to the MMCD Standard Detail Drawing C7. The near side of a driveway shall be located no closer than 6 m from the end of the curb return at a roadway intersection.
- 1.38 The maximum design grades for driveways shall be:

Industrial, commercial and institutional property	8%
Multiple residential property	15%
Single family and duplex property	20%

Grade changes in driveways shall be designed with adequate vertical curves so as to prevent vehicle bottom contact or hang-up. The vertical curve nearest the roadway shall not begin closer to the roadway than the private property side of the existing or future sidewalk.

- 1.39 Driveway width for a single family house should not exceed 6m for that portion of the driveway that is situated on the public right of way.

Lanes

- 1.40 Where lanes are to be provided they should run straight from roadway to roadway without corners or T-intersections. When corners cannot be avoided, a 3 m by 3 m triangular right-of-way widening shall be dedicated.
- 1.41 Lanes should be constructed using 50mm hot mix asphalt and be a minimum of 3.5 meters wide.
- 1.42 Where lanes have a cross-fall, a curb or infiltration swale is required along the low side.
- 1.43 On lanes and in areas with other similar uses, drainage may be accomplished by a centre line valley or a cross-fall at 2%.

Walkways, Greenways, Trails & Bikeways

- 1.44 Walkways, greenways, trails and bikeways shall comply with the standards set out in Table 1-5 below.

Table 1-5 – Walkway, Greenway, Trail & Bikeway Requirements

Trail Type	Use/Users	Width	Surface	Grades		
				Optimum Grade	Max Sustained Grade	Max Short Distance Grade
Walkways and Easements – Multi-Use and Barrier Free	Generally for short urban connections; barrier free design, for pedestrians, cyclists and wheelchair access	Min 3.0m	Concrete or Asphalt	0-5 %	8%	15%
Walkways & Easements– Pedestrian Use Only	Generally for short urban connections; primarily pedestrian use	1.8m	Gravel	0-5 %	8%	10%
Multi-Use Trail	Longer connector trails; multiple simultaneous users (pedestrians and cyclists)	Min 2m Max 3m	Gravel (not barrier-free). Asphalt (barrier-free)	0-5%	8%	15%
Commuter Cycle Bikeway	Primarily for cyclists; Low simultaneous use; single file traffic	Min 2.5m Max 3m	Gravel or asphalt	0-8%	10%	15%
Leisure Cycle Bikeway	Primarily for cyclists; higher simultaneous use; single file and side-by-side	Min 3m	Gravel or asphalt	0-8%	10%	15%
Hiking Trail	Pedestrian/Hiking only; single file	Min 0.45m Max 0.6m	Natural terrain, Grubbed out but not surfaced	0-8%	15%	20-25%
Boardwalk		Min 1.5m Max 2m	Wood or metal decking			

- 1.45 Where required, walkways, greenways, trails and bikeways shall be dedicated to the City with a minimum width of 3.0 meters.
- 1.46 Concrete public walkways shall conform to MMCD Standard Detail Drawing C10 and will be constructed of Portland cement concrete.

- 1.47 Unless provisions for controlled infiltration of runoff water are provided, a curb shall be constructed along the low side of any concrete or asphalt walkway which has a cross fall. Catch basins as required shall be located to intercept the water flowing in the centre valley or adjacent to the curbs of a walkway.
- 1.48 Drainage may be accomplished by a centre line valley or a cross-fall at 2%.
- 1.49 Sub-base for all paths shall be engineered native fill or 6 inch lift of pit run.
- 1.50 All trails are to be accessible for multi-users with the exception of hiking trails.
- 1.51 Boardwalks shall be built at a raised height that is well above the high water level and away from any riparian vegetation.
- 1.52 Handrails are necessary for boardwalks that are more than 0.6 m off the ground.

Lane Markings

- 1.53 Directional dividing lines shall be painted on collector and arterial roads only — not on local streets. Short sections (5 m) of directional dividing line may be used in conjunction with stop bars at stop signs on through local streets.
- 1.54 Paved shoulders on local rural roads shall be delineated with a line to accommodate pedestrians, as an alternative to a sidewalk. Paved shoulders on rural collector roads shall accommodate cyclists as an alternative to bicycle lanes, and accommodate pedestrians as an alternative to sidewalks.

On Street Parking

- 1.55 Parking lanes shall be delineated with curb extensions at intersections plus optional mid-block curb extensions, except where increased clearance or larger curb radii are needed to accommodate buses and large trucks. In 6.0m wide pavement sections, where curb extensions are not used — the pavement width remains 6.0 m throughout, including at intersections. Parking on 6.0 m pavement width shall be on one side only, and shall be regulated under the traffic control bylaw.
- 1.56 Except where it would interfere with truck movements, parking shall be permitted on both sides of 10.8 m local industrial street.

Signage

- 1.57 All signage installed is to conform to Ministry of Transportation or TAC Standards.
- 1.58 Street name signs are to be black lettering on reflectorized white blades, except at traffic light controlled intersections where street name signs shall be blue blade with reflectorized white lettering.

- 1.59 All signs are to be installed with knock off bases as specified in the Approved Products List

Traffic Signals

- 1.60 All traffic signal systems are to be designed using with the BC Ministry of Transportation and Infrastructure's "Electrical and Traffic Engineering Manual; Guidelines for the Design of Lighting, Signal and Sign Installations" (2004)
- 1.61 All traffic signal systems are required to include an emergency vehicle pre-emption system. See the Approved Product List for equipment specifications.
- 1.62 Traffic signal pole bases shall be designed in accordance with the table in MMCD Standard Detail Drawing E1.1.

Structural Design

- 1.63 Roadways shall be designed in accordance with this standard, and with MMCD Platinum Edition, Sections 32 01 11 through 32 01 17.7, Sections 32 12 13.1 through 32 12 33 and Sections 32 13 16.1 through 32 17 23. All arterial roads must have a structural design submitted with the construction drawings.
- 1.64 Pavement design shall include consideration of the subgrade soil type, moisture conditions and subgrade drainage provisions. Design life of asphalt road pavement shall be for a minimum of 20 years; the road design should be acceptable for 50 years.
- 1.65 Regardless of the method used for pavement structure design, pavement structures shall be at least equal to or better than the minimum pavement structures in Table 1-6 and Table 1-7. Specifications for aggregate gradation for bases and asphalt pavement mix are found in Sections 02226 Aggregates, and 02512 Hot Mix Asphalt Concrete Paving.

Table 1-6– Roadway Base Design

Land Use	Road Classification	Min. Depth of Pitrun Gravel Subbase (mm)	Depth of Crushed Gravel Base (mm)
All	Local	230	75
All	Collector	230	130
All	Arterial	300	130
All	Lanes	230	75
All	Walkways	--	100

Table 1-7 – Roadway Pavement Requirements

Specification/Road	Arterial	Collector	Local Bus Route	Local	Rural Local
Paved Width (m) (approx)	see Table 1-2 and Table 1-3				
Total Pavement Thickness(mm)	100	75	75	50	50
Asphalt aggregate mix passing sieve size(mm) Lower course	25	19	19	n/a	n/a
Upper course	19	12	12	19	19

- 1.66 The grain size distribution curve tolerances for the 100% passing 25 mm and 19 mm are shown in the Supplemental Specifications under Section 02512 Hot Mix Asphalt Concrete Paving.
- 1.67 The City reserves the right to require that local roads be built to collector standards as determined by the City.
- 1.68 Urban roads shall be in accordance with Drawing CR-R114, CR-R115 and CR-R116 and rural local roads shall be in accordance with Drawing CR-R117. Gravel roads shall be as shown in Drawing CR-R118.
- 1.69 In-situ granular materials may be used in lieu of imported pit run gravel when such material complies with the MMCD and Supplementary Specifications.
- 1.70 Where walkways are to be used as emergency access roads they shall be constructed to lane standards.

Community Mail Centres

- 1.71 The location of Community Mail Centres (CMC) shall be shown on the Overall Development Plan. Canada Post must be contacted with regard to the location, however, in general the following procedures must be adhered to the BC Supplement to TAC Geometric Design Guide and the following:

They are not to be located at or on:

- roadways with 4 or more travelled lanes, including roads which will have 4 or more travelled lanes in the future,
- at major intersections which are controlled by traffic signals, including pedestrian signals, they are not to be located within 100 m of the intersection,

- at major intersections where the minor roadway is controlled by a stop sign, the CMC may be placed on the minor leg only, at a minimum distance of 30 m from the corner truncation,
- at minor intersections the CMC must be placed a minimum of 15 m from the beginning of the curb radii, and
- the brow of hills, corners or bends which would inhibit the safe flow of traffic.

Figure 1-1– Community Mail Centre on 6m Street

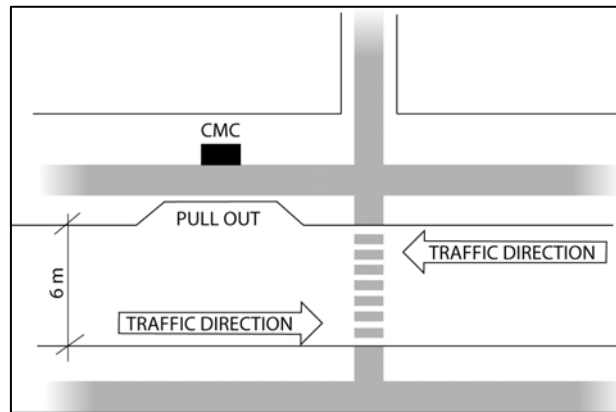
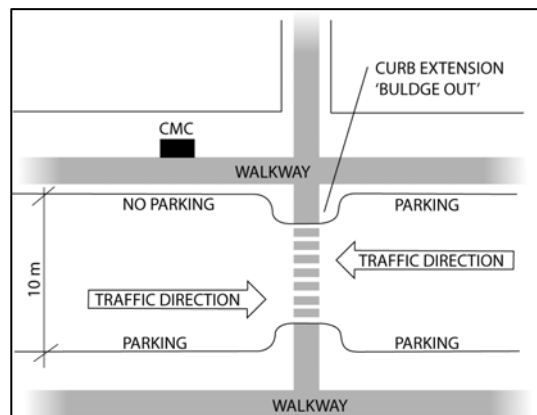


Figure 1-2– Community Mail Center on 10m Street



- 1.72 The CMC must be placed a minimum of 30 m from and on the far side of marked crosswalks, unless the developer provides a pull-out and/or curb bulges and the design provides for sight distance from motorists around stopped cars to users of the crosswalk, following the principles of Figure 1-1 and Figure 1-2.
- 1.73 The CMC must be placed at least 20 m from major driveways, e.g. to schools, commercial developments, institutional developments, etc. The CMC are not permitted in areas with "No Stopping Signs".
- 1.74 The developer of new subdivisions must obtain agreement on type and location with Canada Post, Pacific Division, Delivery Services, PO Box 2110, Vancouver, British Columbia, V6B 4Z3 or local representative of Delivery Services at (604) 334-3347.
- 1.75 In existing subdivisions Canada Post shall notify property owners adjoining proposed CMC locations before proceeding with the installations.
- 1.76 Canada Post will supply and install CMCs for single family lot subdivisions.
- 1.77 Canada Post with developers cost sharing will supply and install kiosk type CMC.
- 1.78 CMC will be located adjacent to street lights and alongside sidewalks with rollover curbs.
- 1.79 Where rollover curbs are not provided, dropped curb crossings will be installed on the sidewalk at the road intersections either side of the CMC.
- 1.80 CMC shall be set back 1.5m from the face of curb where curb exists and 3.0m from the outside edge of the through lane in rural areas.
- 1.81 Maintenance of the CMC shall be the jurisdiction of the Canada Post.

2 WATERWORKS

Application of the Waterworks Section

- 2.1 All water system designs must receive a Waterworks Construction Permit from the Vancouver Island Health Authority prior to the construction of the water system.
- 2.2 The waterworks section applies to the design of public potable water systems in the City of Campbell River. Potable water systems on private lands (private water systems) are to be designed, constructed and approved in accordance with the provisions of the current edition of the B.C. Building Code and the City of Campbell River Building Bylaw No 3060 prior to connection to the public water system.
- 2.3 The design requirements for water storage reservoirs, water pumping stations, pressure reducing valve stations and regional water supply mains are not included as part of these standards. The written approval of the City is required for any design proposed for these types of facilities and pipelines.
- 2.4 All materials incorporated into the City water systems must be new and in accordance with the City of Campbell River Approved Products List.
- 2.5 Refer to Section 9 for guidance on irrigation systems.

Performance Standards – Waterworks Systems

- 2.6 Intended for large, complex, unusual and innovative developments, Performance Standards set out general guidelines that designs must meet, but allow qualified professionals to determine the methods to meet the guidelines, subject to the written approval of the City. The Prescriptive Standards described in the following section should be a starting point for the development of any Performance Standards.

Performance Standards for Waterworks Systems are:

- Designers and developers are encouraged to include demand-management provisions in their projects, including:
 - Efficient landscape irrigation design and practices,
 - Water metering.
- Where demand-management provisions are included in a development, and related operations procedures are enforceable by strata bylaw, city bylaw or

contract, the City will consider project-specific calculations of water demand and related water supply sizing.

- Other aspects of a proposed system shall be 'equivalent' or better to the Prescriptive Standards.

- 2.7 Required Professional Qualifications for applicants using the Performance Standards approach for Waterworks Design:

Professional Engineer with minimum 5 years experience in Water System Design.

Prescriptive Standards – Waterworks Systems

- 2.8 Intended for small or simple developments, Prescriptive Standards set out both specific rules and design details that if used with good professional practice are pre-approved by the City.

- 2.9 Required Professional Qualifications for applicants using the Prescriptive Standards approach for Waterworks Design:

Professional Engineer with experience in Civil Engineering

Demand

- 2.10 The minimum design flows shall be based upon population and fireflow demand as follows:

- 2.10.1 Domestic Demand (Litres per capita per day)

- annual average daily per capita demand - 635 L/c/d
- peak day - 2100 L/c/d
- peak hour (expressed as a daily flow) - 3,000 L/c/d

- 2.10.2 Fireflow demand and storage amounts shall be in accordance with the current "Water Supply for Public Fire Protection", by Fire Underwriters Survey, for the existing or anticipated land use, but shall in no case be less than 60 L/s for 90 minutes. The fireflow demand should not exceed 300 L/s except in the case of an unusual risk.

- 2.11 The peak demand shall be the greater of:

- peak hour demand, or
- peak day demand plus fireflow demand with the fire at that location which will put the greatest strain on the system or part of system under consideration.

Supply

- 2.12 The water supply system shall be designed to satisfy the peak demand. The pressure in the street main shall not normally be less than 300 kPa during peak hour demand nor more than 850 kPa. The minimum pressure in the water system during a combined peak day demand and fire flow demand shall not be less than 150 kPa at any point in the mains. In areas where buildings may be expected to have automatic sprinkler systems, a special design is required to ensure a continuous supply to the sprinklers while providing adequate flow to stand pipes and hydrants.
- 2.13 The presence of an existing water main adjacent to a proposed development does not imply that adequate pressure or flow exists. The Consultant shall determine the quantity of water available in existing and proposed mains, having regard for the nature and extent of existing and ultimate development within the subdivision and other areas which the mains will serve. The design shall incorporate additional or alternate sources of supply if necessary to satisfy the supply requirements.

Configuration and Capacity of Mains

- 2.14 The design of mains in a subdivision should be consistent with the requirements for arterial feeder mains of larger diameter looping throughout the entire system. All other mains, except in cul-de-sacs, shall be looped, or provision shall be made for looping.
- 2.15 The minimum sizes of water mains shall be as follows:
- commercial and industrial areas 200 mm
 - elsewhere 150 mm except in dead end sections where to hydrant is required which may be 100 mm
- 2.16 Unsupported runs of 150 mm main in excess of 500 m should be avoided, unless peak demand requirements can be met.
- 2.17 Flow calculations should be performed using the Hazen-Williams formula. The flow velocity should be calculated:

$$V = \frac{C D^{.63} S^{.54}}{219}$$

where V = velocity of flow, m/s

C = roughness coefficient

D = inside pipe diameter, mm

S = slope of hydraulic gradient, m/m

The roughness coefficient should generally be as follows:

- | | |
|---------------------------|---------|
| - lined ductile iron pipe | C = 140 |
| - PVC pipe | C = 150 |

If required, the roughness coefficient of existing mains may be established by field testing.

The design velocity in supply mains should not normally exceed 3 m/s. There is no maximum velocity for distribution mains.

Location, Alignment and Grade

- 2.18 Water mains shall be located so as to serve all parcels directly. Mains shall normally be located within public road allowances, and located as shown on Drawing CR-R104. Mains shall be laid in a straight line on a uniform grade at a constant offset except as follows:
- 2.19 Where pipes are to be laid on a curve the method of installation of curved pipe and the maximum degree of curvature shall be less than 60% of that permitted by the pipe manufacturer's recommendations. Tapping of water services in curved sections of PVC water main pipe is prohibited.
- 2.20 Where the proposed traveled surface of a roadway is on a consistently ascending or descending grade, the main may be installed at a constant depth below that grade with appropriate vertical curves if necessary. Where the road grade fluctuates moderately between ascending and descending, the main shall be laid on a uniform grade, avoiding unnecessary high and low points. For ductile iron pipe the minimum depth of cover shall be 0.9 m, in all other cases it shall be 1 m.
- 2.21 Where topography does not permit installation within a road allowance, the main may be installed in a public walkway, or a utility right-of-way on private property. The minimum width of right of way shall be 3 m for a single pipe or 5 m for a double pipe or greater width required to permit the repair or maintenance of the pipeline(s). Additional ROW to ensure maintenance vehicle accessibility to utilities for maintenance and replacement will be required.

Hydrants

- 2.22 Hydrants shall be located throughout the distribution system having regard for the properties to be served, the direction of approach of the fire-fighting apparatus, the access of the pumper truck to the hydrant, and the locations of adjacent hydrants relative to line valves. Good practice calls for hydrants at intersections.

- 2.23 Hydrants should be located at the entrance to cul-de-sac bulbs. Blow-outs should be provided at the end of cul de sac bulbs as shown in Drawing CR-R119.
- 2.24 The spacing of hydrants shall be in accordance with the most current Fire Underwriters Survey publication Water Supply for Public Fire Protection and not exceed the following maximum recommended spacing :
- Commercial 90 m
 - Residential 150 m
- 2.25 A hydrant or air valve shall be located at a high point in a water main.
- 2.26 Hydrants shall be installed in accordance with MMCD Standard Detail Drawing W4. Hydrants shall be connected only to 150 mm diameter or larger mains. Hydrant leads shall not be less than 150 mm diameter. Each hydrant shall have an isolation valve and shall be fitted with a 100 mm 'STORZ' connection.

Valves

- 2.27 Valves shall be located so as to direct the flow of water to the required areas and keep to a minimum the portion of the distribution system affected by a single water main break or shut down due to unserviceability. Zone valves shall be clearly marked as such.
- 2.28 Except as specifically permitted by the City for large diameter mains, all valves shall be gate valves of the same size as the main. There shall be at least two valves at a tee and three valves at a cross. Valves shall be attached directly to such fittings on the downstream sides.
- 2.29 The spacing of valves should not exceed the following maximum recommended spacing:
- Commercial 150 m
 - Residential 245 m
- But in no case shall more than two hydrants be deprived of water due to a single water main break or unserviceability.
- 2.30 Additional valves may be required for satisfactory system operation or testing purposes:
- on a new water line near the point of connection to the existing system.
 - adjacent to a pressure reduction station or a connection to a supply main.
 - at the boundary between pressure zones.
 - in high density residential areas where more than 50 dwelling units would otherwise be without water supply in the event of a single water break or unserviceability.

Fittings and Appurtenances

- 2.31 A 50 mm standpipe or blow-off shall be installed at the end of any main which does not have a hydrant within 10 m of the termination point. Location and installation shall be in accordance with MMCD Standard Detail Drawing W8.
- 2.32 Where a pressure reduction device is required, it shall consist of at least two pressure reduction valves, the larger of which shall be 150 mm diameter or larger. In each case a design is required and to the satisfaction to the City.
- 2.33 For the purpose of hydrostatic pressure testing and chlorination of new mains, test points should be installed at those locations where no hydrant or other appurtenance is available for that purpose. Advance installation of a planned building service connection may be used in lieu of a test point.
- 2.34 Thrust blocks shall be provided on all tees, crosses, reducers, bends and caps in accordance with Drawings CR-W1 and CR-W1a. Thrust blocks shall be designed to withstand the maximum thrust generated at such locations. Hydrant tie rods may be used in lieu of thrust blocks in accordance with the MMCD Standard Detail Drawing W4.

Service Connections

- 2.35 Services shall be installed to all parcels of land that ultimately will require service. The sizes of such connections should take into account the full development potential of the parcel but shall in no case be smaller than 19 mm diameter.
- 2.36 The water main shall be designed so that the building service connection for each parcel may be installed within the projection of the frontage of such parcel. Except in cul-de-sacs, the alignment of the building service connection shall be straight and should be at right-angles to the road allowance centre-line.
- 2.37 The building service shall be installed in accordance with Drawing CR-W2a. The minimum cover over a building service connection shall be one metre.

Water Meters

- 2.38 Water meters shall be supplied on all building service connections and public irrigation systems
- 2.39 Water meters for building service connections up to 50mm in diameter shall be supplied in accordance with Drawings CR-W2a, CR-W2e and CR-W2f and MMCD Standard Detail Drawing W2d.
- 2.40 For large diameter service connections greater than 50 mm in diameter the water meter design shall be submitted to the City for written approval.

Cross-Connection Control

- 2.41 There shall be no connection permitted between a public water system and a private water system without an approved cross connection control device connected to the water system.
- 2.42 All backflow protection assemblies shall be manufactured in accordance with the American Waterworks Standards AWWA/ANSI C510-92 Standard for Double Check Valve Backflow Prevention Assemblies and AWWA/ANSI C511-92 Standard For Reduced Pressure Principle Backflow Prevention Assemblies, and AWWA/ANSI Standard for Dual Check Backflow Prevention Assemblies. Double Check and Reduced Pressure Principle Backflow Prevention Assemblies shall have isolation valves with ports suitable to allow testing.
- 2.43 There shall be maintained a 3 metre separation between a water main and sewer and drainage mains where laid parallel and shall cross with 500 mm clear distance.
- 2.44 Where the separation distance can not be maintained there shall be submitted to the City a design detailing the provisions made to preserve the integrity of the water system.
- 2.45 Crossing of sewer and water mains should be avoided, if absolutely required a crossing may be constructed as shown in MMCD Standard Detail Drawing G6.

Cathodic Protection

- 2.46 Cathodic protection is required for any metal pipes or appurtenance unless soil analysis proves that the soil is non-corrosive.

Tracing Wires

- 2.47 Conduits of non-ferrous material buried underground shall have a marking tape and tracing wire buried in the trench.
- 2.48 Marking tape shall be installed approximately 18" above the conduit, but not less than 24" below grade.
- 2.49 Tracing wire shall be taped directly on the pipe in a matter that a continuous tract results.

Abandonment of Mains

- 2.50 Abandoned sections of utilities shall be removed in accordance with appropriate procedures unless otherwise approved by the City.

3 SANITARY SEWER SYSTEMS

Requirements of a Sewerage System

- 3.1 The quantity of sewage to be carried in a proposed sanitary sewer shall be determined by the Consultant having regard for the type and extent of existing and ultimate development within the total area to be served using the following Performance and Prescriptive Standards.
- 3.2 The presence of an existing City sewer pipe does not imply that it is a suitable or adequate for a proposed development. The Consultant is required to submit a design report for every development over the size of 1 hectare identifying the impact of sewage discharge on the downstream sewer system unless this requirement is waived by the City. Where downstream facilities are inadequate to handle the increased flow from the proposed development a special design, downstream improvements or a written waiver by the City permitting the discharge is required.
- 3.3 The design requirements for sewage pumping stations and sewer force mains are not included with these standards. The written approval of the City is required for any design standard proposed for this type of facility and pipeline.

Performance Standards – Sanitary Sewer Systems

- 3.4 Intended for large, complex, unusual and innovative developments, Performance Standards set out general guidelines that designs must meet, but allow qualified professionals to determine the methods to meet the guidelines, subject to the written approval of the City. The prescriptive standards described in the following section should be a starting point for the development of any performance standards.

Performance Standards for Sanitary Sewer Systems are:

- Designers and developers are encouraged to include demand-management provisions in their projects, including:
 - Inflow and Infiltration reduction programs
 - Water metering.
- Where demand-management provisions are included in a development, and related operations procedures are enforceable by strata bylaw, city bylaw or contract, the City will consider project-specific calculations of sewage flows and related sanitary sewer sizing.

- Use of appropriate trenchless technologies is encouraged for sewer rehabilitation and replacement. Trenchless technology is not anticipated for new works.
- Other aspects of a proposed system shall be 'equivalent' or better to the Prescriptive Standards.

- 3.5 Required Professional Qualifications for applicants using the Performance Standards approach for Sanitary Sewer System Design:

Professional Engineer with minimum 5 years experience in the design of sanitary sewer systems.

Prescriptive Standards – Sanitary Sewer Systems

- 3.6 Intended for small or simple developments, Prescriptive Standards set out both specific rules and design details that if used with good professional practice are pre-approved by the City.
- 3.7 Required Professional Qualifications for applicants using the Prescriptive Standards approach for Sanitary Sewer System Design:

Professional Engineer with experience in civil engineering

Quantity of Sewage

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

3.8.1 Average dry weather flow 360 litres per day per capita.

3.8.2 Other daily sewage quantities:

- School, pupils and staff - 45 litres/capita per day
- Hotel, full service - 1000 litres/room
- Motel - 350 litres/unit
- Restaurant and pub - 150 litres/seat
- Other retail and office - 120 litres/employee
- Commercial or Industrial - 75 people/hectare equivalent

3.8.3 Peaking factor according to the Harmon formula:

$$PF = 1 + \frac{14}{4 + \sqrt{P}} \quad \text{where } PF = \text{peaking factor}$$

$$P = \text{population in thousands}$$

Sewage from non-residential sources shall be converted to population equivalents when determining the peaking factor.

3.8.4 Allowance for infiltration 0.06 litres/second/hectare minimum.

Capacity of Sewers

- 3.9 Sanitary sewers shall be designed to accommodate (per capita flow) x (population) x (peaking factor) + (infiltration). At maximum design flow the depth of sewage in each main shall not exceed 50% of the pipe diameter for mains 150 and 200mm in diameter, 60% for 250mm mains and 70% for 300mm mains or larger.
- 3.10 The minimum size of a sanitary sewer main shall be 150 mm. The use of 150 mm pipe shall be limited to the terminal sections of non-extendable branches. Elsewhere the minimum size shall be 200 mm.
- 3.11 The minimum grade shall be that which will result in a minimum velocity of 0.60 metres/second flowing full or half-full. For sections of the sanitary sewer that serve a design population of 25 people or less the minimum grade shall be 0.75%.
- 3.12 Design flows shall be determined by the Manning formula,:

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

where: Q = Design flow Litres/second
 R = hydraulic radius, millimetres
 S = slope, metres/metre
 n = Manning roughness coefficient
 A=Cross sectional area of the pipe

The value of the Manning roughness coefficient n shall be 0.011 for PVC pipe and 0.013 for all other pipes.

Location, Alignment and Grade

- 3.13 Sanitary sewers shall be of sufficient depth to drain the properties they are intended to serve, but in no case shall the depth of cover be less than one metre below finished grade.
- 3.14 Sanitary sewers should normally be located within public road allowances. They should be laid in a straight line at a uniform grade and on a constant offset, from manhole to manhole. Where the road allowance curves the sewer may be laid on a horizontal circular curve at a constant offset, unless otherwise prohibited by this specification. The offsets shall be generally in accordance with Drawing CR-R105.
- 3.15 Where pipes are to be laid on a curve the method of installation of curved pipe and the maximum degree of curvature shall be less than 60% of that permitted by the pipe manufacturer's recommendations. Only one curve, vertical or horizontal shall be permitted between adjacent manholes. Vertical curves should be avoided.

- 3.16 Where topography does not permit installation within a road allowance, the sanitary sewer may be installed in a public walkway or a utility right-of-way on private property. The minimum width of right of way shall be 3 m for a single pipe or 5 m for a double pipe or greater width required to permit the repair or maintenance of the pipeline(s). Additional ROW to ensure maintenance vehicle accessibility to utilities for maintenance and replacement will be required.

Pipe Selection and Bury

- 3.17 The strength of pipe and quality of bedding shall be in accordance with the recommendations of the pipe manufacturer for the depth of bury, and loads, construction loading as well as the finished loading, as detailed in Section 31 23 01 Excavating, Trenching and Backfilling. Bedding and backfill shall be in accordance with MMCD Standard Detail Drawing G4.

Manholes and Cleanouts

- 3.18 The maximum distance between sanitary manholes shall be as follows:

- Pipe up to 400 mm diameter = 125 m
- All other pipes = 155 m

Manholes shall be sized in accordance with MMCD Standard Detail Drawing S1. Manholes with depths of 3 m or greater shall have a minimum inside diameter of 1200 mm. Manholes shall be located at: grade or alignment changes (except a curve in accordance with section 3.14 of these specifications), pipe size changes, all pipe junctions other than service connections, the upstream end of all sewer mains (except as in 3.19) and connections where the service connection pipe diameter is within two sizes of the main line.

- 3.19 Where the terminus of a main is at a location where it will be extended in the future, a clean out may be installed at the upstream end, in accordance with MMCD Standard Detail Drawing S6.
- 3.20 When a smaller sewer joins a larger, normally the crown (obvert) of the smaller pipe should be placed at or above the level of the crown of the larger pipe. Where this is not practicable, the elevation of the larger pipe may be adjusted and the manhole constructed so as to maintain the energy gradient. The 0.8 depth point of the larger pipe shall not be higher than the 0.8 depth point of the smaller.
- 3.21 When the sewer pipes of the same size pass through a manholes, there shall be a minimum elevation difference between the discharging pipe and receiving pipe as follows:
- straight through, or bend less than 45 degrees: design grade plus 20 mm
 - bend 45 degrees to 90 degrees: design grade plus 30 mm

- - bends within manholes should not exceed 90 degrees and shall in no case exceed 110 degrees.
- 3.22 A drop manhole shall be provided in accordance with MMCD Standard Detail Drawings S3 and S4 where the difference in elevation between a discharging pipe and the receiving pipe exceeds 0.60 m. A vertical drop of 0.25 m or less should be accomplished by benching. Vertical drops of 0.25 m to 0.60 m should be avoided by adjusting pipe gradients.

Sanitary Service Connections

- 3.23 Service connections shall be installed to all parcels of land that will ultimately require service. The sizes of such connections should take into account the full development potential of the parcel and its zoning but shall in no case be smaller than 100 mm in diameter. The sizes of connections shall be in accordance with the Province of British Columbia Plumbing Code.
- 3.24 All service connections shall be connected to the main as shown in MMCD Standard Detail Drawing S7. All service connections to new mains shall be accomplished by wye branches. Connections to existing mains shall be by the use of materials and methods permitted in writing by the City.
- 3.25 The minimum gradients of service connections shall be as follows:
- 100 mm 1.5%
 - 150 mm 1%
- 3.26 Except in cul-de-sacs, the sanitary sewer shall be designed so that the service connection for each parcel may be installed within the projection of the frontage of such parcel. In certain circumstances, the City may approve alternate locations for service connection. The alignment of the sewer connection shall be straight and should be approximately at right angles to the centre line of the road allowance. Inspection and cleanout facilities shall be installed on each service as shown in MMCD Standard Detail Drawings S7 and S9.
- 3.27 Where the depth of cover over the main exceeds 3.6 m, and the service connection requires it, service drops shall be provided. Such service drops shall be in accordance with MMCD Standard Detail Drawing S8.
- 3.28 The minimum cover over a service connection below final grade shall be 1.2 m. In rural areas with drainage ditches, deeper service connections will be required and shall be approved by the City.

4 STORMWATER SYSTEMS & MANAGEMENT

Requirements of a Stormwater Management System

- 4.1 The design catchment area shall include the entire area tributary to the storm drain. The catchment area should be shown on the Catchment Area and Storm Drainage Plan and shall be in accordance with stormwater management plans developed by the City. Detailed boundaries shall be established by the Consultant insofar as they affect the proposed subdivision.
- 4.2 All development shall adhere to the following Federal and Provincial regulations and guidelines, with the most stringent requirements taking precedence:
 - Land Development Guidelines for the Protection of Aquatic Habitat (Canada / BC)
 - Fisheries Act (Canada)
 - Water Act (BC)
 - Fish Protection Act (BC)
 - Riparian Area Regulation (BC)
 - Stormwater Planning: A Guidebook for British Columbia (BC)
 - Stormwater Source Controls: Design Guidelines 2005 (GVSDD)
 - Urban Runoff Quality Control Guidelines for British Columbia (BC)
- 4.3 The presence of an existing City drainage facility or natural channel does not imply that such is a suitable or adequate point of discharge. The Consultant shall confirm that downstream capacity is adequate. Where existing downstream facilities are inadequate to handle the increased flow from the proposed subdivision, an alternate design is required. At no time, however, will direct discharge be permitted without adequately addressing stormwater quality and detention.
- 4.4 The storm drainage system shall be designed, with sufficient capacity to collect and convey anticipated storm runoff from the total catchment area to be served when fully developed.
- 4.5 The drainage system shall have two components, the "minor" and the "major".
 - 4.5.1 The minor system shall consist of underground conduits and appurtenances capable of conveying runoff from the five year return storm.
 - 4.5.2 The major system shall consist of surface flowpaths within roadways and walkways, and other open channels, capable of conveying that portion of the runoff from the 100 year return storm over and above the capacity of the minor system.

Components of the minor system may be enlarged to accommodate the major flow, but only in cases where an overland flow route is physically impossible, and only with the approval of the City.

- 4.6 Suitable on-site or off-site stormwater detention facilities may be required depending upon the impact of runoff on downstream areas. They shall be designed in accordance with the most recent Federal and Provincial regulations and guidelines and are subject to the approval of the City.
- 4.7 Erosion and Sediment Control is required on all developments, in accordance with Part 5 of the City of Campbell River Engineering Standards.

Performance Standards – Stormwater Management Systems

- 4.8 Intended for large, complex, unusual and innovative developments, Performance Standards set out general guidelines that designs must meet, but allow qualified professionals to determine the methods to meet the guidelines, subject to the written approval of the City. The prescriptive standards described in the following section should be a starting point for the development of any performance standards.

Performance Standards for Stormwater Management Systems are:

- No discharge from impervious surface areas for storm events with rainfall depths up to one half the 24-hour Mean Annual Rainfall (MAR) (1/2 of 55mm, or 27.5mm in 24 hours)
- Post-development runoff for the 2-year recurrence 24-hour storm shall be 50% of the pre-development runoff and the post-development runoff of the 5-year recurrence 24-hour storm shall not exceed the pre-development runoff.
- For storm events exceed the 5-year recurrence, safe conveyance of runoff.

Proposals for Stormwater Management Systems using the Performance Approach shall be in report form, sealed by the responsible professional, and shall include information on the following to the satisfaction of the City:

- Tributary areas in the catchment with existing and ultimate land uses.
- Details indicating how the local catchment area relates to the boundaries ISMP's ,.
- Contours at 1.0 m elevation intervals.
- Existing watercourses including environmental classifications and/ or fish presence information.
- Continuous- flow modelling using currently accepted hydrologic and hydraulic modelling software and practices. Selection of computer programs requires review of the historical application of each program in watersheds similar to those under consideration. City approval of computer program selection should be obtained before design is commenced.
- Layouts of existing and proposed drainage systems.
- Major flow paths.

- Conceptual lot grading patterns.
- Design of proposed infiltration facilities, if appropriate, including location, sizing, detail cross sections and typical profiles. Results of on-site infiltration testing of soils at the elevation of the proposed infiltration.
- Locations, sizes and hydraulic grade line (HGL) elevations of proposed detention facilities, if appropriate.
- Other proposed mitigation measures, if appropriate.
- Proposed minimum building elevations (MBE) and 100 year HGL of major flowpath (100 year storm).
- Pre and post-development flows, with and without the impact mitigation measures.
- Current and future upstream and downstream flows and system capacities.
- Plan for erosion and sediment control during all phases of construction.
- Plan for monitoring of performance by qualified professionals during construction and maintenance periods.
- Plan for maintenance during the maintenance period.
- Plan for maintenance of oil/water separators.

The proposed system shall be 'equivalent' or better to the Prescriptive Standards.

- 4.9 Required Professional Qualifications for applicants using the Performance Standards approach for Stormwater Management System Design:

Professional Engineer with a minimum of 5 years experience in Stormwater Management Engineering.

Landscape Architect (BCSLA) with experience in Stormwater Management landscapes for soil / planting / irrigation design.

Professional Engineer with experience in Soil Hydraulics and/or Hydrogeology for soil infiltration capacity assessments.

Prescriptive Standards – Stormwater Management Systems

- 4.10 Intended for small or simple developments, Prescriptive Standards set out both specific rules and design details that if used with good professional practice are pre-approved by the City.

- 4.11 Required Professional Qualifications for applicants using the Prescriptive Standards approach for Stormwater Management System Design:

Professional Engineer with experience in civil engineering

Landscape Architect (BCSLA) or Certified Horticultural Technician for soil / planting design

Certified Irrigation Designer for irrigation design

STORM WATER SYSTEM

Capacity of Storm Drains

- 4.12 The minimum diameter for all stormwater mains shall be 200 mm.
- 4.13 Stormwater flows shall be calculated by the Manning formula, using the velocity determined by:

$$V = \frac{r^{2/3} s^{1/2}}{n}$$

where: V = velocity of flow, metres per second
 r = hydraulic radius, metres
 s = slope, metres/metre
 n = roughness coefficient

The value of the roughness coefficient shall be as follows:

PVC pipe	0.010
Corrugated metal pipe	0.024
Other pipe	0.013
Excavated ditch	0.030
Natural grass channel	0.050

The minimum velocity shall be 0.75 m/s when the pipe is running full but not surcharged.

- 4.14 Subject to the approval of the City, a design may involve intentional surcharging of short portions of a storm drain provided that this will not involve backup of storm water in service connections, and the hydraulic grade line is not less than 0.5 m below ground level at manholes or catch basins. Joints of intentionally surcharged drains shall be made with rubber "O" rings or equivalent.

Location, Alignment and Grade

- 4.15 The storm drains should be deep enough to service all those abutting properties that are required by By-Law to connect to such drains. In no case shall the depth of cover be less than one metre, measured from finished grade.
- 4.16 Storm drains should normally be located within public road allowances. They should be laid in a straight line from manhole to manhole at a uniform grade on a constant offset, in accordance with Drawing CR-R105. Where the road allowance curves, the sewer may be laid on a horizontal circular curve at a constant offset unless otherwise prohibited by these specifications. Horizontal curves shall not be used where a straight line main is feasible.
- 4.17 Where topography does not permit installation within a road right of way, the storm drain may be installed in a public walkway or within a utility right-of-way on private property. The minimum width of right of way shall be 3 m for a single pipe or 5 m for a double pipe or greater width required to permit the repair or maintenance of the pipeline(s). Additional ROW to ensure maintenance vehicle accessibility to utilities for maintenance and replacement will be required.
- 4.18 Where curvature is permitted, storm drains may be laid on a uniform curve. The method of installation of curved pipe and the maximum degree of curvature shall be in accordance with the pipe manufacturer's recommendations.
- 4.19 Any components of the major system that traverse private property shall be protected by appropriate statutory rights of way. Such statutory rights of way shall specify a minimum floor elevation so that all habitable areas of buildings will be above the major flow hydraulic grade line.

Pipe Selection and Bury

- 4.20 The strength of pipe and quality of bedding shall be in accordance with the recommendations of the pipe manufacturer for the particular service and depth of bury, taking into account the anticipated construction loading as well as the finished loading. Bedding shall be in accordance with MMCD Standard Detail Drawing G4 and with MMCD Section 31 23 01 Excavating, Trenching and Backfilling.

Manholes

- 4.21 The maximum distance between storm manholes shall be as follows:
 - Pipe up to 400 mm diameter = 125 m
 - All other pipes = 155 m
- 4.22 Manholes shall be sized in accordance with MMCD Standard Detail Drawing S1. Manholes with depths of 3 m or greater shall have a minimum inside diameter of 1200 mm.

- 4.23 Manholes shall be located at: grade or alignment changes (except a curve in accordance with section 4.25 of these specifications), pipe size changes, all pipe junctions other than service connections, at the upstream end of each storm drain and where a service connection diameter is within two sizes of the main line. A cleanout shall be installed at the upstream end of a storm drain that is intended to be extended later.
- 4.24 Pipe diameter of a downstream main should not normally be less than that of an upstream main.
- 4.25 When a smaller drain joins a larger, normally the crown of the smaller pipe should be placed at or above the level of the crown of the larger. Where this is not practicable, the elevation of the larger pipe may be adjusted and the manhole construction so as to maintain the energy gradient. The 0.8 depth point of the larger pipe shall not be higher than the 0.8 depth point of the smaller. Factory manufactured wye branches should be crown to crown, but if not available, centre line to centre line may be used.
- 4.26 A drop manhole shall be provided in accordance with MMCD Standard Detail Drawings S3 and S4 for drains entering a manhole at an elevation of 0.60 m or more above the manhole invert. A vertical drop of 0.25 m or less should be accomplished by benching. Vertical drops of 0.25 m to 0.60 m should be avoided by adjusting sewer gradients.
- 4.27 Stub pipes, where provided, shall extend at least 1.5 m from the outside face of the manhole.

Catch Basins

- 4.28 Catch basins shall be installed at locations best suited to collect runoff water. The maximum distance between catch basins for 6m to 10m wide roads shall be:
 - 155 m. on pavement grades up to 2%
 - 90 m. on pavement grades steeper than 2%
- 4.29 In no case shall the catch basin spacing or quantity create conditions that exceed the hydraulic capacity of the catch basin inlet for the design storm. Catch basins should be spaced and located to intercept all the flow resulting from the 10 year design storm. Catch basins shall be located to isolate intersections from through-drainage.
- 4.30 Single or double side inlet gratings shall be used on catch basins located on steep grades, at low spots and at such other places where damage by flooding might occur if a flat grating was blocked.
- 4.31 Catch basins shall be pre-cast, installed in accordance with Drawing CR-S11.
- 4.32 In areas with rollover curbs double flat grate catch basins shall be used at low points or on steep gradients.

- 4.33 Catch basin leads shall not be smaller than 200 mm, and shall have at least 0.6 m cover. In the case of double catch basins one lead shall be 250 mm minimum, and shall have a wye connection with the other. Catch basins leads should run in a straight line to a storm manhole or to another catch basin. Long radius bends will be used between the leads and the storm main and a wye branch shall be used to connect to the main.
- 4.34 The barrel of each catch basin shall be constructed in accordance with ASTM C 478-82. Any elements not specified in that standard shall be designed to withstand H-20 loading.

Service Connections

- 4.35 Storm service connections shall be installed to all parcels of land that will ultimately require service, suitable for the full development of the parent parcel. The sizes of such connections shall be in accordance with the zoning of the parcel and the Province of British Columbia Plumbing Code, except that none shall be smaller than 150 mm diameter with a minimum velocity of 0.75 m/s.
- 4.36 All service connections should be connected to the main as shown in MMCD Standard Detail Drawing S8. All service connections to new mains shall be accomplished by wye branches. Tapping saddles are permitted on existing mains and on mains 375 mm and larger.
- 4.37 The storm sewer shall be designed so that the service connection for each parcel may be installed within the projection of the frontage of such parcel. The alignment of the sewer connection shall be straight and should be approximately at right angles to the centre line of the road allowance.
- 4.38 Where the depth of cover over the main exceeds 3.6 m, and the service connection requires it, service drops shall be provided. Such service drops shall be in accordance with MMCD Standard Detail Drawings S8.
- 4.39 The minimum cover over a service connection below final grade shall be 1.2 m.
- 4.40 All service connections shall have an Inspection Chamber as shown on MMCD Standard Detail Drawing S9 and S10.

Separation

- 4.41 A storm drain may be laid in the same trench as a sanitary sewer provided there is a clear distance of 0.6 m between the mains and the relative elevation of one does not interfere with service connections to the other.

STORMWATER MANAGEMENT**Stormwater Source Control**

- 4.42 Stormwater Source Control shall be incorporated into subdivision and lot development to meet the requirements of stormwater management plans developed by the City for various watershed areas, and the requirements below. Figure 4-1 illustrates the integration of stormwater source controls into a neighbourhood, illustrating potential use of best management practices on public lands.
- 4.43 Selection of Stormwater Source Controls shall be made with regard to the topography, water table, soil or rock infiltration capacity, and downstream slope stability hazards. Stormwater Source Control use and sizing shall be customized by the design engineer for each development, subject to the following general guidelines and the approval of the City:
- 4.43.1 All unpaved landscape areas shall have a minimum depth of 200mm of free draining topsoil / organic matter mix meeting the requirements of MMCD Section 32 91 21 - either existing to remain or imported over scarified free-draining subgrade. The surface shall be vegetated or revegetated. Immediately before seeding or planting, the surface shall be cultivated to remove surface crusting, and compacted areas that do not exhibit free drainage shall be scarified.
- 4.43.2 Narrow paved areas, such as streets, driveways or walkways, shall be sloped to drain onto adjacent unpaved landscape areas designed as infiltration facilities in accordance with the guidelines below, to encourage runoff from these areas to infiltrate into the soil.
- 4.43.3 Maximum ponding depth of infiltration areas shall be 150mm. All infiltration areas shall drain away from buildings, shall have a provision for draining within 48 hours to the 5 year return period drainage system, and shall have an overflow to the 100 return period year flow path.
- 4.43.4 The surface of unpaved landscape areas shall be designed for positive drainage away from pavements and buildings. Slopes of 1% to 3% are desirable to encourage infiltration of small rainfalls while facilitating drainage of large storms.
- 4.43.5 Infiltration-based stormwater source controls shall not be used in the following conditions:
- areas within 30m of a slope that is steeper than 3 (horizontal) to 1 (vertical) and higher than 6m, or other unstable slopes.
 - areas where the post-development wet season groundwater table is less than 0.6m below the base of infiltration trenches.
 - areas where existing dwellings do not have foundation drains.

Figure 4-1 – Potential Integration of Stormwater Source Controls into Residential Development



- 4.43.6 In all developments other than those listed in 4.43.5 above, infiltration-based stormwater source controls with an overflow to the City storm drain system are required, except when a professional engineer with experience in geotechnical engineering identifies conditions that would preclude the use of infiltration practices, with written recommendations to the approval of the City. Required practices are:
- 4.43.6.1 Infiltration Swales and/or Rain Gardens with reservoir and underdrain shall be installed where appropriate and with City approval, in accordance with Drawings CR-S101, CR-S102 and CR-S106.
- 4.43.6.2 Whereas the reservoir and underdrain shown in the Drawing CR-S101, CR-S102 and CR-S106 are generally required, the underdrain and/or reservoir may be deleted in cases where a report by a professional engineer with experience in geotechnical engineering provides on-site infiltration test results that indicate that subsurface infiltration rates are adequate to allow absorption of one half the Mean Annual Rainfall (MAR) depth ($\frac{1}{2}$ of 55mm, or 27.5 mm, in 24 hours) within the drainage area of the stormwater source control. In such cases the geotechnical engineering report shall recommend the appropriate detail, with reference to Drawings CR-S103, CR-S104, CR-S105, CR-S107, CR-S108, CR-S109, CR-S111, CR-S112 etc.
- 4.43.6.3 All utility crossings of infiltration-based stormwater source controls shall have trench dam installed as necessary to stop infiltration water from flowing down the utility trench to downstream basements or crawl spaces.
- 4.43.7 Permeable pavers shall be allowed with the City's approval in appropriate areas.
- 4.44 **Infiltration Swales** Drawings CR-S101, CR-S102, CR-S103, CR-S104 CR-S105, shall meet the supplementary specifications and the following design guidelines:
- The swale infiltration area should be approximately 10-20% of the upstream impervious area that it serves, with its sizing preferably calculated by continuous flow modelling.
 - Flow to the swale should be distributed sheet flow, travelling through a grassy filter area at the swale verges (500 mm min., >3000 mm desirable). Provide pre-treatment erosion control to avoid sedimentation in the swale. Provide non-erodible material, sediment cleanout basins, and weir flow spreaders at point-source inlets.
 - Provide vegetated erosion control along all sides of weir and at drainage inlets.
 - Pavement edge at the swale may be wheel stop, flush curb, drop curb or side inlet curb (Drawing CR-R113). Provide a 25mm drop at the edge of paving to the swale soil surface, to allow for positive drainage and buildup of road sanding/organic materials at this edge. Ensure positive drainage from curb into the swale invert.
 - Swale planting is typically sodded lawn. Low volume swales can be finished with a combination of grasses, shrub, groundcover and tree planting to provide a 100%

vegetated cover within 2 years of planting. Meet the requirements in Section 8 Landscape for growing medium depth / volume where shrub and groundcover is used, and at planted trees.

- Swale longitudinal slope should be 1-2%, or dished between weirs.
- Swale bottom width - 600mm minimum, 2400mm maximum, flat in cross section.
- Swale surface side slopes - 3(horizontal):1(vertical) maximum, 4:1 preferred for maintenance. Minimum sideslope shall exceed the slope of the road edge profile.
- Weirs to have level top to spread flows and avoid channelization, keyed in 100mm minimum. Integrated mowing strip at the weir is desirable in lawn areas.
- Design stormwater conveyance using Manning's formula, with attention to erosion and channel stability during maximum flows.
- Maximum ponded level: 150mm.
- Drawdown time for the maximum surface ponded volume – 48 hours maximum.
- Minimum freeboard to adjacent paving: 100mm or in accordance with swale conveyance design.
- Treatment soil depth: 350mm depth of growing medium is desirable, 150mm depth of growing medium is the minimum required, both over 100mm minimum depth of washed sand.
- Drain rock reservoir bottom shall be level.
- Underground weirs of undisturbed native

material or constructed ditch blocks shall be provided to create underground pooling in the reservoir sufficient for infiltration performance.

- A non-erodible outlet or spillway must be established to discharge overflow.



Photo Credit: Lanarc Consultants Ltd.

Flush curb (left) to grass filter to vegetated (shrubs, groundcover) swale

4.45 **Rain Gardens** shall meet the supplementary specifications, Drawings CR-S106 through CR-S109, and the following design guidelines:

- The Rain Garden area should be 10-20% of the upstream impervious area that it serves, preferably sized by continuous flow modelling. Common rain garden size is about 50 m² draining 250m² of impervious area, although this sizing and proportion will vary by rainfall and soil characteristics. Smaller, distributed Rain Gardens are better than single large-scale facilities.



- Siting of Rain Gardens should be similar to other infiltration facilities – minimum 30m from wells or unstable slopes, minimum 3 m downslope of building foundations, and only in areas where foundations have footing drains.
- Provide pretreatment erosion control to avoid sedimentation in the garden. Provide non-erodible material, sediment cleanout basins, and weir flow spreaders at point-source inlets. Flow to the swale should be distributed sheet flow, travelling through a grassy filter area or grass swale prior to entering the Rain Garden (500 mm minimum, greater than 3000 mm desirable grassy pretreatment swale length).

Photo Credit: Lanarc Consultants Ltd.

Formal rain garden, Buckman Terrace, Portland Oregon.



Photo Credit: Lanarc Consultants Ltd.

Informal rain garden, Water Pollution Control Laboratory, Portland Oregon

- 4.46 Rain Garden bottom (Drawing CR-S106, CR-S107, CR-S108, CR-S109): flat cross section, with a longitudinal slope of 1 to 2%. Provide a 50mm – 75mm layer of organic mulch – well aged compost, bark mulch or similar weed free material. The mulch is important for both erosion control and maintaining infiltration capacity.
- Rain Garden bottom width: 600mm minimum, 3000mm desirable, length:width ratio of 2:1 desirable.
 - Rain Garden side slopes 2 horizontal : 1 vertical maximum, 4:1 preferred for maintenance. Provide organic mulch on side slopes similar to bottom.
 - Maximum ponded level: 150mm.
 - Drawdown time for the maximum surface ponded volume: 48 hours.
 - Treatment soil depth: 450mm minimum, 1200mm desirable. Treatment soil should have a minimum infiltration rate of 13mm/hr, with 6mm/hr used for design. If a filter cloth is used over drain rock reservoir, provide clean washed sand over the filter cloth as a replacement for the lower 100mm of growing medium.
 - Slope of the drain rock reservoir bottom shall be level.
 - A non-erodible outlet or spillway must be established to discharge overflow.
 - Avoid utility or other crossings of the Rain Garden. Where utility trenches must be constructed crossing below the garden, install trench dams to avoid infiltration water following the utility trench.

- Rain gardens can be constructed in a variety of shapes. Gain a letter of approval from an engineer with experience in geotechnical engineering prior to siting rain gardens closer than 3m to building foundations.

4.47 **Pervious Pavers** shall meet the supplementary specifications, Drawing CR-S110, CR-S111 and CR-S112 and the following design guidelines:

Pervious pavement designs may be one of three types:

- Full Infiltration – where all inflow is intended to infiltrate into the underlying subsoil (Drawing CR-S111).
- Partial Infiltration – designed so that some water may infiltrate into the underlying soil while the remainder is drained by perforated pipes (Drawing CR-S110).
- Partial Infiltration with Flow Restrictor – designed with a



Photo Credit: Lanarc Consultants Ltd.

Pervious paving reservoir base.

- perforated pipe and flow restrictor located at the bottom of the drain rock reservoir. A small orifice in the flow restrictor allows the gradual decanting of water above the perforated pipe, with infiltration occurring as much as possible. These systems are essentially underground detention systems, and are used in cases where the underlying soil has low permeability or there is high water table (Drawing CR-S112).

Design Guidelines for all three types include the following:

- Soil subgrade sampling and analysis should be provided by a professional engineer knowledgeable in the local soils. Testing of soil cores taken at the proposed area to be paved should include soil texture classification, sampled moisture content, 96 hour soaked California Bearing Ratio (CBR) with a target of at least 5% for light vehicular traffic, 15% for heavy vehicles, and on-site infiltration tests using a Double-Ring Infiltrometer taken at the elevation of the proposed base of the reservoir.
- Minimum recommended tested infiltration rate for a full infiltration pavement design is 12.5 mm/hr. Sites with lower rates will require partial infiltration solutions with drain pipes, and care must be taken that the subbase will remain stable while saturated.

- Where it is proposed to drain impermeable surfaces onto pervious pavement surfaces, it is recommended that a maximum ratio of 2:1 impermeable to permeable is used. This may vary by rainfall and soil characteristics as determined by modelling.
- Permeable Unit Pavers should be selected and designed based on a manufacturer's tests that the installed unit paving system can maintain a minimum 28mm/hr infiltration rate over the pavement life (usually 20 years). This rate includes a factor of safety of 10 – the initial infiltration rate should be >280mm/hr.
- Permeable unit pavers are usually 80mm depth. Provide edge restraint to contain the pavers, similar to standard unit paving. Edgers that use spikes are not recommended.
- Permeable unit paving surface slope should be 1% minimum to avoid ponding on the surface, and related settlement of clay sized particles.
- Provision of vegetated joints, and overhanging trees which drop needles onto the pavement have, in research studies, helped to maintain high infiltration capabilities of pervious unit paving. Vegetated joints are not suitable in heavily shaded areas such as under long-term parking.
- Paver bedding material shall be wrapped with geotextile filter cloth on bottom and all sides. This is critical to the water quality performance of the pavement, and also keeps any intrusion of fines near the surface, where localized clogging could be repaired by replacing only the aggregate above the filter cloth and patching the cloth, reusing the pavers.
- Bottom of reservoir: flat in full infiltration designs, minimum 0.1% slope to drain in piped systems.
- If the pavement is being designed for heavy loads, optional reinforcing grids may be included in the pavement subbase.
- With infiltration designs, the bottom and sides of all reservoir base and subbase courses shall be contained by a geotextile filter cloth. Geotextile shall be adhered to the drains.
- Design reservoir water levels and stormwater detention using a continuous modelling program. Drawdown time for the reservoir: 96 hours maximum, 72 hours desirable.
- If the design is for partial infiltration with a flow restrictor assembly, size the orifice for a design flow that meets local requirements or replicates base flow from the drainage area.
- Provide a secondary overflow inlet and inspection chamber (catch basin or manhole) at the flow control assembly. If no secondary overflow inlet is installed, provide a non-erodible outlet or spillway to the major storm flow path.
- Underground weirs of undisturbed native material or constructed ditch blocks shall be provided to create underground pooling in the reservoir sufficient for infiltration performance.

- Avoid utility or other crossings of the pervious pavement area. Where utility trenches must be constructed crossing below the reservoir, install trench dams at exits to avoid infiltration water following the utility trench.

4.48 **Infiltration Trench** systems shall meet the supplementary specifications, Drawing CR-S113 and the following design guidelines:

- Locate Infiltration Trench at least 3m from any building, 1.5m from property lines, and 6m from adjacent infiltration facilities (or as recommended by a geotechnical engineer).
- If any surface water is to enter the system, provide pre-treatment erosion control to avoid sedimentation in the Infiltration Trench. Provide non-erodable material and sediment cleanout basins at point-source inlets. Do not allow drainage from land uses with a high risk for water pollution (e.g. refueling stations) to enter an infiltration trench.
- Provide vegetated erosion control along any surface water conveyance swales (e.g. between rain water leader and sump inlet). Swale planting is typically sodded lawn. Low volume swales can be finished with a combination of grasses, shrub, groundcover and tree planting to provide a 100% vegetated cover within 2 years of planting.
- Sump: Concrete, plastic, or other non-degradable box with strength suitable to withstand surface loads. Provide a lid for periodic inspection and cleanout. Include a T-inlet pipe to trap oils, sediments and debris. Provide weep holes to dewater the sump, for mosquito management. In high volume situations, an oil/grit separator will be required by the City.
- Infiltration Trench: installation of perforated distribution pipe and bottom of drainrock to be level. If more than one section of infiltration trench is required, design so that underground water is temporarily 'ponded' in each infiltration section, using underground weirs of undisturbed native material or constructed ditch blocks designed to create underground pooling in the reservoir sufficient for infiltration performance.
- Infiltration Trench bottom width - 600mm minimum, 2400mm maximum.
- Install the Infiltration Trench in native ground, and avoid over-compaction of the trench sides and bottom, which reduces infiltration.
- Observation well for each Infiltration Trench (optional): vertical standpipe, with perforated sides, and locking lid, to allow the monitoring of water depth.



Photo Credit: Lanarc Consultants Ltd.

Infiltration trench can be in any plan shape – the photo shows a rectangular 'soakaway' under construction at a single family subdivision in BC.

- Size the Infiltration Trench system by continuous flow modelling to provide rainfall capture of the design target.
 - A non-erodible outlet or spillway must be established to discharge overflow.
 - Avoid utility or other crossings of the Infiltration Trench. Where utility trenches must be constructed crossing below the Infiltration Trench, install trench dams to avoid infiltration water following the utility trench.
- 4.49 Additional stormwater source controls are described in the publication Stormwater Source Control Design Guidelines 2005 (GVSD / GVRD). The following stormwater source controls are encouraged for use when appropriate, and shall require a custom design and specification document to be submitted for the approval of the City:
- 4.49.1 Soakaway Manhole System (Drawings CR-S114, CR-S115, CR-S116), with design supported by a hydrogeotechnical engineering report concerning groundwater quality.
- 4.50 **Oil / Grit Separators** installation of Oil/Grit Separators shall meet the following requirements:
- 4.50.1 treat a minimum of 90% of the annual runoff volume of the catchment area.
- 4.50.2 provide an internal high flow bypass that regulates the flow rate into the treatment chamber and conveys high flows (10% or less of the annual runoff volume) directly to the outlet such that scour and re-suspension of material previously collected does not occur.
- 4.50.3 be capable of removing 50% to 80% of the total suspended sediment load (TSS, including fine and clay particles) and 60% to 95% of the floatable free oil. Design calculations for sizing the structure shall be based on the drainage area, historic rainfall data, and shall meet the upper range of the removal targets (80% of TSS and 95% of oil). Average performance of the installation shall meet the lower range of the removal targets as a minimum (50% of TSS and 60% of oil).
- 4.50.4 maintenance access both to the structure and within the structure shall be provided so that accumulated oils and sediments can be readily removed with a vacuum truck.
- 4.50.5 the oil/grit separator shall be enclosed in a concrete manhole or vault structure. The structure and lid shall meet H20 loading. Concrete joints shall be oil resistant and water tight.

- 4.51 Stormwater Source Control practices are intended to infiltrate the frequent minor storm events to provide recharge of ground water for stream base flows, and also to improve water quality. Unless proven by a Performance Standard calculation, stormwater source controls shall be assumed to not substantially reduce the quantity of storm runoff in events exceeding one half of the Mean Annual Rainfall (MAR) depth (½ of 55mm, or 27.5 mm, in 24 hours).

Quantity of Storm Runoff

- 4.52 Runoff should be calculated by the Rational Method using the formula:

$$Q = \frac{A I C}{360}$$

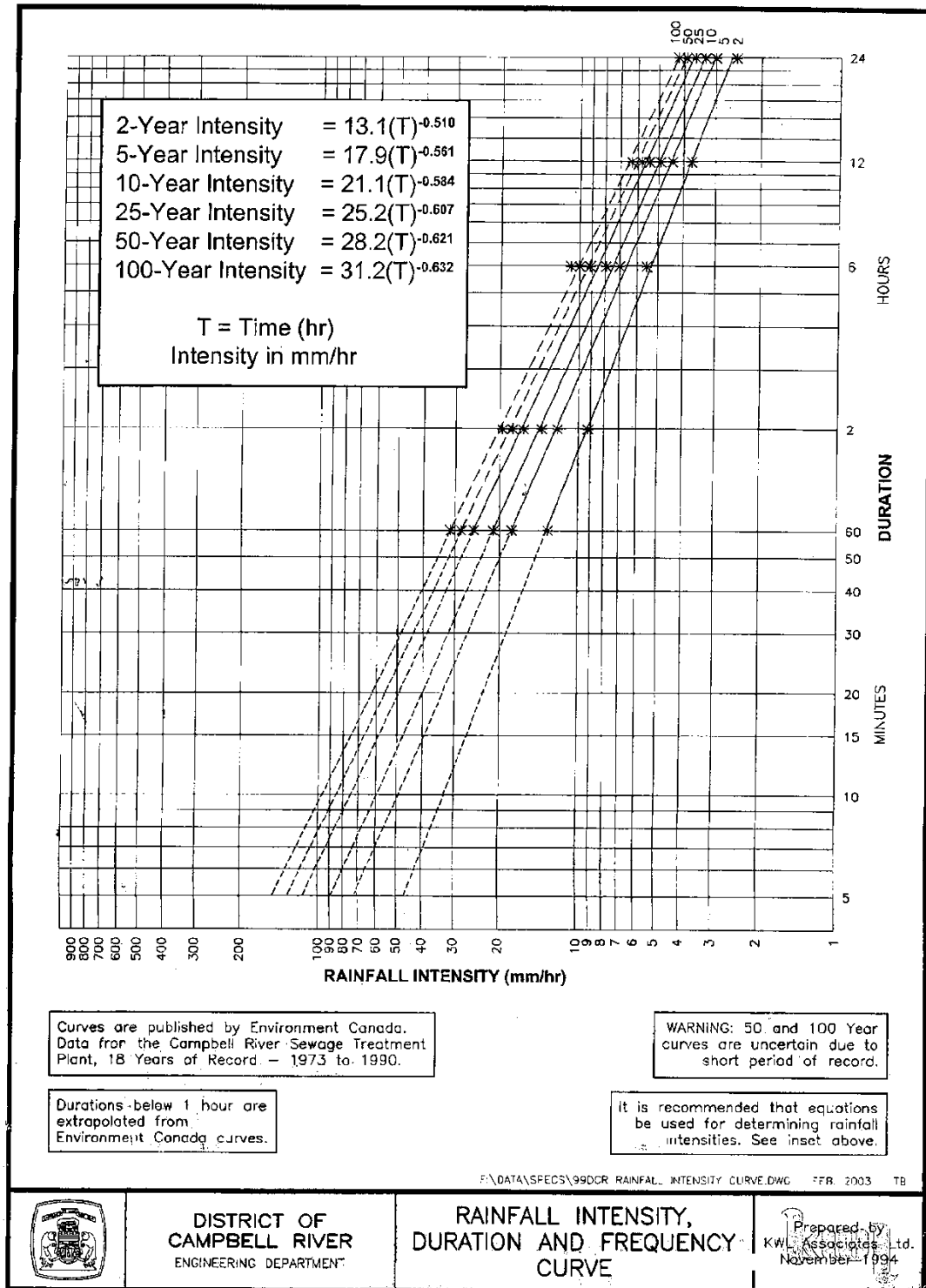
Q = Runoff in cubic metres per second
 A = Area in hectares
 I = Rainfall Intensity in mm/hour

C = Runoff coefficient, based on the actual topography and soil conditions, and should generally be as follows:

Grassland, Forest, Park, ALR	0.10 - 0.30
Schools, Developed Parks	0.40 - 0.60
Single Family Residential	0.30 - 0.40
Multiple Residential	0.40 - 0.60
Industrial	0.70
Commercial	0.70 - 0.90

- 4.53 The intensity shall be determined from the Rainfall Intensity Duration Frequency curve and equations shown in Figure 4-2.
- 4.54 Inlet times shall be determined in accordance with good engineering practice and individual site conditions. An inlet time of 10 minutes shall normally be used for single family lot areas. Inlet times in excess of fifteen minutes may only be used when that portion of the catchment area is in the Agricultural Land Reserve (ALR), or is otherwise prohibited from development.
- 4.55 Other approved methods of determining runoff may be by the Consultant if approved by the City.

Figure 4-2 – IDF Curve for Campbell River



Detention of Storm Runoff

- 4.56 All developments which are within the study boundary of a City approved stormwater or drainage plan must conform to the objectives and recommendations of the approved plan.
- 4.57 Where possible, stormwater runoff is to be directed to a regional detention system (whether existing or proposed) in an effort to maximize the tributary area of the regional detention systems. Where an engineering investigation concludes that connection to a regional system is not practical in the long term, independent drainage systems with direct drainage discharge to creek systems may be permitted, provided in all cases that water quality protection measures are provided to the approval of the City. Local stormwater detention will generally be required in such cases.
- 4.58 **Wet Detention Ponds** - see Drawings CR-S117, CR-S118, CR-S119, CR-S120, CR-S121, CR-S122, CR-S123 and CR-S124
- 4.58.1 Wet detention ponds, complete with a permanent low level pool, are the preferred method of stormwater detention, however, for small development parcels, where engineering studies have determined that wet detention ponds are not feasible, dry detention ponds, pipe-based, stormwater detention systems may be considered, but only if approved by the City.
- 4.58.2 In general, wet detention pond designs should maximize habitat and structural complexity in order to fully utilize the benefits offered by the wet detention pond while avoiding undesirable habitats with few species resulting from simple wet detention pond designs. Aesthetics and multiple-use aspects should be emphasized throughout the design.
- 4.58.3 All vegetation within the low level pool, pond and surrounding buffer shall conform to the detention pond landscaping criteria set out in this section, and Drawing CR-S124.
- 4.58.4 The surface area of the permanent low level pool should represent at least 1% of the total developed area.
- 4.58.5 The wet detention pond and outlet structure shall be designed such that the designed post-development discharge rate of the pond outflow does not exceed runoff levels generated by a pre-development 2 year storm event. If development is located within the boundary of a City approved stormwater or drainage plan, refer to the appropriate plan for approved discharge rates.
- 4.58.6 A primary spillway shall be designed to accommodate the post-development run-off generated by a 1:10 year storm event and an emergency spillway shall be designed to accommodate the post-development run-off generated by a 1:100 year storm event. The discharge path from the wet detention pond to the receiving environment shall be adequately protected from erosion.
- 4.58.7 The depth of the permanent low level pool shall be maintained between 0.6 m and 1.2 m.

- 4.58.8 The maximum depth of water during storm events shall not exceed 2.5 m.
- 4.58.9 A minimum freeboard of 0.6 m shall be provided above the designed maximum water level.
- 4.58.10 The wet detention pond shape combined with meandering channels in the permanent low level pool shall maximize the distance between the inlet and the outlet as per Drawing CR-S123.
- 4.58.11 The wet detention pond walls shall be constructed with a minimum interior side slope of 4 (horizontal) to 1 (vertical) and a minimum exterior side slope of 3 (horizontal) to 1 (vertical).
- 4.58.12 The top of the wet detention pond bank should be a minimum width of 3.0 m.
- 4.58.13 A pretreatment sump is to be provided at the inlet to the wet detention pond.
- 4.58.14 An oil/water separator structure or equivalent source control treatment set of BMPs such as infiltration swales, pervious pavements, or rain gardens is to be installed upstream of the pond inlet.
- 4.58.15 The flow control structure is to be constructed with a removable orifice plate sized to restrict flows to the pre-development 1:2 year storm event, and a riser sized to handle the post-development 1:100 year storm event as per Drawing CR-S122.
- 4.58.16 The flow control structure shall be located within a lockable manhole positioned within the embankment for purpose of maintenance, access, safety and aesthetics.
- 4.58.17 The design of the outfall structure shall be determined based on the exit velocity of stormwater runoff from the wet detention pond.
- 4.58.18 Safety is to be provided by managing the contours of the wet detention pond to eliminate dropoffs and other hazards and by discouraging access to the permanent low level pool with appropriate vegetation on the safety bench in accordance with the detention pond landscaping criteria and Section 8. The safety bench, located at the toe of the side-slopes leading to the permanent low level pool, is to be 2 m wide with a maximum slope of 3% and is required around the entire perimeter of the wet detention pond. Where safety benches cannot be accommodated, fencing may be considered, subject to the approval of the City.
- 4.58.19 A minimum of 4 signs shall be installed around the perimeter of the wet detention pond with the following wording:

Danger!
Water levels are subject to sudden change.
Please keep out.

For information, call the City of Campbell River Operations Department.
286-4033

- 4.58.20 A buffer strip of at least 7.5 m measured from the inside of the top bank is to be provided around the entire perimeter of the wet detention pond.
- 4.58.21 A minimum distance of 12 m shall be maintained between the inside of the top bank and any structure.
- 4.58.22 Where possible, the wet detention pond's perimeter should be maintained as a forested buffer. In cases where retention of forest is not feasible, the buffer is to be landscaped in accordance with the detention pond landscaping criteria below and Section 8 Landscape and Drawing CR-S124, with preference to native species.
- 4.58.23 An access tract or road sufficient to accommodate maintenance vehicles shall be provided from the public right-of-way to the outlet structure as per Drawings CR-S121 and CR-S123.
- 4.58.24 Pedestrian trails to City Standards may be included where applicable and desired, subject to City approval.

Detention Pond Landscaping Criteria

- 4.59 All planting and pond landscaping is to be completed in accordance with the conditions of Section 8 Landscape, as well as the clauses in this section.
- 4.60 Where feasible, plantings should consist of native plants.
- 4.61 All planting areas that are above permanent wetland pool shall be supplied with an automatic irrigation system in accordance with Section 9 Irrigation. Planting and soils design shall anticipate that the irrigation system will be shut off approximately 3 years after planting, once the plants are established.
- 4.62 Upon completion of basic excavation of the wet detention pond, topsoil / wetland mulch amendments are to be incorporated. 0.30 m - 0.15 m of topsoil and/or wetland mulch is to be added to all depth zones. (Wetland mulch or topsoil can be stockpiled on site during excavation as per Section 5 Erosion and Sediment Control.)
- 4.63 Grade to final elevations - after mulch and/or topsoil has been placed. All areas surrounding pond should be hydro seeded using a wet mix or other similar seed mix as prescribed by Section 8.
- 4.64 Provide standing time for wet pond - leave pond area for six to nine months to allow pond to experience storm flows. Details of the aquatic portion of the detention pond landscaping plan can be finalized using data collected during this time.
- 4.65 All landscape/revegetation work in pond and surrounding areas must be performed by a competent landscape contractor, preferably experienced in aquatic/wetland revegetation.
- 4.66 For the purposes of environmental design, the wet detention pond shall be divided into six zones (Drawing CR-S124):

Zone One - Deep water areas: includes the permanent pool of water that is greater than 0.3 m in depth. This zone to be vegetated with submerged aquatic vegetation.

Zone Two - Shallow Marsh areas: A permanently wet area with water depths of 0.3 m or less. This area is to be vegetated with emergent aquatic vegetation. As many emergent plants prefer a water depth of less than 0.15 m, these shallow areas should constitute 50% of the wetland surface area.

Zone Three - Shoreline Fringe areas: This zone is regularly flooded during periods of rain, but plantings in these areas must also withstand dry periods during summer months.

Zone Four - Riparian Fringe areas: This zone is infrequently flooded during periods of rain. Plantings must withstand both wet and dry conditions.

Zone Five - Floodplain areas: This zone is also infrequently flooded, yet soils often remain moist. Plantings must withstand both wet and dry conditions. Deep rooted species are well suited to this zone.

Zone Six - Upland Areas: This zone is seldom or never flooded. Selection of plant species for this zone should depend on local soil conditions and intended use of the area.

4.67 Planting specifications for wetland areas (Zones 1, 2 & 3):

- 4.67.1 Transplanting window for emergent wetland stock is from April through mid-June. Planting should not take place after this time as wetland plants need a full growing season to build root mass. Dormant rhizomes can be planted in fall or winter.
- 4.67.2 Plants should be ordered six months in advance to ensure availability of species.
- 4.67.3 Plant stock is to be kept watered and shaded prior to planting.
- 4.67.4 To ensure diversity of the wetland, 5 - 7 species of emergent wetland plants should be planted. Three of these species should be aggressive colonizers.
- 4.67.5 Wetland area should be planted according to depth zones. Individual plants should be planted 0.45 m on center within each zone, or as specified for each species.
- 4.67.6 Pond planting should be completed within one day if possible. Peat pots and containers should be removed or broken to allow for root penetration.
- 4.67.7 Plants should be firmly tamped into wetland mulch.
- 4.67.8 Pond should be drained prior to planting and filled immediately after planting.

4.68 Planting specifications for vegetated buffer areas (Zones 3, 4, 5 & 6)

- 4.68.1 Existing forested buffer zone should be retained wherever possible.
- 4.68.2 All buffer areas and slopes should be stabilized and seeded within fourteen days of excavation during dry conditions and immediately during wet conditions to minimize erosion.

- 4.68.3 Buffer areas should be planted and managed as a meadow / forest area to reduce the need for regular maintenance.

5 EROSION & SEDIMENT CONTROL

- 5.1 All developments within the City of Campbell River that create land disturbance that could be susceptible to erosion, other than agriculture or forestry that are under jurisdiction of the Province of BC, shall undertake erosion and sediment control (ESC) in accordance with this Part. Erosion controls (source controls) must be the primary control implemented on a construction site. Sediment control shall be implemented only to manage the residual sediment that occurs after effective erosion controls have been applied and sediment controls are not an alternative or replacement for effective erosion controls.

Performance Standards – Erosion and Sediment Control

- 5.2 Performance standards are intended for large, complex, unusual and innovative developments that create a disturbed area 2000m² or greater. Performance Standards set out general guidelines that designs must meet, but allow qualified professionals to determine the methods to meet the guidelines, subject to the written approval of the City. The prescriptive standards described in the following section should be a starting point for the development of any performance standards.
- 5.3 Performance Standards for Erosion and Sediment Control are:
- At the point of discharge from the development site stormwater runoff shall not exceed turbidity levels of 25 Nephelometric Turbidity Units (NTU) during dry conditions and 100 NTU during wet weather conditions. Where spawning areas are situated in the receiving waters, the stormwater runoff shall not, at any time, increase turbidity levels above background levels of the receiving waters.
- 5.4 The proposed system shall be 'equivalent' or better than the Prescriptive Standards.
- 5.5 Required Professional Qualifications for applicants using the Performance Standards approach for Erosion and Sediment Control Design:
- Certified Professional in Erosion and Sediment Control under the certification program administered by the BC Chapter of the Soil and Water Conservation Society and the International Erosion Control Association (IECA).
- 5.6 All developments using the Performance Standards approach shall require an Erosion and Sediment Control Plan (ESCP) that must:
- Focus on protecting the soil surface from erosion (source control) and capture all sediment on-site during each phase of the land development. This includes requirements to control the amount, water quality and velocity of runoff to ensure that no excessive sediment laden water is discharged, either directly or indirectly,

into the Municipal Drainage System or into watercourse features through a combination of best management practices

- Indicate the nature of the project, the potential for environmental impacts, anticipated soil type in all areas to be disturbed and the mitigation measures and monitoring process proposed
- Include phased construction plans, a site location map that distinguishes between primary erosion control techniques and sediment control measures
- Include the location and width of existing or proposed access(es) to the property and wheel wash facilities as required
- Include notes or specifications to provide adequate guidance for the contractor performing the work
- Include layout of the site and lot(s) that promotes use of pervious infiltration areas wherever possible
- Include property lines and other legal designations of the subject property with locations(s) of any existing/proposed lots, buildings, services, or connections to existing services from the site
- Show the location(s) of any existing drainage infrastructure and the proposed measures to protect it
- Include a multi-staged plan which shows the measures for erosion and sediment control during clearing and grubbing , the installation of services, and final works to be completed during the maintenance period
- Include a schedule of the maintenance and final decommissioning of ESC facilities, ponds, and source controls for each of the phases. This will include proposed re-vegetation and stabilization measures for restoring disturbed or exposed soil areas.
- Detail that all ESC facilities and works described in the plan be installed, constructed and operational in accordance with the approved ESC drawings before land disturbance begins. Preliminary inspection and sign off by the designated professional(s) will be required to ensure that ESC facilities and controls have been successfully installed in accordance with the ESC plan drawings
- Include sample and analysis of the water being discharged from the site. Where there is an exceedance of the allowable turbidity (NTU) levels, corrective measures are to be implemented immediately

- Specify environmental monitoring required to inspect at least once a day during construction in the wet season (October 15 – May 15), at least once a day during or within 48 hours after a significant rainfall event (>25mm rainfall per day or 10mm rainfall per hour), and once a week during the dry season (May 16 – October 14) and to carry out alterations if necessary. The qualified professional shall make a written record of their observations available to the City on request.
 - Be certified by the professional(s) who has prepared it
 - Name and provide contact information for the Environmental Monitor appointed to oversee the plan
 - Be reviewed and signed by the Environmental Monitor
 - Every construction site where an ESC Plan has been issued must have a waterproof copy of the ESC Plan, emergency contact information for the site owner, the designated ESC professional(s) and the designated Environmental Monitor for the site in a location visible from outside the construction site, for the duration of the construction project.
- 5.7 The developer and related contractor(s) shall comply with the requirements of the Environmental Monitoring Report(s) within 48 hours of the field review time, or such other time as listed in the Environmental Monitoring Report.

Prescriptive Standards – Erosion and Sediment Control

- 5.8 Intended for small or simple developments that create a disturbed area less than 2000m², Prescriptive Standards set out default best management practices described below that if used with good professional practice are pre-approved by the City.
- 5.9 Required Professional Qualifications for applicants using the Prescriptive Standards approach for Erosion and Sediment Control Design and Supervision:
- Certified Professional in Erosion and Sediment Control under the certification program administered by the BC Chapter of the Soil and Water Conservation Society and the International Erosion Control Association (IECA).

- 5.10 Exemptions: A Certified Professional in Erosion and Sediment Control is not required if the proposed land clearing is shown to the satisfaction of the City in writing to have no negative impact on watercourse habitat (includes streams, ditches and wetlands whether they are wetted or not and whether or not they are considered fish habitat) or the City storm drainage system taking into account the following factors: construction timing and schedule in relation to the Wet Season and the Dry Season; size and location of the proposed land disturbance with respect to the perimeter and sensitivity of the parcel of land on which the works will take place; the soil conditions on the said parcel; existing vegetation and growth; topographical conditions pertinent to drainage.

Required Erosion and Sediment Control Best Management Practices

- 5.11 Stop land disturbance (construction work) during rain.
- 5.12 A gravel access pad (3.6m wide, 15m long, composed of 50-75mm clean course aggregate, minimum depth of 150mm) for each proposed lot at the point of entry onto the lots from the roadway. They shall be constructed and maintained to minimize the migration of sediment onto the roadways.
- 5.13 Physically mark clearing boundaries on construction sites and ensure temporary fencing is placed around watercourse protection areas and any other designated environmentally sensitive areas or features as determined by a Qualified Environmental Professional.
- 5.14 Install and maintain perimeter ditches, swales, and interceptor ditches on plans that divert runoff away from cleared areas during phased approach and divert runoff into staged primary and auxiliary sediment traps or sediment ponds where appropriate, prior to discharge off site.
- 5.15 Vehicle/machinery access to and from the disturbed area shall be limited to the access pad, staging areas, or prepared working road to minimize soil disturbance.
- 5.16 Wheel wash facilities will be required for all lots during the wet season (October 15 – May 15).
- 5.17 Roadways fronting the disturbed area are to be swept free and cleaned on a regular basis (once a day or more frequently during rain events). Flushing of the roadway is prohibited.
- 5.18 Excavated/imported soils are not to be stockpiled or unloaded on road allowances, curbs, or sidewalks and if soils are stockpiled within the boundary of the lot, then the stockpiles shall be covered with polyethylene sheeting and weighted down. Breaks in the cover must be repaired immediately.
- 5.19 Concrete truck wash and construction wash of exposed aggregate surfaces is not to be directed into any watercourse feature or any storm drain system or catch basin.

- 5.20 All waters captured within foundations, sediment ponds, or when flushing sediment facilities and controls, shall be removed by appropriate sediment and stormwater management controls or by pumper trucks to ensure surface runoff and sediment discharge levels do not exceed NTU guidelines.
- 5.21 Temporary graded areas, such as housing lots, must be protected from erosion through the use of straw, mulch and/or polyethylene tarps in non traffic areas and a gravel cap in zones of construction traffic. Final graded or landscaped areas must have the appropriate permanent surface protection or landscaping in place as soon as possible.
- 5.22 Where slopes exceed three metres in height and are steeper than five percent, or where soil types consist predominantly of clays or fines, immediate surface protection using polyethylene sheeting or tarps must be used during the wet season or when rain events are forecast by Environment Canada within 24 hours. Surface protection should be well anchored to resist wind and prevent major leakage. Breaks in the cover must be repaired immediately.
- 5.23 All bare and exposed areas not under active grading require erosion control measures (tarps, mulches, rolled erosion control products etc) within 1 day in the wet season and within 1 week in the dry season or if rain is forecast within 24 hours or is present, All bare and exposed areas that will be left dormant for longer than 30 days are to be seeded and stabilized with vegetation species prior to October 15 where possible.
- 5.24 Install and maintain drop and / or curb inlet sediment barriers around any catch basins, on all road frontage catch basins and lawn basins collecting runoff from the construction site.
- 5.25 For the purposes of the erosion and sediment control plans and default best management practices:
- 'rain' means when Environment Canada reports rain in the City. Forecasted 'rain' is when this source predicts rainfall within the upcoming 24 hours. Does not include days of 'showers' as defined by Environment Canada.
 - 'wet season' means site works that create soils unprotected by vegetation cover in the period commencing October 15 of any year up to and including May 15 of the next year.
 - 'dry season' means site works that create soils unprotected by vegetation cover in the period commencing May 16 of any year up to and including October 14 of the same year.
 - 'watercourse' means any wetted area including streams, ditches and wetlands whether they are wetted or not and whether or not they are considered fish habitat

Erosion or Source Controls

5.26 Scheduling and staging

- Identify major construction and land disturbing activities in order to prescribe effective ESC practices prior to start of land disturbance and for all stages of construction
- Clear and grub in stages to maintain vegetation and minimize exposed soil
- Stop active work during rain
- After clearing, hold back grubbing tree roots until grading is to proceed as the root masses and groundcover provide substantial erosion control
- Complete mass grading work, as much as possible in the dry season
- On larger sites divide the project area into small catchment areas, complete grading and erosion control in one area before opening another
- Very large projects must include regular assessments and modifications to reflect changing conditions

5.27 Temporary Diversion Ditches and Berms, Drawing CR-ES101

- Limited to small catchments <2ha
- Swale, diversion (interceptor) ditches or berms can be used to help keep work sites dry by intercepting overland flow upslope of the active work area
- Can be used at crest of cut and fill slopes to intercept and prevent runoff over slopes
- Berms must be stabilized immediately after construction
- Because this technique concentrates runoff and increases erosion potential, ensure minimal (1%) ditch grades in erodible material or install erosion control lining or check dams
- Can be used for perimeter control around material stockpiles, note that stockpiles must also be covered or mulched
- Regular inspection and maintenance is required to remove sediment accumulations in created ditches
- Increase the erosion control performance of other BMPs (such as mulches or erosion control blankets) by controlling the amount of runoff flowing over a slope
- Sediment laden water must not be directed to watercourses or the storm drainage system unless runoff meets provincial or federal water quality guidelines

5.28 Slope Texturing, Drawing CR-ES102

- Maximum gradient 2H:1V and on slopes >8m in length
- Ensure slope lengths of 30m or less between slope breaks
- Roughens slope soils to minimize erosion and sediment production and encourage infiltration
- Techniques include machine tracking, contour ripping and ploughing
- Provides preferred sites for seed germination and growth
- Not suitable for loose soils or soils prone to compaction
- Post construction considerations, such as mowing, may prohibit the use of certain texturing methods

5.29 Mulch Drawing, Drawings CR-ES103 and CR-ES104

- All mulches are difficult to apply on steep slopes
- Organic mulches (compost, wood chips, straw) must be applied at recommended rates to ensure effective temporary control
- Most organic mulches persist for six months to three years
- Seed prior to mulch for long term stabilization
- Depending on mulch type, may be applied by hand or with construction equipment
- If susceptible to water or wind movement, anchor mulch by tracking or tackifier
- Topsoil mulch is limited to slopes 2H:1V or flatter and provides limited erosion control
- Inorganic mulches (gravel or rock blankets) can provide permanent erosion control and can be applied at most times of the year
- Topsoil stripped from a construction site can be reapplied to the site
- If mulch is for short term erosion control it can be used as a stand alone BMP – otherwise mulch must be used in conjunction with other BMPs
- Woodchips may produce deleterious substances detrimental to water quality or prevent /deter vegetation growth
- Inorganic mulches may prevent the establishment of a vegetative cover
- Topsoil mulch may be desirable where existing soil structure, depth, pH, or nutrient balance cannot be amended to provide an adequate growth medium for the desired vegetation

- Topsoil mulch is desirable when native, indigenous grasses and shrubs are desired and seeds or root fragments are “banked” in the soil

5.30 Rolled Erosion Control Products, Drawing CR- ES105

- Not suitable for rocky soils
- Seed prior to application for long term stabilization
- Product manufacturers can provide assistance to assure proper product is selected for slope and soil conditions as well as advising on product lifespan
- Successful installation requires site preparation to ensure intimate contact between product and soil (no roughening)
- Ensure blanket top is trenched in
- Blankets must be overlapped and anchored with staples due to susceptibility to movement by wind and water
- On slopes, concentrated runoff must not be directed over product

5.31 Straw Wattles, Drawing CR-ES106

- Slope application up to 1H:1V
- For use on slopes subject to very low sheetflow velocity and discharge
- For use on slopes susceptible to sheet and rill erosion, dry ravel and freeze/thaw activity
- Not appropriate for erosion or sediment control in concentrated flow (ditches)
- Good for slopes where other sediment retention structures (such as sediment fences) are not feasible
- Product application shall follow the manufactures detailed instructions
- Can be used with live staking as a bioengineering erosion control

5.32 Ditch Check Dams, Drawings CR-ES107, CR-ES108, CR-ES109

- The base elevation of a check dam should be the same level as the top of the check dam below
- For rock dams, rocks must be sized to resist displacement by flowing water; high volume or high velocity flows require design by a qualified professional
- Severe erosion may occur if the dam is undermined or outflanked

- Rock check dams are limited to ditches where the contributing drainage area is <4ha and maximum flow velocity is <1.5m/s and with gradient of 8% or less
- Sand bag and straw bale check dams are limited to drainage ditches where the contributing drainage area is <2ha with a gradient of 5% or less and flow velocities of <0.3m/s
- Straw bale check dams have a short service life of 6 months to one year; must be limited to a height of one bale (300mm) and require extensive maintenance after adverse weather
- Sediment laden runoff must be directed into sediment treatment structures (such as sediment retention ponds) and must not enter into watercourses or the municipal storm drainage system unless it meets provincial or federal water quality guidelines
- Additional sediment control measures will be required to capture and retain fine sediment
- Check dam application can provide effective channel erosion control where a continuous erosion control structure (such as lining the channel with rock) is not practical or desired
- Should not be used as a stand alone erosion control measure

5.33 Rock Channel Lining, Drawing CR-ES110

- Effective in ditches subject to higher flow velocities of 2-5m/s, with gradients >2% and with erodible soils
- Rock must meet specification for gradation (size range), durability and angularity; rounded, uniformly sized rocks should be avoided
- Rocks must be clean of fines
- Must incorporate a non-woven geotextile or a gravel blanket underlay to prevent entrainment and displacement of finer materials from the surface of the underlying soil layer
- Sediment laden runoff must be directed into sediment treatment structures (such as sediment retention ponds) and must not enter into watercourses or the municipal storm drainage system unless it meets NTU guidelines.
- Severe erosion may occur if a portion of the blanket is displaced
- Should not be used as a stand alone erosion control measure

5.34 Rolled Erosion Control Products in Ditches, Drawing CR-ES111

- Erosion control blankets provide protection in ditches for flow velocities <1m/sec until permanent vegetation is established
- Turf reinforcement mats provide protection in ditches for flow velocities <2m/s until permanent vegetation is established
- Turf reinforcement mats combined with established vegetation are appropriate for flow velocities <3m/s
- Product manufacturers can provide assistance to assure proper product is selected for gradient, discharge and soil conditions as well as detailed installation instructions
- Successful installation requires site preparation to ensure intimate contact between product and soil, not suitable for rocky soil
- Sediment laden runoff must be directed into sediment treatment structures (such as sediment retention ponds) and must not enter into watercourses or the municipal storm drainage system unless it meets NTU guidelines
- Should not be used as a standalone erosion control measure

5.35 Temporary Slope Drain, Drawing CR-ES112

- Use where runoff that collects above a cut or fill slope would cause severe erosion if allowed to spill over the slope
- Use in conjunction with diversion berms/ constructed ditches that collect and direct runoff along the top of cut and fill slopes
- Must be sized, installed and maintained properly to ensure function until permanent slope drain is installed, slopes are stabilized with vegetation or diversion ditch/berm constructed upslope has been removed
- Inlet and drain outlets must be properly constructed to prevent severe erosion
- Runoff after flowing through drain must be directed to a non-erodible area or into non-erodible structures designed to convey runoff through a construction site
- Sediment laden runoff must be directed into sediment treatment structures (such as sediment retention ponds) and must not enter into watercourses or the municipal storm drainage system unless it meets NTU guidelines
- Requires secure anchoring to slope
- Must not be used as a standalone erosion control measure

5.36 Energy Dissipater, Drawing CR-ES113

- Use at outlets of slope drains, culverts, conduits or channels with significant flow, commonly either precast concrete or riprap/geotextile
- Use where the discharge velocity from the water conveyance structure exceeds the permissible velocity of the receiving watercourse or disposal area
- Dissipaters should reduce runoff velocities to < 2m/s
- Rock must meet specification for gradation (size range), durability and angularity (rounded and uniformly sized rocks should be avoided)
- Rock must be clean of fines
- Sediment laden runoff must be directed into sediment treatment structures (such as sediment retention ponds) and must not enter into watercourses or the municipal storm drainage system unless it meets NTU guidelines
- Severe erosion may occur if a portion of the dissipater is displaced or if runoff has sufficient velocity after flowing over the dissipater
- Must not be used as a stand alone erosion control measure

5.37 Seeding

- Seed promptly after construction, no soil should be left unseeded for >30 days
- Grade to final contour, install other erosion and sediment controls, decompact subsoils 75 to 150mm depth, apply minimum of 50mm topsoil
- Consult specialist or seed distributor to determine appropriate seed mixture, application rates, seasonal planting windows; soil amendments may be required
- Seeding will be most effective if completed during seasonal planting windows
- Temporary erosion and sediment control measures must be applied and maintained until the vegetation cover is established
- Areas where seeding has not resulted in a stabilizing vegetative cover will require reseeded
- Seeded areas may require irrigation to ensure successful establishment of a vegetation cover prior to seasonal heavy rains
- Seed mixtures must compliment long term vegetation goals for site

5.38 Hydroseeding – Hydromulching

- Can be used to apply a number of complementary erosion control and soil amendment materials in one or more application

- Useful when seedbed preparation is impractical or an unacceptable level of soil disturbance would result from seedbed preparation
- Soil surface can be left irregular and applications can be used on steep or inaccessible slope where other seeding and mulching methods may be impractical or unsafe

5.39 Polyethylene Sheeting, Drawing CR-ES114

- Must be installed by hand to prevent tearing
- Used for short periods of inactivity or immediate erosion control of erodible surfaces during rain events
- Requires frequent inspection and maintenance to remain effective and not recommended as a long-term measure >45 days
- Continuous perimeter anchoring is critical for successful implementation
- Minimum sheet thickness should be 6 mil (6/1000 of an inch)
- Sediment laden runoff must be directed into sediment treatment structures (such as sediment retention ponds) and must not enter into watercourses or the municipal storm drainage system unless it meets NTU guidelines

Sediment Controls

5.40 Sediment Fencing, Drawings CR-ES115, CR-ES116 and CR-ES117

- Sediment fencing must be properly installed as per manufacturers' directions – improper installation is the major reason for ineffectiveness and failure of this BMP
- Drainage area should not exceed 0.1 ha per 30m of sediment fence
- Runoff flow path length upslope of sediment fence should be <30m
- Maximum slope gradient upslope of sediment fence should be 2H:1V
- Install on contour on nearly flat ground offset at least 2m from toe of slope
- Install in “J” or smile on contour to maximize ponding efficiency
- Maximum length of a single fence should be <40m
- Fences should be no higher than 0.6m
- Maximum sediment build-up should be less than ½ the height of the sediment fence or 0.2m

- Retained sediment must be removed when sediment contained exceeds 225mm in height and the sediment fence must be inspected and maintained on a regular basis
- Added support in the form of additional posts may be required to support large volumes of water that may be retained behind a sediment fence
- Useable life is one year if installed, inspected and maintained properly
- Should not be used as a control measure for fine textured soils
- Do not install in or across defined drainage, ditch or watercourse for flow or sediment control
- May be effective for sand and coarse silt

5.41 Sediment Retention Berm, Continuous Berm, Earth Dykes, Drawing CR-ES118

- Berm may have to be wrapped in geotextile
- Retained sediment must be removed and the berm must be inspected and maintained on a regular basis; maximum sediment build-up should be 1/3 the height of the berm
- Footprint of berm must be seeded after berm is removed
- Do not install in or across defined drainage, ditch or watercourse for flow or sediment control
- Not for use at locations where high discharge is likely to occur

5.42 Stabilized Worksite Entrance, Drawing CR-ES119

- All construction site entrances/exits that adjoin public roads must have a stabilized temporary gravel pad
- Constructed from 50-75 mm clean course aggregate to a minimum depth of 150mm
- Place geotextile fabric under pad to improve pad stability
- Pad should be the full width of the entrance/exit point and should not be less than 3.6m wide with a minimum length of 15m
- Avoid entrances with steep grades and entrances that enter public roads at a curve
- Aggregate must be maintained to ensure sediment and runoff is retained on site
- Sediment tracked onto public roads must be removed immediately

- Vehicle undercarriages and wheels must be washed to minimize amount of sediment being transported from site
- Additional measures to collect sediment from the gravel pads, such as sediment retention pond, are required

5.43 Drop and Curb Inlet Sediment Barriers, Drawings CR-ES120 and CR-ES121

- Drop inlet sediment barrier use is limited to: relatively flat areas (slope <5%) where runoff velocity and volume areas are low; contributing drainage <0.4ha; areas with sheetflow drainage and concentrated flows <0.014m³/s
- Drop inlets should have approximately 25m³ of sediment storage available per disturbed 0.4ha
- Curb Inlet sediment barriers are limited to gentle sloping paved streets where water can pond and discharge is very low at <0.01m³/s and sediment must be removed after each rain event
- Made from gravel filled sandbags or supported structures of filter cloth and drain rock
- Must be used in combination with other erosion and sediment control measures.
- Not suitable for locations where high discharge is likely to occur
- May not be suitable measure if water will pool on traveled roadway or extend beyond the construction site

5.44 Sediment Retention Pond Drawings CR-ES122 and CR-ES123

- Requires design by qualified personnel to provide adequate size for water and sediment storage (about 140 m³/ha)
- Locate at the stormwater outlet from the site but not in riparian areas or other environmentally sensitive areas as identified in Chapter 9 of the City of Campbell River Official Community Plan
- Design or use baffles to create a minimum of 3:1 length:width ratio (9:1 preferred) to allow sediment to settle
- During development, stormwater shall be routed through sediment basin/ponds as per Drawings CR-ES122 and CR-ES123 prior to entering the stormwater drainage system
- Ponds shall be designed to accommodate a minimum retention time of 40 minutes with a minimum drawdown time of 48 hours

- A primary spillway shall be designed to accommodate the post-development run-off generated by a 1:10 year storm event
- An emergency spillway shall be designed to accommodate the post-development run-off generated by a 1:100 year storm event
- The minimum sediment storage depth shall be 0.5m while the minimum live storage shall be 0.5m above the maximum designed sediment level
- A minimum freeboard of 0.6m shall be provided above the designed maximum live storage level
- The effective length to width ratio of the sediment control trap should be at least 5:1
- The pond walls shall be constructed with a minimum interior side slope of 2H:1V and a minimum exterior side slope of 3H:1V
- The top of the pond bank should be a minimum width of 3.0m
- A pretreatment sump is to be provided at the inlet to the pond
- Where required, the design of the outfall structure shall be determined based on the exit velocity of the stormwater runoff from the pond
- If sediment retention ponds will not provide the required NTU guideline levels or where lack of space does not permit adequate detention times, mechanical filtering devices or chemical agents (i.e. flocculants) may be required. Prior approval for flocculent use must be secured from regulatory agencies
- Accumulated sediment should be removed from each facility when it is determined that the facility is no longer effectively removing sediment and this work is to be performed only during dry periods
- Ponds shall be constructed during initial site development and shall be maintained by the developer until directed by the City, at which time the pond(s) are to be removed or retrofitted for use as stormwater detention ponds

6 UNDERGROUND AND OVERHEAD WIRING

Requirements and Options for Underground Wiring

- 6.1 This section applies to the installation of electrical, telephone and communications wiring, either overhead or underground.
- 6.2 In areas where there is no overhead wiring, and where subdivision or building is creating new wiring, all new wiring shall be underground.
- 6.3 In areas of existing roads and overhead wiring, refer to Map B that shows the City's priorities for undergrounding of existing overhead wiring. Referring to Map B:
 - Developments which front on 'High Priority for Undergrounding' roadways shall be required to construct on-parcel ducting and in-building provisions for underground connection to the future underground service at the street, to the satisfaction of the City. Developments with works and services on frontages of 45m or more shall also be required to underground wires on the fronting roadway(s).
 - Developments which front on 'Low Priority for Undergrounding' roadways may be serviced by either underground or overhead wiring from the building to the existing on-street overhead wiring.

Wiring Standards

- 6.4 In transition zones between underground and above ground wiring, the method of distribution shall be at the discretion of BC Hydro in accordance with good engineering practice and shall be approved by the City.
- 6.5 Underground wiring shall conform when required to the Canadian Electrical Code as revised and adopted by the Province of British Columbia, and to the requirements of the electrical, telephone and cable television utilities. The ducts and conductors should be laid in a straight line at a constant offset and a uniform grade. Where the road allowance curves, the ducts and cables may be laid on a horizontal curve at a constant offset. The location and offset of conductors along roads, lanes and walkways shall be in accordance with Drawings CR-R101 through CR- R122. Roadway crossings shall be laid in a straight line and, where possible, should be at right angles to the centre-line of the roadway. Design drawings shall be submitted to the City for approval before construction.

Street light service connections and distribution cables shall conform to these requirements wherever possible.

- 6.6 Surface and subsurface electrical, telephone and cable television appurtenances within roads shall be designed and located so as not to interfere with other street fixtures such as hydrants, catch basins and driveways. Such appurtenances should be located on the same offset as the cables they access, and must not be directly above water mains or water service connections. Above ground appurtenances shall not be installed within the right-of-way of any lane, walkway, or the access portion of any panhandle lot. Appurtenances may be installed in easements on private property.
- 6.7 Electrical as-constructed drawings shall show the locations of:
- all buried cables and underground ducts
 - all above ground appurtenances
 - all underground splicing and pull chambers.

7 STREET LIGHTING

General

Lighting Concepts and Illuminance Levels

- 7.1 The primary purpose of this Standard is to serve as a basis for design for fixed lighting systems for roadway lighting. These standards are guidelines and not intended to be a substitute for sound engineering knowledge and experience.
- 7.2 Streets within the City of Campbell River shall be designated as Lane, Local, Collector, or Arterial, in accordance with the Road Classification Network and Transportation Plan in the Official Community Plan.
- 7.3 Lighting requirements shall vary based on the street classification, and shall be based on using fixtures from the 'Approved Products List'. Minimum requirements for lighting shall be those shown in Table 7-2 – Illuminance Values and Uniformity Ratios and Table 7-3.
- 7.4 Required Roadway illuminance and uniformity ratios are based on the current edition of the ANSI/IES RP-8 – National Standards Practice for Roadway lighting and the MMCD Green Design Guideline Manual Section 6.0.
- 7.5 Street Lighting design shall meet the following minimum standards in accordance with the Development Standard designation for the parcel on Map A:
 - Rural Standards:** Street lighting shall be to rural standards as outlined in this section;
 - Urban Standards:** Ornamental street lighting shall be required in Urban Standards areas – and lighting standards shall vary based on the roadway classification of Lane, Local, Collector, or Arterial. Within Special Lighting Areas as shown on Map C, a performance lighting design shall meet the guidelines provided.
 - Streetscape Detail Areas:** custom lighting and wiring design of a neighbourhood that may include a mix of urban and rural standards on a block by block basis, all designed to meet the Performance Standards set out in this document. Determination of the acceptable standard for each block in Streetscape Detail Areas shall relate to the adjacent land use, shall be consistent within a given block, and shall be decided by the City.
- 7.6 This Lighting Design Standard includes a performance based option for larger projects and a prescriptive approach for small projects. Table 7-1 indicates when each method is permitted. Street Lighting design shall meet the following minimum standards in accordance with the Development Standard designation for the parcel on Map A: Refer to the Special Lighting Areas for design criteria for areas shown on Map C.

Table 7-1 – Lighting Design Method

Roadway	Approach
Urban Local - Low Density - Limited Parking	Performance(1) or Prescriptive
Urban Local - Low Density - Full Parking	Performance(1) or Prescriptive
Urban Local - High Density	Performance(1) or Prescriptive
Urban Local - Commercial (2)	Performance
Urban Local Industrial	Performance
Urban Collector	Performance
Urban Arterial	Performance
Rural Local Residential	Performance(1) or Prescriptive
Rural Local - Commercial / Industrial	Performance
Rural Collector	Performance
Special Lighting Areas	Performance

Notes: (1) Depending on size of project the City may require a Performance approach for these areas.

(2) Special design standards apply to commercial Special Lighting Areas indicated on Map C.

Performance Standards – Lighting Systems

7.7 Intended for large, complex, unusual and innovative developments, Performance Standards set out general guidelines that designs must meet, but allow qualified professionals to determine the methods to meet the guidelines, subject to the written approval of the City.

7.8 Required Professional Qualifications for applicants using the Performance Standards approach for roadway lighting;

Designs should be complete under the direction of a design professional that has the appropriate experience and is registered with the Association of Professional Engineers and Geoscientists of British Columbia.

- 7.9 Lighting calculations are based on the illuminance methods described in IES RP-8. Lighting calculations shall be done using appropriate software, (ex. AGI32, LumanMicro, or Visual) designed to carry out the required calculations using the luminaire manufacturer's IES photometric files.
- 7.10 Certified calculation drawings shall be submitted for review by the City showing, at a minimum, calculated average illuminance, average to minimum uniformity, isolux line showing adequate coverage on all areas of the roadway and manufacturer and catalog number of luminaires used in calculations.
- 7.11 Table 7-2 Required roadway illuminance levels and uniformity ratios are listed in Table 7-2 below.

Table 7-2 – Illuminance Values and Uniformity Ratios

Road Classification	Maintained average horizontal illuminance (lux) (1)	Average to minimum uniformity ratio not to exceed
Urban Local - Low Density	4	6:1
Urban Local - High Density	6	6:1
Urban Local - Commercial	9	6:1
Urban Local Industrial	6	4:1
Urban Collector	9	4:1
Urban Arterial	12	3:1
Rural Local Residential	4	6:1
Rural Local Residential	4	6:1
Rural Local Residential	4	6:1

Note: (1) Maintained levels shall include a total Light Loss Factor (LLF) of 0.75

7.12 Luminaire Types, Pole Heights, Spacing Criteria and Wattages

Table 7-3 – Luminaire Types, Pole Heights, Spacing Criteria and Wattages

Road Classification	9.0 m high davit pole with Flat Glass Luminaire	Post Top with Post Top Luminaire
Urban local - Low Density	One Sided 100W	Staggered 100W
Urban Local - High Density	One Sided 100W	Staggered 100W
Urban Local - Commercial (1)	One Sided 150W	Staggered 100W
Urban Local Industrial	One Sided 150W	
Rural Local Residential	One sided 100W	
Rural Local - Commercial / Industrial	One Sided 150W	
Rural Collector	One Sided 150W	

Note: 1) Use Metal Halide or alternative lamps acceptable to the City in commercial Special Lighting Areas indicated on Map B

- 7.13 Spacing and location of poles is governed by road width, road configuration, intersecting property lines, luminaire photometrics, mounting heights and required illumination levels.
- 7.14 Pole spacing is also governed by clearances to overhead BC Hydro power lines in accordance to the Canadian Electrical Code, Worker's Compensation Board and the BC Electrical Safety Act.
- 7.15 Generally, poles shall be arranged in a one sided or staggered spacing. In circumstances where BC Hydro power lines are in conflict with street light poles, single sided spacing may be considered if the required illuminance and uniformity ratios can be achieved. Alternate spacing must be approved by the City.
- 7.16 Where possible, locate poles on property lines to avoid driveway conflicts.
- 7.17 Street lighting ducts shall be installed behind the street lights where possible.
- 7.18 Where tying into an existing system or area luminaire types, wattages and mounting heights should match those previously installed unless they do not follow these guidelines.
- 7.19 Luminaire wattages, distribution and voltage shall be noted on the Design Drawings.

Special Lighting Areas

7.20 Map C indicates areas of Campbell River where special lighting is required. In these mixed use and commercial areas, lighting designers must use the performance design process to meet the following guidelines, to the approval of the City:

- Refer to Figure 7-1 for illustration of the fixtures to be used in Special Lighting Areas.
- Davit fixture shall be on 9.0m poles with ornamental brackets and banners.
- Post top fixtures shall be one of Option A or Option B, complete with banners, hanging basket brackets, electrical outlets and information and street identification signage in selected locations.
- Pedestrian level lighting is encouraged in commercial areas.
- All street lighting luminaires in Special Lighting Areas shall be metal halide or alternative acceptable to the City.
- Lighting fixtures, poles and brackets shall be powder coated aluminium.
- Lighting fixture and colour choice shall be coordinated to create a unified appearance within a given block or district, to the satisfaction of the City.

Figure 7-1 – Guidelines for Special Lighting Area Fixtures

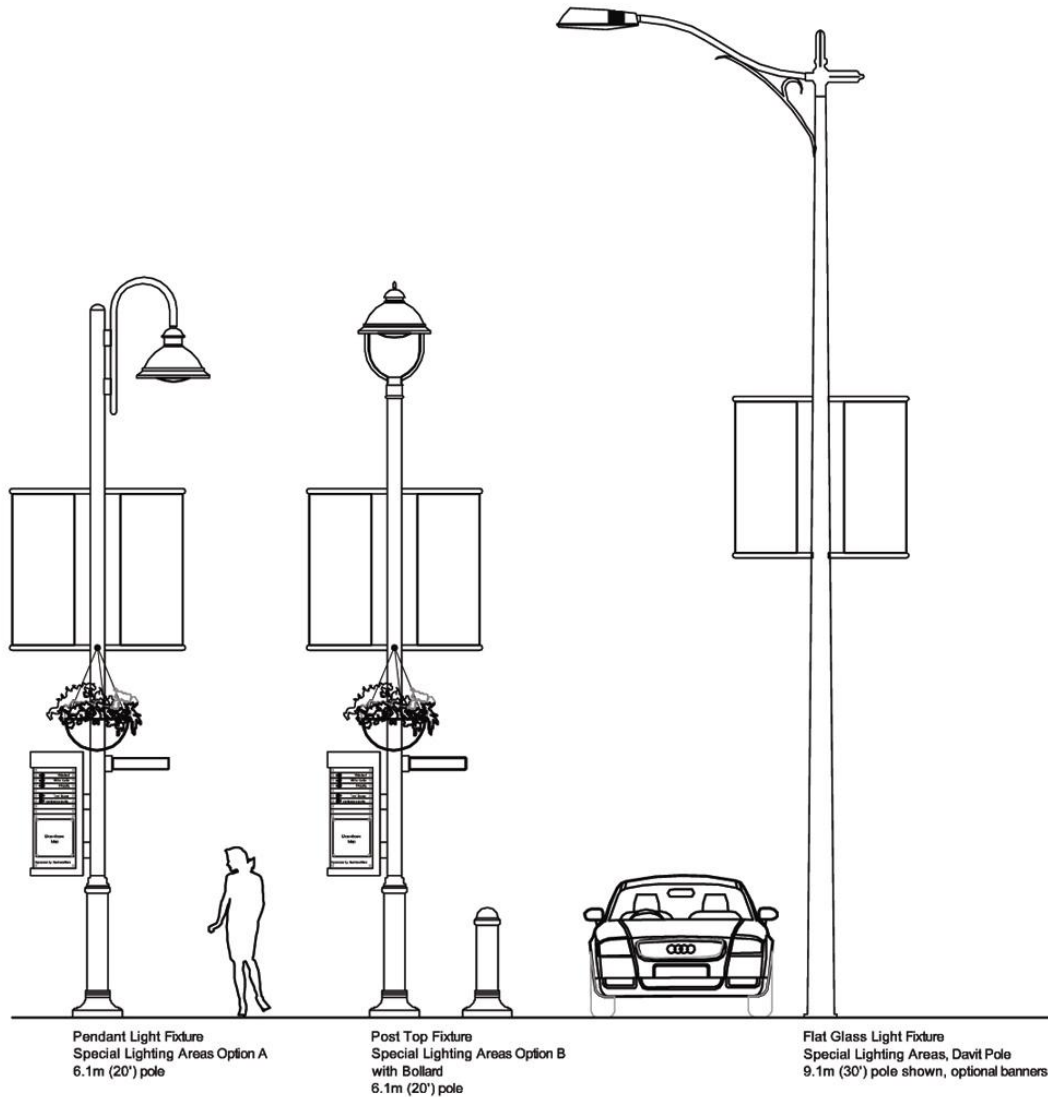
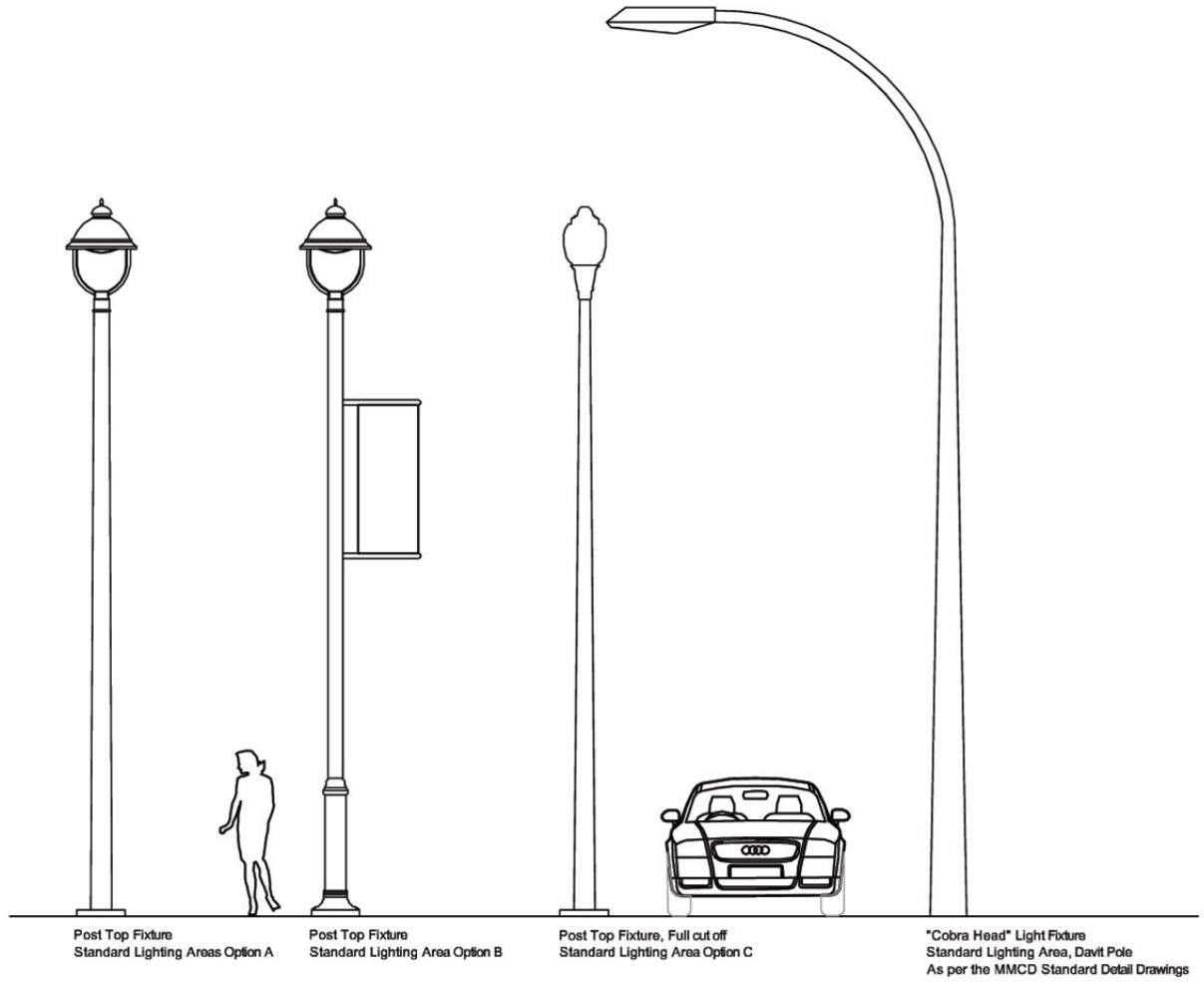


Figure 7-2 – Guidelines for Standard Lighting Area Fixtures



Standard Lighting Areas

- 7.21 Map C indicates areas of Campbell River where special lighting is required. Lighting outside these 'Special Lighting Areas' shall meet the following guidelines for 'Standard Lighting Area,' to the approval of the City:
- Refer to Figure 7-2 for illustration of the fixtures to be used in Standard Lighting Areas.
 - Davit fixture shall be on 9.0m davit poles with hot dipped galvanized finish in accordance with MMCD Section 26 56 01.
 - Post top fixtures shall be one of Option A, or B complete with banners and ornamental bases as an option for areas with a commercial component of land use, if their use is approved for the area by the City.
 - For post top fixtures, lighting fixtures, poles and brackets shall be powder coated aluminum.
 - For post top fixtures, lighting fixture and colour choice shall be coordinated to create a unified appearance within a given block or district, in accordance with the Approved Products List.
 - All street lighting luminaires in Standard Lighting Areas shall be high pressure sodium.

Prescriptive Standards – Lighting Systems

- 7.22 Intended for small or simple developments, Prescriptive Standards set out both specific rules and design details that if used with good professional practice are pre-approved by the City.
- 7.23 Documentation indicating compliance with prescriptive criteria (for example drawing indicating location, fixture type, wattage, and mounting height) shall be submitted to the City for review. Documentation shall be prepared by a Registered Professional Engineer licensed in the province of British Columbia
- 7.24 Fixtures shall be spaced as indicated in Table 7-4. Refer to the approved products list for guidance on accepted fixtures.

Table 7-4 – Spacing Criteria

Road Classification in Standard Lighting Area	9.0 m high davit pole with Flat Glass Luminaire with 100W HPS lamp	4.3m High Post with Post Top Luminaire with 100W HPS lamp, Option A, B or C
Urban Local - Low Density - Limited Parking	One sided, 60m	Staggered, 45m
Urban Local - Low Density - Full Parking	One sided, 60m	Staggered, 45m
Urban Local - High Density	One sided, 50m	Staggered, 30m
Rural Local Residential	One sided, 60m	

Design of Street Lighting

- 7.25 In underground wiring areas with ornamental street lights, davit poles shall be used on subdivision roadways at or near their intersections with arterial and collector roadways. Elsewhere within the subdivision post-top lights may be used.
- 7.26 Street light pole bases shall be designed in accordance with the table in MMCD Standard Detail Drawing E1.1.
- 7.27 Street lights shall be installed at every roadway intersection (two) and bend (one).
- 7.28 A mid-block street light shall not be located at the same lot line as a hydrant on the same side of the roadway. The restrictions on location of street lights apply equally to utility poles.
- 7.29 Street light bases shall be located on the offset shown in Drawing CR-R101 through CR-R122 for ornamental street lights in residential subdivisions with underground wiring.
- 7.30 Additional street lights shall be installed on walkways where there is not inter-visibility of the street lights at each end.
- 7.31 Street lighting ducts shall be installed behind the street lights where possible.

Protection from Vandals

- 7.32 Street light installation and testing shall be completed prior to commencement of the one year maintenance period. The Owner is responsible for damage occurring during the maintenance period.

8 LANDSCAPE

Scope of Application

- 8.1 These landscape standards and specifications shall apply to all landscape areas within City Rights-of-way (R.O.W.) (roadways) in the City of Campbell River including: medians, boulevards, soft landscape areas between the curbs and the property lines, and plantings in urban plaza and sidewalk areas. The general design and construction of the landscape shall be in accordance with the standards set out in this section.
- 8.2 Street Tree plantings shall be required in all subdivisions where new roads (including cul-de-sacs) or road extensions are required.
- 8.3 All Boulevard and Median (landscape) Areas within the road right of way shall be vegetated with fine grass sod, seeded fine grass, or densely planted groundcover in accordance with Part 8 Landscape. Rough grass or wildflower mixture may be used on background areas only subject to the approval of the City.
- 8.4 All landscape areas shall be provided establishment maintenance including watering, mowing, weeding, supplemental fertilization and litter pickup until acceptance by the City.
- 8.5 Use of Naturescape Principles (Naturescape BC, Caring for Wildlife Habitat at Home: Provincial Guide) in landscape development is encouraged.
- 8.6 All landscape development shall be guaranteed for 1 year from the date of acceptance by the City. Plants or other materials that fail in the guarantee period shall be replaced at no cost to the City.
- 8.7 Replacement trees shall be guaranteed for a further year after planting, with guarantees and replacements repeated until trees are provided that are acceptable to the City at the end of a guarantee period.

Driver Visibility and Clearance

- 8.8 Do not obstruct the line of vision at intersections within the triangular area bounded by the intersection of lot lines and a line joining each lot line 7 metres from their intersection.
- 8.9 The maximum mature maintained height for plant materials located within sight distance triangles at intersections shall be 300 mm above finish grade.
- 8.10 Specify trees near approaches to left turn slots, driveways or pedestrian crosswalks which can be pruned up from the base to a minimum height of 1.5 metres. Shrubs in these areas shall not exceed 300mm in mature height.
- 8.11 Locate trees a minimum of 1 metre distance from the pavement or curb face, unless planted in accordance with Drawings CR-L104, CR-L105, CR-L106 or CR-L107, urban trees in pavement.

- 8.12 Requirements for tree branch clearances are: 5m over the traveled portion of road and 2m over the sidewalk.

Performance Standards – Landscape Development

- 8.13 Intended for large, complex, unusual and innovative developments, Performance Standards set out general guidelines that designs must meet, but allow qualified professionals to determine the methods to meet the guidelines, subject to the written approval of the City. The prescriptive standards described in the following section should be a starting point for the development of any performance standards.

Performance Standards for Landscape Development are:

- Proposed designs must be 'equivalent' in performance to the prescriptive requirements.
- When alternates to standard tree planting details are proposed, the drawings shall include project-specific tree planting details showing, by plan and cross section:
 - Typical view of surrounding pavements, curbs, above and below ground utilities, light standards, and adjacent buildings and structures.
 - Typical details of proposed rooting environment including tree pit dimensions, sub-grade scarification, drainage structure if required, topsoil mix layers or 'horizons', root deflecting structure location and type if required, location and type of irrigation device and pipe, and soil surface treatment such as tree grate, porous pavement or other; and
 - Typical above ground details such as staking, special appurtenances, pruning for headroom etc.

- 8.14 Required Professional Qualifications for applicants using the Performance Standards approach for Landscape Design:

Landscape Architect (BCSLA)

Prescriptive Standards – Landscape Development

- 8.15 Intended for small or simple developments, Prescriptive Standards set out both specific rules and design details that if used with good professional practice are pre-approved by the City.

- 8.16 Required Professional Qualifications for applicants using the Prescriptive Standards approach for Landscape Design and Supervision:

For landscape value less than \$10,000: Landscape Architect (BCSLA), or Certified Horticultural Technician

For landscape value \$10,000 or greater: Landscape Architect (BCSLA).

Planting Details and Procedures

- 8.17 Drawings CR-L101 through CR-L107 shall specify the appropriate planting detail standard from the City of Campbell River Standard Details.
- 8.18 All planting shall meet the City of Campbell River Landscape Specifications.

Minimum Landscape Area Dimensions and Maximum Grades

- 8.19 The minimum width for grass boulevards shall be 1m, 1.5m or greater is preferable. Maximum slope for lawns from back of sidewalk to property line to be 3:1.
- 8.20 The minimum width for shrub or ground cover beds shall be 0.6 metre, 1m or greater is preferred. Maximum slope for shrub or ground cover beds to be 2:1.
- 8.21 The minimum width of boulevards for tree planting shall be 1.85 m measured from face of curb to sidewalk.

Topsoil Specifications

- 8.22 All topsoil is to conform to MMCD Section 32 91 21.
- 8.23 Topsoil stock piles shall be tested with results complying MMCD Section 32 9 21 2.4.1 and submitted to the City for review.
- 8.24 Minimum topsoil depth shall be 0.1m in all applications.

Plant Material Selection

- 8.25 All plant materials shall meet the following criteria:
- Plants shall have the ability to withstand adverse conditions such as airborne pollutants, maximum sun exposure and reflected heat from pavements, high winds and abrasive forces, occasional snow loading and exposure to salt from road clearing operations, and limited root zone soil volumes.
 - Plants shall be hardy to Zone 7 or colder.
 - Plants shall be capable of reduced water demand following a one year establishment period.
 - Plants shall have relatively low maintenance attributes including: fine to medium leaf size and canopy density; non-fruit bearing or having only berry-sized non-staining and non-toxic fruits; low susceptibility to disfiguring or fatal diseases and infestations; infrequent demands for pruning, fertilizing and other cultural requirements.
 - Plants shall be of appropriate size and form at maturity to meet criteria in Table 8-2

8.26 Lawns/Fine Grass, Rough Grass and Wildflowers:

- Sod or hydro seeding shall be used on all lawn/fine grass areas.
- Rough grass and wildflowers areas shall be seeded. Seeding method shall be noted on drawings.
- Areas to be seeded with grades greater than 3:1 and/or highly erodible soils shall be hydroseeded with a nurse crop seed mix, a hydraulically applied erosion control mulch, or erosion control blanket. Erosion control method to be noted on drawings.
- Seed mixes shall comply with the requirement within the British Columbia Landscape Standard.

8.27 Trees shall be selected such that:

- Boulevard or 'street' trees shall be of a single specie/cultivar on either side of the street within a given block. Median tree species may vary.
- Street trees species shall vary between intersecting streets. Street tree selection will be made with consideration of maintaining a diverse and varied street tree distribution across a neighbourhood, to minimize disease risks.

8.28 All street trees shall meet the following criteria:

- Compact or upward branching structure.
- Ability to withstand pruning for pedestrian, vehicle and/or building clearance without compromise to tree health or form.
- Absence of species/variatal characteristics of structural weakness, susceptibility to wind damage, or thin, easily damaged bark.

8.29 Select street trees according to proposed site conditions either from: Table 8-1, Table 8-2, Table 8-4, or Table 8-5 below.

- An alternative source provided that the proposed trees meet the site criteria contained within the relevant tables below and all other criteria contained in this section.
- Obtain written approval from the City for tree selections not taken from Table 8-1, Table 8-2, Table 8-3, Table 8-4, or Table 8-5 below.

Table 8-1 – Trees For Directly Under Hydro Lines

Minimum allowable soil volume per tree 4 cu.m. with 1 m depth pit.

Selection criterion for alternative trees not listed in Part 1: Mature height not greater than 7.62m.

SCIENTIFIC NAME	COMMON NAME
Acer griseum	Paperbark Maple
Acer ginnala	Amur Maple (tree form)
Acer platinoides 'Globosom'	Globe Norway Maple
Acer tataricum	Tatarian Maple
Maackia amurensis	Amur Maackia
Malus 'Adirondack',	Adirondack Crabapple
Malus 'Golden Raindrops'	Golden Raindrops Crabapple'
Malus 'Sentinel'	Sentinel Crabapple
Prunus serrulata 'Amanagawa'	Amanagawa Cherry
Prunus serrulata 'Kwanzan'	Kwanzan Cherry
Prunus serrulata 'Pink Perfection'	Pink Perfection Cherry

Table 8-2 – Trees For Beside Hydro Lines (Min. 2.75m Lateral Distance from Nearest Line)

Minimum allowable soil volume per tree 4 cu.m. with 1 m depth pit. Trees listed in Part 1 may also be used. Selection criterion for alternative trees not listed in Part 2: Mature spread not greater than 5m.

SCIENTIFIC NAME	COMMON NAME
<i>Acer platinoides</i> 'Columnare'	Columnar Norway Maple
<i>Acer platinoides</i> 'Crimson Sentry'	Crimson Sentry Norway maple
<i>Acer rubrum</i> 'Bowhall'	Bowhall Red Maple
<i>Carpinus betulus</i> 'Fastigiata'	Fastigate Hornbeam
<i>Ginkgo biloba</i> 'Princeton Sentinel'	Princeton Sentinel Ginkgo
<i>Fagus sylvatica</i> 'Fastigiata' ('Dawyckii')	Fastigate Beech
<i>Prunus sargentii</i> "Columnaris"	Columnar Sargent's Cherry
<i>Quercus robur</i> 'Fastigiata'	Fastigate English Oak
<i>Sorbus aucuparia</i> 'Rosedale'	Rosedale Mountain Ash
<i>Tilia cordata</i> 'Corzam'	Corinthian Linden

Table 8-3 – Trees For Limited Available Soil Volume (Min. 4 cu.m. per Tree, 1m pit Depth)

Trees listed in Table 8-1 or Table 8-2 may also be used. Selection criterion for alternative trees not listed in Part 3: Mature height not greater than 10m.

SCIENTIFIC NAME	COMMON NAME
<i>Acer campestre</i> (tree form)	Hedge Maple
<i>Acer circinatum</i> (tree form)	Vine Maple
<i>Acer platinoides</i> x <i>truncatum</i> cv.	Norwegian and Pacific Sunset Maples
<i>Fraxinus oxycarpa</i> 'Raywood'	Raywood Ash
<i>Pyrus calleryana</i> 'Redspire'	Redspire Callery Pear
<i>Sorbus aucuparia</i> ' Cardinal Royal'	Cardinal Royal Mountain Ash

Table 8-4 – Trees For Available Soil Volumes of 9 cu.m. per Tree or More, 1m pit Depth

Trees listed in Table 8-1, Table 8-2 or Table 8-3 may also be used. Selection criterion for alternative trees not listed in Part 3: Mature height not greater than 20m.

SCIENTIFIC NAME	COMMON NAME
<i>Acer rubrum</i> cvs.	Red Maple cultivars
<i>Gleditsia triacanthos</i> 'Shademaster'	Shademaster Honeylocust
<i>Quercus coccinea</i>	Scarlet oak
<i>Quercus rubra</i>	Red oak
<i>Robinia psuedoacacia</i>	Frisia
<i>Tilia x euchlora</i>	Crimean Linden

Table 8-5 – Trees For Wide Boulevard or Wide Median Use Only

Trees listed in Table 8-1, Table 8-2, Table 8-3 or Table 8-4 may also be used. Trees in this Part require a minimum available root zone of 20 cu.m. per tree with a minimum width of 3.5m.

SCIENTIFIC NAME	COMMON NAME
All non-dwarf coniferous spp.	
Fagus sylvatica (sp., & full size cultivars)	European beech
Liquidambar styracaflua	Sweetgum
Liriodendron tulipifera	Tulip tree
Platanus acerifolia	London Planetree
Quercus palustris	Pin Oak
Zelkova serrata cv.	Japanese Zelkova

Street Tree Size, Spacing and Location

8.30 Trees shall be minimum 5 cm caliper measured at 300mm above the rootball at the time of planting, and of uniform size if planted in a boulevard row.

8.31 Minimum number of boulevard trees shall be calculated as follows:

Tree Size Single Family

- Medium Trees (± 10 - 20m ht.) Greater of 1 per lot or 15m
- Small Trees (Under 10m ht.) Greater of 1 per lot or 10m
- Plantings of trees closer than 6m on centre shall require the written approval of the City.
- Locate trees at least 1m offset from the curb face.
- Locate trees fronting on single family lots in locations that avoid all utility service alignments and driveways. Generally this will lead to tree placement in the half of the lot frontage away from the driveway side, and not at either the lot centerline or at a lot line.

Minimum Setbacks for Trees

8.32 Setbacks for trees to objects shall be as follows:

Table 8-6 – Setbacks for Trees

SETBACK TREES FROM:	DISTANCE
Underground street light conduit or irrigation main	0.6m
Other underground utilities	1.2m
Lamp standards	6.0m
Steel and wooden utility poles	3.0m
Driveways	1.5m
Catch basins	1.5m
Manholes, valve boxes, services	1.2m
Sewer service boxes	1.5m
Fire hydrants	2.0m
Road intersection	7.0m
Curb face	1.0m
Sidewalk	0.85m
Buildings - fastigate (columnar) tree	2.0m
Buildings - regular crown tree	3.0-5.0m

Urban Trees in Pavement

- 8.33 Select urban trees in pavement in accordance with Table 8-1, Table 8-2, Table 8-3, Table 8-4, or Table 8-5 above.
- 8.34 Select and site urban trees in pavement to eliminate long term above-ground and below ground conflicts with utilities, buildings and structures, and pedestrian and vehicular traffic.

Planting Timing and Establishment Watering Provisions in Single Family Subdivisions

- 8.35 Street trees and landscape finish of the public road right of way fronting occupied homes shall be completed no later than the date that 85% of the homes in a single family development are completed and occupied. Earlier completion dates are encouraged provided that landscape maintenance and repair is provided at no cost to the City until such time as units are occupied.
- 8.36 Watering provisions are required for establishment of all street tree planting. A deep root watering system on public property shall be provided that meets the requirements of Part 9 Irrigation. Water supply and irrigation controller shall be provided in central location(s) in the subdivision, with valves and distribution piping designed in accordance with Part 9.
- 8.37 Irrigation sleeves shall be provided under all driveways or other paved areas to provide pipe access to all landscape areas in the right of way.
- 8.38 Planting of street trees in the hot dry summer period of June, July and August is discouraged, due to the risk of failure of the planting caused by heat and drought.
- 8.39 For planting in normal planting seasons, install a deep root bubbler system at each tree in accordance with Standard Drawing CR-I104a. If summer planting is necessary, meet the requirements of Drawing CR-I04b for the first summer dry period, and then reconfigure the irrigation heads to Drawing CR-I104a.

9 IRRIGATION

General Irrigation Design Requirements

- 9.1 Provisions for watering of planted trees, shrubs, groundcover and fine grass areas shall be made by the developer on all lands to be dedicated as road right of way to the City of Campbell River.
- 9.2 All Irrigation Design shall follow these guidelines:
- Irrigation of the City ROW, per block or other applicable spacing, shall be from a single service off the water main.
 - After the maintenance period the irrigation will be owned and operated by the City.
 - Boulevard trees, shrubs and ground covers shall be watered from an automatic irrigation system.
 - Landscape in medians shall be irrigated.
 - In grassed boulevards fronting institutional, commercial and multifamily residential uses with potential for heavy pedestrian traffic between the curb and sidewalk, grass areas shall be irrigated. Low traffic grassed boulevards in single family neighbourhoods may be installed without irrigation, but manual watering for establishment and maintenance is required. The City's decision on irrigation requirements for grass areas shall be final.
 - Urban trees in pavement shall be irrigated with an automatic irrigation system that shall include bubblers or drip elements.
 - Clear boundaries and edges of irrigated vs. non-irrigated area should be designed and maintained as such on every project.
 - Irrigation systems shall be designed to provide water conservation by employing a soil moisture probe, weather station, or other devices to override the controller during periods of adequate soil moisture or rainfall.
 - Sleeves shall be provided under sidewalks and driveways, and to medians / islands, as required for installation and maintenance of the irrigation system without removing surface paving.

Performance Standards – Irrigation

- 9.3 Intended for large, complex, unusual and innovative developments, Performance Standards set out general guidelines that designs must meet, but allow qualified professionals to determine the methods to meet the guidelines, subject to the written approval of the City. The prescriptive standards described in the following section should be a starting point for the development of any performance standards.

Performance Standards for Irrigation Development are:

- Performance Irrigation designs shall include a complete, professionally drafted, package showing the following:
 - Site plan showing all buildings, paving, walls, fences, contours or spot elevations, and general planting layout allowing differentiation between areas of rough grass, fine grass, shrub or groundcover area, and trees.
 - Irrigation plan, typical details and specifications coordinated with the site plan to show location of water supply, electrical supply and controller(s), point of connection and cross connection control, winterization provisions, water conservation provisions, all valves, pipes with sizing and grade, all heads and emitters.
 - Calculation of precipitation rate and watering times per circuit type and by season (spring, summer, fall), coordinated with Campbell River ET rate data and the City's watering restrictions. Provide timeclock settings for spring, summer and fall to show that all required watering shall be possible within the watering restriction hours.
 - Maintenance guidelines – including guidance on how systems can be readily monitored and repaired by maintenance staff – in particular for drip systems.

Performance Irrigation Designs shall be 'equivalent' or better to the Prescriptive standards.

- 9.4 Required Professional Qualifications for applicants using the Performance Standards approach for Irrigation Design:

Member of Irrigation Industry Association of BC, plus Certified Irrigation Designer

Prescriptive Standards – Irrigation

- 9.5 Intended for small or simple developments, Prescriptive Standards set out both specific rules and design details that if used with good professional practice are pre-approved by the City.
- 9.6 Required Professional Qualifications for applicants using the Prescriptive Standards approach for Irrigation Design and Supervision:

For irrigation installations of \$10,000 value or more: Member of Irrigation Industry Association of BC, plus Certified Irrigation Designer

For irrigation installations of under \$10,000 value: Member of Irrigation Industry Association of BC, plus Certified Irrigation Technician I or II.

- 9.7 Irrigation Systems shall be designed and installed in accordance with:
- Drawings CR- I101, CR- I102, CR-I103, CR-I104a, CR-I04b and CR-I105.
 - City of Campbell River Supplementary Specifications for Irrigation.

Irrigation Service Connections

- 9.8 Design service connections from City of Campbell River water main to, and including, water meter chamber, to be in accordance with Part 2 – Waterworks.
- 9.9 Install automatic shut-off devices on every system.
- 9.10 Required backflow prevention in accordance with Drawings CR-I101 or CR-I102.
- 9.11 Install flow sensors and master valves after the backflow preventer on every site.
- 9.12 Measure static water pressure at or near the point of connection and include with irrigation system design.
- 9.13 Install pressure regulating devices in high pressure situations.

Irrigation System Parameters

- 9.14 Maximum design flow velocity to be 1.5 m/sec.
- 9.15 Size pipes and valves for minimum friction loss.
- 9.16 Specify all irrigation components from a coordinated manufacturer's line listed in the Approved Products List.

- 9.17 Irrigations systems should be programmed to irrigate early in the morning or late at night and should be programmed with a minimum 4 (four) season schedule for both plant establishment and established landscape.
- 9.18 Irrigation systems should be programmed for multiple start times on a given zone.
- 9.19 Provide an isolation gate valve upstream of all automatic sprinkler valves and at regular intervals along the main line.
- 9.20 Valve boxes should be installed on (4) four bricks with 150mm of pea gravel set 50mm below the remote control valve.
- 9.21 Design head-to-head coverage for turf and shrub areas.
- 9.22 Design to water plant materials with different watering requirements (e.g. grass vs. shrub areas) on different valve circuits.
- 9.23 Design sprinkler circuits with matched precipitation heads. Do not mix heads with varied precipitation rates on the same circuit.
- 9.24 Design zones such that rotors have matched rates, patterns and spacing.
- 9.25 Rotor spacing should be spaced to 75-80% of the design radius recommended by the manufacturer.
- 9.26 Specify low flow heads for sloping areas.
- 9.27 Irrigation zones should be installed to follow the contours of the site. Avoid extreme elevation changes. If elevation changes cannot be avoided, install check valves to prevent low head drainage.
- 9.28 Where surface sprinklers are used, ensure unobstructed sprinkler coverage to tree bases from at least two sides.
- 9.29 Every drip circuit shall be designed with a filter, pressure regulator, flush valve and air relief valve. The drip component manufacturer's instructions for installation and maintenance shall be included in the project specifications.
- 9.30 Careful alignment of heads should be done during design and construction to avoid overspray on to adjacent structures, paving and properties.
- 9.31 Spray heads and nozzles should be installed no more than 150mm from the edge of any paving, fence line or planter edging.
- 9.32 Mitigate vandalism by installing heavy duty rotors and spray heads, valve boxes that lock and vandal resistant enclosures.

Irrigation System Maintenance

- 9.33 As-constructed irrigation plans shall be provided acceptable to the City prior to award of substantial performance

- 9.34 Maintain and repair irrigation systems for the duration of the maintenance period. Provide winterization and spring startup as required in the maintenance period.
- 9.35 After the maintenance period, provide Operating and Maintenance Manuals to the City which includes all current settings.

10 SIGNAGE, HANDRAIL, FURNITURE, FENCES, NOISE BARRIER

General

- 10.1 Part 10 of the Design Standards shall apply to all street developments, park sites and other public lands within the City of Campbell River.
- 10.2 The standard is separated into sections for each of performance standards and prescriptive standards. Table 10-1 indicates when each method is permitted.

Table 10-1 – Design Method

Item	Approach
Street Identification Signage	Prescriptive
Information and Wayfinding Signage	Performance
Basic Safety Handrail	Prescriptive or Performance
Appearance Safety Handrail	Performance (1)
Basic Fence	Prescriptive
Appearance Fence	Performance (1)
Noise Barrier	Performance (1)

Notes: (1) The City may introduce, in a future edition, a prescriptive design standard as an option.

Performance Standards – Signage, Handrail, Furniture, Fences, Noise Barrier

- 10.3 Intended for large, complex, unusual and innovative developments, Performance Standards set out general guidelines that designs must meet, but allow qualified professionals to determine the methods to meet the guidelines, subject to the written approval of the City. The prescriptive standards described in the following section should be a starting point for the development of any performance standards.

General Performance Standards

- 10.4 General Performance Standards applicable to signage, handrails, wood fence and noise barrier are:
- Signs, benches, other site furniture, handrails, fences and the like shall be installed plum. Where slope is to be taken up, preference shall be given for either leveling the grade at the base of the fixture, or stepping the top of long fixtures like handrails or fences.
 - A concrete pad or other method to reduce landscape trimming requirements shall be installed at all fixtures that are adjacent to fine or rough grass areas, to avoid an overgrown appearance.
 - If pre-manufactured products are used, they shall be selected from the City of Campbell River approved product list, or shall be approved by the City as an addition to that list. Preference shall be given to products that incorporate local, reused or recycled materials.
 - Metals shall be selected for corrosion and vandalism resistance. In general, aluminum with a powder coat textured finish is the preferred material for appearance items. Hot dipped galvanized is the preferred treatment for non-appearance items. Use of unfinished metals or metals subject to corrosion is not acceptable.
 - Wood elements shall be above both grade and the 'splash zone' for resistance to rot. Below grade, preference will be given for use of concrete, with suitable galvanized metal brackets to provide stability. Preference in wood elements shall be given to local (BC) materials and those that can be readily replaced or repaired if vandalized.
 - Plastics shall be resistant to breakage, scratching and UV degradation. Layered plastics shall be designed to avoid condensation issues.
 - Vertical concrete faces larger than 3 sq.m. that are exposed to public view shall be provided with an appearance finish: one of sandblast, bush hammer, exposed aggregate, stone, brick or other masonry veneer, to the satisfaction of the City.
 - All finishes shall be designed for attractive colour, texture and low maintenance. All finishes shall be capable of having 'tag' paint removed, and shall be scratch

resistant. Colours shall be black or earth tones in general. Use of primary colours as an accent is subject to the approval of the City.

- The City may require the following:
 - anti-skate devices
 - mid-bench handrails
 - provision of repair parts for non-local items.

Performance Standards for Entrance, Information and Wayfinding Signage

10.5 Performance Standards for Entrance, Information and Wayfinding Signage on public property, in addition to the General Performance standards, are:

- 10.5.1 Private Entrance Signage that is intended to mark the entrance to new subdivisions or other developments shall have arrangements for long term maintenance provided to the satisfaction of the City, e.g. by placement on private land or by easement over public land with designated maintenance by a responsible party, by contract or other agreement.
- 10.5.2 Design of private entrance signage shall be subject to the City Sign Bylaw #2476. When this signage is by easement on public land, the placement, design and construction shall be to approval of the City. The signage will be removed or replaced at the written request of the City.
- 10.5.3 Design of information and wayfinding signage on public land shall create a coordinated signage system on a given development or neighbourhood – such that the materials, scale, colour and graphics of the signs creates a unified visual appearance or variation around a theme. If such signage systems are being dedicated by a developer to the City, the signage system design and installation is subject to the City approval of a detailed signage system proposal.
- 10.5.4 Design of signage within Parks shall be to the City's satisfaction.
- 10.5.5 Use of neon, large areas of metal, and interior lit signs are discouraged.

Performance Standards for Handrail

10.6 Performance Standards for Handrail in addition to the General Performance standards, are:

- 10.6.1 Handrail away from buildings is sometimes installed when not warranted. Installation of handrail shall be limited to that considered absolutely necessary by the design professional, in accordance with the BC Building Code. In general, use of handrail away from buildings shall be questioned by the City if it is proposed in areas where:
 - Vertical drops are less than 600mm;
 - Structures are not in close proximity to sidewalks or other pedestrian areas, such that they are reached only by maintenance personnel.

- Design alternatives exist to reduce the vertical drop to less than 600mm, or to otherwise introduce terracing or other barriers such as culvert inlet and outlet safety grills that will provide public safety without the installation of a vertical handrail.
- 10.6.2 Handrail may be one of two types:
- Basic Safety Handrail, that is designed primarily for function and low maintenance;
 - Appearance Safety Handrail, that is designed to add aesthetic and character appeal to its safety function, but also with low maintenance.
- 10.6.3 When a handrail is warranted on public property, Appearance Safety Handrail design standards are required under the following circumstances:
- When handrail is necessary within the foreground (e.g. within 5m) of the view from a public road, trail or sidewalk.
 - In other highly visible locations as determined by the City.
- 10.6.4 Appearance Safety Handrail shall be custom designed to meet the following guidelines:
- Materials shall be highly durable, e.g. metals and composites, with preference for aluminum.
 - Finish shall be to a high standard of colour and texture, e.g. hot dipped galvanized.
 - Design shall be customized in plan and elevation to fit the site and context, regarding height, number of bars, graphic elements, post spacing, stepping of the top rail, etc.
 - Designs which graphically or creatively reflect the natural or cultural environment of Campbell River are encouraged.
- 10.7 When handrail is warranted on public property other than the circumstances identified above, Basic Safety Handrail shall be used, unless the use of Appearance Grade Handrail is proposed by the Applicant and approved by the City.

Performance Standards for Fences

- 10.8 Performance Standards for Fences, in addition to the General Performance standards, are:
- 10.8.1 Fences may be one of two types:
- Basic Fence, that is designed primarily for function and low maintenance;
 - Appearance Fence, that is designed to add aesthetic and character appeal to its function, but also with low maintenance.

- 10.8.2 When a fence is warranted on public property, Appearance Fence design standards are required under the following circumstances:
- When fence is necessary within the foreground (e.g. within 5m) of the view from a public road, trail or sidewalk.
 - In other highly visible locations as determined by the City.
- 10.8.3 Appearance Fence shall be custom designed to meet the following guidelines:
- Above-grade materials shall be wood, brick or stone masonry, or fencecrete of like materials. Use of 'replica' materials like shall be subject to approval of the City.
 - Foundation materials shall be concrete, with suitable structural connections to the posts or fence materials.
 - Finish shall be to a high standard of colour and texture, e.g. stained wood or natural masonry.
 - Design shall be customized in plan and elevation to fit the site and context, regarding height, material and shadow patterns, post spacing, stepping of the top rail, etc.
 - Designs which graphically or creatively reflect the natural or cultural environment of Campbell River are encouraged.
- 10.9 When fence is warranted on public property other than the circumstances identified above, Basic Fence shall be used, unless the use of Appearance Fence is proposed by the Applicant and approved by the City. Basic Fence may also be used at public parks where play structures or playing fields require separation from adjacent roadways.

Performance Standards for Noise Barrier

- 10.10 Performance Standards for Noise Barrier, in addition to the General Performance standards, are:
- 10.10.1 Berm or berm/noise wall combinations will be considered, with noise walls being the preference.
- 10.10.2 Noise barriers shall not be constructed in front yards of residences – site planning shall accommodate noise barriers on rear or side yards of residences.
- 10.10.3 Noise barrier walls or fences shall be constructed on public land.
- 10.10.4 Noise Barrier Wall or Fence shall provide a minimum surface density of 4 lbs/sq. ft.
- 10.10.5 All noise barrier shall effectively break a line of sight between the sound source and the sound receiver.

- 10.10.6 Noise barrier location shall respect sight lines at intersections.
- 10.10.7 Setbacks between sidewalk or other pedestrian spaces to noise barrier walls or fences shall be a minimum of 1.5m, unless otherwise approved by the City.
- 10.10.8 The space between sidewalk and noise barrier walls or fences shall be landscaped and maintained to an 'open space' landscape standard, at a minimum, as described in the BC Landscape Standard.
- 10.10.9 Berm slopes and landscape finish shall meet the requirements of Part 8 Landscape and Part 9 Irrigation.
- 10.11 Required Professional Qualifications for applicants using the Performance Standards approach for Signage, Handrail, Fences, and Noise Barrier Design:
- Landscape Architect (BCSLA)
 - Architect (RAIBC)
 - Sound Attenuation Specialist (P.Eng.) for Noise Barrier Performance

Prescriptive Standards

- 10.12 Intended for small or simple developments, Prescriptive Standards set out both specific rules and design details that if used with good professional practice are pre-approved by the City.
- 10.13 Required Professional Qualifications for applicants using the Prescriptive Standards approach for Signage, Handrail, Furniture, Fences, and Noise Barrier Design:
- Landscape Architect (BCSLA) or Architect (MRAIC)
 - or
 - Professional Engineer (P.Eng.)
 - Or
 - Graphic or Industrial Designer with Professional Draftsperson
- 10.14 Street Identification Signage shall be in accordance with Drawings CR-G101 and CR-G102.

10.15 Basic Safety Handrail shall be galvanized pipe rail in accordance with MMCD Standard Detail Drawing C14.

10.16 Basic Fence shall be chain link fence in accordance with MMCD Standard Detail Drawing C13.

11 GENERAL PROCEDURES

Procedures

- 11.1 The Owner shall be responsible for all the legal surveys in connection with the subdivision and shall prepare all the documents necessary for the registration of the subdivision.
- 11.2 The Owner shall engage a Land Surveyor to carry out all the legal land surveys required for the registration and final posting of the subdivision. All legal drawings and calculations submitted by the Owner shall bear the signature of the Land Surveyor.
- 11.3 The Owner shall provide statutory right of ways (SRW) in accordance with this Bylaw. Utility SRWs that contain one main shall not be less than three metres wide and utility SRWs which contain two mains shall not be less than five metres wide. Additional ROW to ensure maintenance vehicle accessibility to utilities for maintenance and replacement will be required. Such easements shall not be split on a property line. Where Municipal services are installed in SRWs, each pipe run shall be accessible to vehicles by an all-weather surface route. If additional access routes are required, they shall be a minimum of three (3) metres wide, described by a right-of-way plan and shall be registered against the title of the affected parcel or parcels.
- 11.4 The Owner shall provide sufficient legal land survey control during the construction of the subdivision to ensure the correct location of all works to be installed in the subdivision. Upon completion of the subdivision construction, the Owner shall cause his Land Surveyor to post each corner of each piece of property and easement contained within the subdivision and to install approved control monuments at the required locations.
- 11.5 The Owner shall retain a Consultant who shall be responsible for the design, preparation of drawings, layout, inspection and preparation of "As-Built" drawings for all services required to be installed by or on behalf of the Owner. Installations for power, telephone, gas and cable television will be designed and supervised by the appropriate authority having jurisdiction. The ultimate responsibility for compliance with all standards and specifications lies with the Consultant, and it is the Consultant's responsibility to coordinate all work involved. All contact with the City and private utility companies regarding design and construction shall be made through the Consultant. The Owner shall not change Consultants during the course of the work without notifying the City in advance.
- 11.6 The Consultant shall design and inspect the installation of services in accordance with these specifications and the rules of good engineering practice. Details of municipal practices and bench mark data may be obtained from the City.

- 11.7 Notwithstanding Sections 11.5, 11.6 and 11.16 where the owner is acting as the Contractor, an independent Consultant may be retained by the Municipality to inspect the installation of services in accordance with these specifications and the rules of good engineering practice. The cost of the said independent engineering shall be paid to the Municipality by the owner prior to the approval of the final subdivision plan. A onetime administrative charge will also be levied to the owner to cover the costs of processing the independent Consultants invoices.

Approval of Engineering Drawings

- 11.8 The design criteria contained in the City of Campbell River 2010 Design Standards and Master Municipal Specifications (MMCD) shall be considered minimum standards and shall not relieve Consultants of their professional responsibilities and from satisfying themselves as to the adequacy of their designs.
- 11.9 The Consultant shall submit to the City for approval an overall development plan and a topographic plan in accordance with the requirements of the Supplementary Specifications.
- 11.9.1 The Consultant shall submit to the City for approval detailed design drawings of the various works to be constructed together with:
- 11.9.2 Such calculations of sewer, storm drain and water system capacity and pipe loading as may be required to support the design, and
- 11.9.3 A plan prepared by a Land Surveyor showing locations of sufficient survey markers to enable utilities to be installed accurately, together with proposed locations for control monuments, and
- 11.9.4 Supporting documents to show the required statutory right of ways for the installation of services, and
- 11.9.5 Such other supporting documents as may be required.
- The City may waive this requirement under certain conditions.
- 11.10 One set of detailed design drawings bearing the approval of the City will be returned to the Consultant. No work shall be undertaken on the site prior to receipt of these approved drawings. No major departure shall be made from the approved design without the written approval of the City in the form of a letter or as a signature on revised drawings.

Permits

- 11.11 Approval of design shall not relieve the Consultant, Owner or Contractor from obtaining such other permits as may be required by other statute, regulation or Bylaw.

Construction and Inspection

- 11.12 The Consultant shall submit in writing to the City a tentative time schedule for the development of the complete subdivision showing the approximate time of commencement for each phase of the subdivision.
- 11.13 Prior to commencing any work on a phase of the subdivision development the Consultant shall submit a more detailed time schedule of the works to be constructed from land clearing to completion of roadway surface improvements.
- 11.14 The Consultant shall provide a list of all the contractors and sub-contractors which will be used to construct the works and services. The list shall also include the names of key personnel and their regular and after hours telephone numbers.
- 11.15 A copy of all approved drawings and other documents shall be kept on the site at all times during active construction periods.
- 11.16 The Consultant shall carry out the layout, inspection and approval of material and the inspection of installation of all services that are to be provided by the Owner and must be available at all reasonable times to visit the site when construction is proceeding.
- 11.17 The Consultant shall notify the City of shut-downs or start-up of work and shall provide a monthly status report by the 7th of each month outlining the work completed in the preceding month and any upcoming requirements for assistance from the City.
- 11.18 The City shall have access to the work at all reasonable times and may observe any part of the work or materials. Such observations shall in no way relieve the Owner from any obligation under this Bylaw.
- 11.19 The Consultant shall submit his testing reports to the City. The City may from time to time order such additional tests as he may consider necessary. The costs of such testing shall be borne by the Owner.
- 11.20 Should the City discover that any portion of the work and/or materials are not in accordance with these specifications, he may so advise the Consultant, who shall forthwith take remedial action. Should the Consultant not then be present at the work site, the City may advise the Consultant in writing that the particular work and/or materials will not be accepted by the City, with a copy of the notice to the Contractor. Upon receipt of such notice the Contractor shall forthwith cease the particular work, and shall not resume same until so ordered by the Consultant. Failure to provide such notice shall not constitute acceptance of such work and/or materials.
- 11.21 If, in the opinion of the City the construction causes an imminent threat to public health, safety, or the environment, the City has the right to require the contractor to stop work directly.
- 11.22 Underground services shall not be allowed to operate as part of the Municipal system until the installations have been inspected and tested by the Consultant and approved in writing by the City.

- 11.23 Applicants and their contractors shall follow the 'Good Neighbour' policy of the City, with letter notice to affected parties about construction operations.

Indemnity and Insurance and Guarantee

- 11.24 Where the Owner is to provide services in, on or to land in accordance with this Bylaw, he shall, except to the extent the same is caused by the gross negligence of the City or its servants or agents, save harmless and effectually indemnify the City against:
- 11.24.1 All actions and proceedings, costs, damages, expenses, claims and demands whatsoever and by whomsoever brought by reason of the construction and installation of all services herein described.
 - 11.24.2 All expenses and costs which may be incurred by reason of the execution of the said work resulting in damage to any property owned in whole or in part by the City or which the City by duty or custom is obliged, directly or indirectly, in any way or to any degree, to construct, repair or maintain.
 - 11.24.3 All expenses and costs which may be incurred by reason of liens for non-payment of labour or materials, Workers' Compensation assessments, unemployment insurance, Federal or Provincial Tax, and for encroachments owing to mistakes in survey.
- 11.25 The Owner shall at his sole expense throughout the currency of the work carry comprehensive liability insurance in the amount of at least Three Million Dollars (\$3,000,000) with insurance companies licensed to carry on business in the Province of British Columbia in partial discharge of its obligation under Clause 7.1 of this section and in every such policy of insurance the City shall be named as an additional insured with proceeds payable as the interests of the City and Owner may appear. Prior to commencement of the work the Owner shall furnish the City with a certified copy of every policy of insurance herein required.
- 11.26 The Owner shall indemnify and save harmless the City against all expenses and costs which may be incurred by the City as a result of faulty workmanship and defective material in any of the works installed by the Owner provided that such fault or defect is called to the attention of the Owner in writing within one year of the date of the City's Certificate of Completion.

Responsibility to the Public

- 11.27 The Owner shall provide all such barricades, lighting and signs as are necessary to protect the public while the works are being installed. In order to maintain traffic movements with the least possible inconvenience, the Owner shall construct and maintain where necessary such detours and barriers as may be required to allow the public to pass safely around the works being installed.

- 11.28 A road closure permit is to be obtained from the City if two lanes of unimpeded traffic cannot be maintained at all times.
- 11.29 The Owner shall, at his own expense, provide for the protection and uninterrupted service of all water courses, sewers, water pipes, drains, conduits, gas pipes, conductors and other services encountered during the progress of the work. Pipes and structures shall be properly supported or shored to prevent settlement, and excavation in their vicinity shall be done with care. Water courses shall be protected in accordance with the Department of Fisheries and Oceans, BC Environmental Protection Act and Section 01561 Environmental Protection. The Owner shall at his own expense at once arrange for the repair through the appropriate authority and make good any injury which may occur to any of these services or to any sidewalk, structures or property, as a result of his work.

Certificate of Partial Completion

- 11.30 A request to the City for a Certificate of Partial Completion may be made. The Consultant must submit a statement to the City certifying that the services have been installed and inspected and are in accordance with the drawings, and a request made for a Certificate of Partial Completion. The Consultant must submit a list of the incomplete and deficient works with an estimate of their value to complete which must include an allowance for repair of any works that are damaged from any cause during the period between the issuing of the Certificate of Partial Completion and the Certificate of Completion.
- 11.31 The following utilities must be complete in their entirety – water system, sanitary sewer system, storm drain system, and power and communication services. The roadway curb and gutter, base and sub-base must be complete. The as constructed plans and lot service records must be complete and submitted. The application shall state the undertaking of the Owner to complete the unfinished work prior to the expiration of the maintenance period for the water, sewer and storm drainage systems.
- 11.32 The Consultant shall prepare an erosion and sediment control plan to address the period between partial completion and final completion. The plan shall be in accordance with Section 5, and the applicant shall install, monitor and maintain the required erosion and sediment control works to the satisfaction of the City.
- 11.33 A maintenance surety to the satisfaction of the City shall be required to secure the works.
- 11.34 Upon receipt of such application and sureties, the City may issue a Certificate of Partial Completion.
- 11.35 Should the outstanding works listed in the Certificate of Partial Completion not be completed and approved before the date stipulated, the City may cause such works to be completed by others at the Owner's expense.

Certificate of Completion

11.36 Upon completion of the work the Consultant shall submit a statement to the City certifying that all the required works and services have been constructed, installed and inspected and are in accordance with the plans, the City of Campbell River Specifications and Standard Detail Drawings and this Bylaw, and request a Certificate of Completion. All payments for miscellaneous works to be done by City crews must also be received.

Upon receipt of such application together with:

- one set of mylar transparencies along with a digital copy of the drawings, showing the works as actually constructed with geodetic elevations, and
- completed service record cards showing the locations of sanitary, storm and water connections to each serviced parcel, minimum footing elevation and minimum underside floor elevation, and
- a list of parts installed, i.e. valves, meters, pressure reducing valves, backflow preventers, etc., including manufacturer, model, and with location shown on the CAD plan or provided by co-ordinates.
- maintenance security to the satisfaction of the City.

The City may issue a Certificate of Completion.

Maintenance Period

11.37 The maintenance period shall commence upon the date of the issuing of the Certificate of Completion, and shall terminate upon the date of issuing of the Certificate of Acceptance. The maintenance period shall be 12 months.

11.38 The Owner shall maintain the works in good operating condition for a period of 12 months following the issuance of a "Certificate of Completion". Where deemed necessary the City retains the right to extend the maintenance period. From time to time during the maintenance period, the City may give notice to the Consultant of any deficiencies and damage not resulting from normal wear and tear of the operation. The Owner shall forthwith correct the deficiencies and repair the damage. If the damage or deficiencies are not repaired or corrected forthwith upon written notice of the same the City may carry out the repairs and corrections at the Owner's expense.

11.39 The City may, at its option, any time within the maintenance period, carry out such repairs and correct such deficiencies, without notice to the Owner if, in the opinion of the City, the work must be done immediately because of a hazard of any kind to the public or to ensure the proper operation of the works considered defective or damaged. The City shall invoice the Owner for such emergency works undertaken and the Owner shall pay the cost of the City within thirty days of receipt of an account.

- 11.40 Not less than one month prior to the scheduled expiration of the maintenance period, the Consultant shall undertake a final inspection and provide a letter to the City confirming that the construction meets City standards and specifications, and that no deficiencies need rectified prior to release of the maintenance bonding. Should there be deficiencies, the Consultant shall state when they will be corrected and notify the City upon their rectification.
- 11.41 In the event that all deficiencies and work are not complete one week before the expiration of the Maintenance period, the securities will be drawn after notice has been given to the Owner or his agent, if other arrangements have not been made.

Certificate of Acceptance

- 11.42 At the end of the maintenance period, provided that all the deficiencies have been corrected and all monies due to the City have been paid, the City may issue a Certificate of Acceptance. Upon the issuance of such certificate the City assumes all responsibility for the works and services.

Abbreviations

- 11.43 References made to abbreviations and capitalized abbreviations for standard specifications for testing materials, manufacturing and installation procedures shall be as in MMCD Section 01 42 00.

12 SPECIFICATIONS FOR DRAWINGS

General

- 12.1 These specifications pertain to the preparation of the preliminary drawing and the complete set of drawings for the subdivision, or a phase thereof, including, as appropriate, the following:

Storm drains, sanitary sewers, waterworks, roadways, curbs, lighting, sidewalks, hydro, gas, telephone and cable television, culverts, street trees, bridges and other permanent structures.

Preliminary Drawing

- 12.2 The preliminary drawing of the proposed plan of subdivision should be at a scale of 1:1000, but other scales may be utilized subject to the approval of the City. The preliminary drawing submitted for preliminary approval need not comply with all the requirements of Part 12, but it shall show:
- 12.2.1 The outside boundary of the property to be subdivided, and the boundaries between phases (if any) of the proposed subdivision.
 - 12.2.2 The relationship of the subdivision to any adjacent existing or proposed roads.
 - 12.2.3 The dimensioned location and use of any existing buildings or other structures.
 - 12.2.4 The locations of any watercourses, including the high water mark or top of bank, and riparian zone.
 - 12.2.5 The locations and dimensions of all existing and proposed lot lines.
 - 12.2.6 The scale and date of the drawing and the direction of north.
 - 12.2.7 The locations of any existing easements or statutory right of ways.
 - 12.2.8 The location of any onsite utilities, water, storm or sewer mains.

Drawings

- 12.3 All drawings shall be completed using computer-aided design; the preferred format is the current release of AutoCAD used by the City.
- 12.4 The complete set of drawings shall clearly show the locations of all services, using offsets from property lines or boundaries of statutory right of ways. The general arrangement of the road cross-section and the utilities to be constructed within the right-of-way shall be in accordance with the City of Campbell River Supplemental Drawings. When existing utilities are already in place and in conflict with these standards, a special design and the City's approval is required.

- 12.5 Elevations shall be relative to geodetic datum. Bench mark locations and elevations may be obtained from the City. A minimum of 2 monuments shall be shown on each set of drawings.
- 12.6 All drawings shall be in metric measurement; all dimensions shall be shown to the nearest 10 mm. All elevations shall be shown to the nearest 10 mm except critical sewer elevations which shall be shown to the nearest 5 mm.
- 12.7 Where a City of Campbell River standard plan exists it shall be sufficient to refer to the appropriate plan by reference number and date of issue. Where a standard plan does not exist, or is unsuitable for a particular case, detail drawings shall be prepared to conform generally with these specifications and so as to portray accurately the variance elements of the installation.
- 12.8 Each plan view shall show sufficient grid reference points to permit the works to be related to Integrated Survey Area No. 28, Campbell River.
- 12.9 Drawings shall bear the seal of a qualified Professional Engineer licensed to practice in British Columbia.
- 12.10 Detention pond landscaping plans shall be prepared by either a registered Landscape Architect or a qualified Consultant and shall be submitted with all other engineering drawings.
- 12.11 The Consultant shall submit such plans as may be required by Provincial and Federal Agencies having jurisdiction over the subject improvements. Copies of required approvals and/or permits and a print of each approved drawing shall be submitted to the City. Copies of drawings prepared by private utility companies and associate consultants shall be reviewed and certified by the Consultant as having been coordinated with all other works and services to be constructed.

Preparation of Drawings

- 12.12 Drawings should normally be prepared on standard sheet with 841 mm x 594 mm outside dimensions. The City's standard legend shall be utilized (a digital copy is available on disk).
- 12.13 The title and revision block shall be located in the lower right corner of the drawing and shall contain a space where the City reference number may be entered. The following information shall be shown on all plans when applicable.
 - lot and plan number, title block and north arrow, road names
 - existing and proposed rights-of-way and easements
 - lot lines substantially as shown on the approved preliminary layout plan

12.14 The following scales should normally be used:

Plan Description		Preferred	Acceptable
Location Plan	Horizontal	1:5000	
Overall Development Plan	Horizontal	1:1000	or 1:500
Topographic and Existing Structures Plan	Horizontal	1:1000	or 1:500
Catchment Area Storm Water Control Plan	Horizontal	1:1000	or 1:2500
Detention pond landscaping Plan	Horizontal	1:500	or 1:1000
Lot Grading Plan	Horizontal	1:1000	or 1:500
Plan/Profile	Horizontal	1:500	
	Vertical	1:50	
Cross-Sections	Horizontal	1:100	
	Vertical	1:25	
Structural Details		1:20	or 1:10

12.15 Both plan and profile must be referenced to a property line or road centreline; the lower half of the plan/profile sheet shall be the plan view.

Description of Subdivision Plans

12.16 A complete set of drawings of the subdivision shall consist of the following:

- Location Plan
- Overall Development Plan
- Topographic and Existing Structures Plan
- Catchment Area and Storm Water Control Plan
- Detention pond landscaping Plan
- Lot Grading Plan
- Roadworks and Waterworks Plans and Profiles
- Sanitary and Storm Sewer Plans and Profiles
- Detail Plans
- Street Lighting Plans

- Landscape Plans
- Irrigation Plans

12.17 Where good cause can be shown, one or more of the above plans may be exempted upon receipt of written approval from the City.

12.18 The Consultant shall submit additional design drawings as requested by the City where other specialized engineered structures are required.

Location Plan

12.19 The Location Plan shall show the location of the project relative to the surrounding district; it shall show a north arrow and major road names.

Overall Development Plan

12.20 The purpose of the Overall Development Plan is to show the general layout of the subdivision and the relation of the various utilities to each other. Details of these utilities shall be shown on the plan/profile sheets. The Overall Development Plan shall show:

- all existing and proposed legal lines, easements, roadworks, public and private utilities, street trees and community mail centres in the subject phase and any future phases.

Topographic and Existing Structures Plan

12.21 The Topographic and Existing Structures Plan shall show the locations of all buildings and structures to be retained, all natural boundaries such as steep banks, watercourses and areas of unstable soil on and adjacent to the subdivision. Where the slope of the existing ground is in excess of fifteen (15) percent contour lines at two (2) metres or less spacing shall be shown, with major contours (every 10 metres) in bold.

Catchment Area and Storm Water Control Plan

12.22 The Catchment Area and Storm Water Control Plan shall show the whole of the drainage catchment area to the point of discharge to a trunk storm sewer or natural watercourse. The plan shall show the design runoff coefficient, area and flow. Required upgrades to downstream drainage structures shall be shown as far as the receiving trunk storm sewer or watercourse.

This plan shall show the location of the major storm-flow route(s).

Detention Pond Landscaping Plan

- 12.23 The detention pond landscaping plan will contain the location, quantity and planting methods for the wetland and buffer areas. It shall also include information on site preparation methods, as well as a schedule for maintenance during the first growing season.
- 12.24 The detention pond landscaping plan may be refined and adjusted during construction subject to City approval in order to adapt to changing field conditions.
- 12.25 Detention pond landscaping plans shall be submitted for review and approval as part of the stormwater control plan and shall include the following information:
- plan view of area, detailing pond location and surrounding areas.
 - details showing each zone and depth.
 - details indicating how aquatic and terrestrial areas shall be vegetatively stabilized.
 - locations and quantities of wetland plants to be planted in each appropriate zone.
 - locations and quantities of native plant species and grasses to be planted in each appropriate zone.
 - a list of wetland plants, showing total quantities, sizes and spacing.
 - a list of native plant species and grasses to be planted in buffer and surrounding areas, showing total quantities, sizes and spacing.
 - location of maintenance access.
 - a detailed program for the care and maintenance of the landscape for one growing season after the original planting.
- 12.26 Final detention pond landscaping plans (working drawings) showing all major or minor changes from the detention pond plan may be required when all construction has been completed and prior to planting. Final detention pond landscaping plan should reflect altered depths and availability of wetland stock. Areas for planting must be shown on the design plan, or as-built and also located in the field.
- 12.27 Prior to the final approval of the subdivision by the Approving Officer, a letter of credit or cash in the amount of 125% of the cost estimate (based on the Detention Pond Landscaping Plan) shall be deposited with the City of Campbell River. Upon Municipal approval of the completed revegetation works, the securities will be released less 10%. The 10% shall secure the guarantee of all materials and the revegetation performance for the period of one year from the date of final acceptance.
- 12.28 All revegetation work required by the City shall be maintained in good condition by the developer until the guarantee has expired. During this time the developer is responsible for all work and maintenance, repairs and plant replacements. Plantings that do not survive shall be replaced to the size and value as specified in the approved Detention Pond Landscaping Plan.

Lot Grading Plan

12.29 The Lot Grading Plan shall show the post-development ground elevation at each corner of the lots and at any breakpoints, the elevations of centre-line or roadways, and the locations of storm drain inlets. For each lot it shall show the minimum base of footing elevation, and the minimum underside of floor joist elevation of the building to be constructed thereon and, where necessary, details of the grading around it to direct surface water away from the building and any other necessary grading or drainage features. Where such building is adjacent to or liable to be affected by a major flow flood path, the highest elevation of the major hydraulic grade line opposite such building shall be shown.

12.30 Where any design ground elevations are below top of curb, the plan shall show the method of disposition of surface water.

Roadworks Plans & Profiles

12.31 Plans and profiles shall be shown for all proposed roadways, utility rights of way, walkways, trails and bicycle paths. Where a new roadway is the continuation of an existing roadway or where the work may be extended at a future date the plans and profiles shall extend a minimum 50 m beyond the work to be constructed.

12.32 The following information shall be shown on the plan:

- all roads including sidewalks, walkways and emergency access routes, their widths, and their offsets from property lines. The roadway width shall be measured between the curb faces (low point in gutter). Where a sidewalk is constructed adjacent to a vertical curb, the curb width shall form part of the sidewalk width.
- details of intersections with spot pavement and gutter elevations at all critical points.
- curb returns and cul-de-sac bulbs, complete with spot gutter elevations.
- hydrant, pole, electrical kiosks, and mailbox locations.
- locations of catch basins referenced to centreline chainage, and catch basin rim elevations.
- typical cross-section if different from standard plan.
- locations of street name signs and traffic control signs.
- locations of traffic islands, retaining walls, guardrails and barricades.

12.33 The following information shall be shown on the profile:

- the existing ground profile and finished pavement profile at true centreline length projected above the plan in as close a relationship as possible.
- percent grade to two decimal places.
- station and elevations of BVC, EVC and PVI.
- length of vertical curve.
- elevations along the vertical curve at intervals not exceeding 7.5 metres.

- elevations and stations of low or high spots of vertical curves.
- where the levels of existing ground vary considerably across the right-of-way, cross-sections shall be shown at intervals not exceeding 15 metres.

12.34 On crossfall sections, a profile should be shown for each gutter and the elevation of each gutter should be shown either on the profile or in tabular form.

Waterworks Plans & Profiles

12.35 Where both roadways and waterworks are required, the two plans and profiles may be combined.

12.36 The following information shall be shown on the waterworks plan:

- locations of existing and proposed pipe centreline, pipe size, type and class, hydrants, valves, thrust blocking, fittings and all related appurtenances in relation to road, easement and adjacent property and lot lines.
- location where the mains terminate.
- the extent of work required by the Municipality in making the connection to the existing water main.
- locations of service connections. Connections not conforming to the standard offset require a reference to a lot line.
- if mains are to be connected to existing mains without a valve, a note must be made as to isolation procedures during testing and flushing.

12.37 A water main profile is only required where there is a conflict with other utilities and/or the pipe is not to be laid at a constant depth of 1.2 metres below the finished grade.

12.38 The following information shall be shown on the profile:

- profile line of the existing and finished grade above the pipe, and the crown profile of the pipe.
- pipe deflections and bends.
- other utilities crossing the water main.

Sanitary and Storm Sewer Plans & Profiles

12.39 The sewer plans shall show the tie-in to existing systems and provision for future extensions where appropriate. Sanitary sewer manholes shall have alphabetical identifications. Storm sewer manholes shall have numerical identifications.

12.40 The following information shall be shown on the sewer plan:

- locations of the pipe centreline, manholes, cleanouts, and other appurtenances in relation to road, easement and adjacent property and lot lines.

- locations and invert elevations of service connections at property line. Connections not conforming to the standard offset require a distance from an iron pin or lot line.
- existing and proposed power and telephone poles.
- dimensions of easements.
- elevations of the existing ground at the centre of the lot.
- horizontal curve information as detailed under Roadworks when curved sewers are proposed.
- locations of ditch lines, culverts and ditch inverts when they are to be retained.*
- culvert diameter and invert elevations, details of intake and outlet structures. *
- structural details of all manholes not covered by City standard plans.
- existing buildings to be connected to the sewers, and existing building sewer outlets, if any.
- direction of flow.

* Show only on storm sewer plans.

12.41 The following information shall be shown on the profile:

- the profile line of existing and proposed finished road grade above the pipe, and the inverts of the proposed sewers at all manholes or changes in grade.
- size, type and class of pipe.
- distance between manholes, and manhole rim elevations.
- distance between manholes and cleanouts.
- percent grades to two decimal places.
- invert elevations of inlet, outlet and branch lines at manholes.
- other underground utilities crossing the sewers.

Detail Plans

12.42 Detail plans of structures such as special manholes, or outlet structures shall be shown on the appropriate plan or on a separate sheet.

Street Lighting Plans

12.43 The following information shall be shown on the Street Lighting Plan:

- street light pole locations and type.
- luminaire type and wattage.
- effective coverage of the street light, shown as a dashed circle (isofoot candle curve)
- street light conduit locations and offsets.
- street light service panel locations.
- location of power source.

- locations of existing and proposed hydro and telephone poles.
- size of ducts, type and size of wire.
- location of grounding points.

Landscape Plan

12.44 The following information shall be shown on the Landscape Plan:

- property lines
- buildings, edge of pavement, curblines and curbs, sidewalks, lighting fixture locations, surface utilities and related service boxes or other elements that would affect the landscape and street tree location.
- Location of all existing vegetation to remain.
- Location of retaining walls and slopes that exceed 3:1 vertical.
- Location of all proposed trees, shrubs, ground cover and lawn areas.
- Indication of which areas will be seeded vs sodded lawn.
- Plant list showing botanical name, common name, size at planting, quantity, typical spacing, and root zone volume of supplied growing medium for trees.

Irrigation

12.45 The following information shall be shown on the Irrigation Plan:

- property lines
- buildings, edge of pavement, curblines and curbs, sidewalks, lighting fixture locations, surface utilities and related service boxes or other elements that would affect the landscape and street tree location.
- Location of all existing vegetation to remain.
- Location of retaining walls and slopes that exceed 3:1 vertical.
- Location of all proposed trees, shrubs, ground cover and lawn areas (may be light tone).
- Indication of which areas will be automatic vs manual watering systems.
- Planting hydrozones – areas of similar water requirement e.g. high, medium, low.
- Schematic layout showing all points of connection, winterization facilities, timeclocks, heads, valves, piping, sleeves, and other elements critical to construction and maintenance of the irrigation system.
- Notes to indicate the operating pressure of design precipitation rate of each circuit.
- Notes to indicate recommended timeclock settings for each circuit – with separate settings for spring, summer, and fall.

Private Utility Plans & Profiles

12.46 BC Hydro, Telus, Shaw and Centra Gas plans shall be prepared by the each utility company.

As-Built Drawings

12.47 As-Built drawings on mylar transparencies along with a digital copy of the drawings showing the works as actually constructed, shall be submitted to the City prior to issuance of certificate completion.

12.48 The As-Built drawings shall be certified by the Consultant to be a true record of the installation and shall be sealed by the Consultant.

Standards For Autocad Drawings

12.49 Prototype drawings with the required variables, layers, text styles, dimension styles, line types and blocks have been created and are available from the City. Plans shall be prepared based on the City's prototype drawings.

CITY OF CAMPBELL RIVER

SECTION III SUPPLEMENTARY SPECIFICATIONS

Introduction

- 1.1 Throughout the Master Municipal Specifications and Campbell River Supplementary Standard Detail Drawings, all brand names, products or materials shall be ignored. Only products and materials approved for use in the City of Campbell River shall be used.
- 1.2 If any conflict occurs between the written specifications and standard detail drawings and/or another code or regulation also enforceable in the City of Campbell River, the City shall determine the standard to be used.
- 1.3 Throughout this document the words "shall" and "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.
- 1.4 The following supplemental specifications and amendments should be read in conjunction with the Master Municipal Specifications and Standard Detail Drawings, Platinum Edition 2009.

(Add)	Gas and Other Non Municipal Utilities	Supplementary Specification 1
1.0	GENERAL	.1 This section refers to works installed for the use of non City utilities and shall be referenced with all other sections pertinent to the works described herein.
		.2 Works installed by: <ul style="list-style-type: none"> .1 Telus .2 BC Hydro .3 Shaw .4 Gas
1.1	Related Work	.1 Excavating, Trenching and Backfilling Section 31 23 01 .2 Controlled Density Fill Section 31 23 23 .3 Concrete Reinforcement Section 03 20 01 .4 Cast-in-Place Concrete Section 03 30 53 .5 Roadway Lighting Section 26 15 01 .6 Traffic Signals Section 34 41 13
2.0	PRODUCTS	
2.1	Materials	.1 Materials for conduit or pipeline shall be as required by the utility company.
2.2	Marker Tape	.1 Marker tape with the utility pipe description shall be placed 300 - 450mm above the pipe along the length of the trench line. Pipe or conduit sections that are bored will not be required to have a marker tape.
2.9	Bedding and Backfill Material.	.1 Material for bedding and backfill shall be as specified by the respective utility company. All bedding and backfill in roadways shall meet at a minimum the materials in Section 31 05 17
3.0	EXECUTION	
3.1	General	.1 Pipe bedding details, including granular surround (pipe cushion) and material specifications to be as shown in MMCD Standard Detail Drawing G4.
3.2	Trenching	.1 Do trenching in accordance with Section 31 23 01 Excavating, Trenching and Backfilling.
3.3	Installation	.1 Work to be carried out as per utility standard procedures.
3.4	Backfill and Surface Repair	.1 Shall be done in accordance with MMCD Standard Detail Drawing G4 and G5
Temporary Facilities		Section 01 53 01
1.13	Construction Sign (add):	.6 Any signs placed on site shall adhere to the current City of Campbell River Sign By-Law.
Environmental Protection		Section 01 57 01

1.1	Fires	.1	(amend to read): Fires and burning rubbish shall only be in accordance with current Provincial and Municipal regulations and by-laws.
1.2	Site Clearing and Plant Protection (add):	.2	Work around watercourses shall be done in accordance with the "Land Development Guidelines", published by the Ministry of Environment, Lands, and Parks, with the Riparian Area Regulations and the City of Campbell River Minor Development Permit.

Traffic Regulation
Section 01 55 00

1.0	GENERAL	.3	(add after emergency services): BC Transit.
1.4	Protection of Public Traffic	.4.4	(add): A permit from the City is required prior to any full and partial road, sidewalk or walkway closure.
1.4	Informational and Warning Devices	.4.9.3	(add): These warning devices shall also be in accordance with Section 194 of the Province of British Columbia Ministry of Transportation "Standard Specifications for Highway Construction 2006".

Clearing and Grubbing
Section 31 11 01

3.5	Removal and Disposal	.3	(amend to read): Fires and burning of rubbish on site shall only be carried out in accordance with Provincial and Municipal Regulations and By-Laws.
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Excavating, Trenching and Backfilling
Section 31 23 01

1.1	Related Work (add):	.12	Roadway Lighting	Section 26 15 01
		.13	Traffic Signals	Section 34 41 13
		.14	Gas and Other Non Municipal Utilities	Supplemental Section 1
2.2	Use of Specified Materials (add):	.2.7	Gas and Other Non Municipal Utilities	Supplemental Section 1
3.4	Pipe Installation (add):	.1.7	Gas and Other Non Municipal Utilities	Supplemental Section 1

Aggregates and Granular Materials
Section 31 05 17

1.1	Related Work (add):.	.6	Roadway Lighting	Section 26 15 01
		.7	Traffic Signals	Section 34 41 13
		.8	Gas and Other Non Municipal Utilities	Supplementary Section

Granular Subbase
Section 31 05 17

2.1	Specified Materials	.1.3	(amend to read): 150mm minus pit run gravel.
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Controlled Density Fill

Section 31 23 23

- 1.1 Related Work (add):
 - .12 Traffic Signals Section 34 41 13
 - .13 Gas and Other Non Municipal Utilities Supplemental Section 1
- 3.4 Placing
 - .3 (amend to read): Do not place controlled density fill around pipe. Fill may be placed from 300mm above crown of pipe, on top of approved pipe bedding, to the full remaining depth.

Gabions

Section 31 36 13

- 1.0 General (add):
 - .2 Gabions are not normally permitted within the City of Campbell River.

**Hot-Mix Asphalt
Concrete Paving**

Section 32 12 16

- 2.1 Materials
 - .3.2 (amend table to read):

Sieve Designation	25mm	19mm	12.5mm
% passing			
25.0mm	100	--	--
19.0mm	--	100	--
12.5mm	70 – 85	84 - 99	100
9.5mm	--	73 - 89	--
4.75mm	40 – 65	50 – 68	55 - 75
2.36mm	32 – 53	36 – 55	40 - 58
1.18mm	26 – 44	29 – 46	32 - 47
0.600mm	18 – 36	21 – 36	24 - 36
0.300mm	12 – 36	14 – 26	16 - 26
0.150mm	4 – 17	4 – 17	4 - 17
0.075mm	3 – 8	3 – 8	3 - 8

.3.12 (amend to read): Crushed fragments: minimum 70% by mass of aggregate shall be retained on the 4.75mm sieve and have 2 fractured faces.

- 3.5 Placing
 - .3.2 (amend to read): All placement shall be done with the paving machine in constant forward motion. There shall be no stops for refilling the hopper with material, the dump must move at the same rate with the paving machine. The temperature of the mix as measured behind the paving machine screed shall not be more than 15°C lower than the mixing temperature.

- | | | | |
|-----|----------------|----|---|
| 3.6 | Compaction | .1 | (amend to read): The minimum average density of compacted asphalt pavement shall be 97% of 75 blow Marshall Density. Where the average density falls below 96% of 75 blow Marshall Density the Contractor shall remove and replace the affected area of the previously placed mix. Prior to any remedial work being carried out the method of investigation and extent of remedial work must be approved by the City. |
| 4.0 | Testing (add): | .1 | For a paving project of 99 tonnes or less lots the 75 blow Marshall Density may be obtained by averaging the results from briquettes made from materials from the same source using the same mix design. |
| | | .2 | At least three core samples are required for the average from any single paving project of a size of 100 tonnes or more. In addition 1 core sample must be taken for each additional 100 tonnes. Sampling must be representative of the total area paved. For projects that are over 1000 tonnes in size, or for work on arterial roads, a Materials Testing Consultant shall be retained to prepare for the approval of the City an asphalt pavement design and construction approval procedure. |
| | | .3 | Field density tests using a non-destructive testing device may be taken frequently during the beginning of each project to verify that the rolling procedure is providing the required compaction. |

**Portland Cement
Concrete Pavement**

Section 32 13 13

- | | | | |
|-----|-----------|----|--|
| 2.1 | Materials | .4 | (add): The average 28-day compressive strength shall be in accordance with the specification and/or Standard Detail Drawing for the intended use. Concrete shall be a special design with a flexural strength of not less than 4.0 MPa when tested in accordance with CSA CAN 3-A23.2. |
|-----|-----------|----|--|

**Concrete Walks, Curbs
and Gutters**

Section 03 30 20

- | | | | |
|------|------------------|----|---|
| 2.1 | Materials (add): | .7 | Use narrow base curbs as shown in Standard Detail Drawing C4. |
| 3.12 | Finishing | .3 | (delete all) |
| 3.19 | Testing (add): | .1 | Portland Cement concrete shall be tested for slump, compressive strength and air content. |
| | | .2 | The first set of tests each day or each project shall be made on samples from the first load of concrete delivered to the site. Thereafter for every 150 metres of curb or sidewalk the Consultant shall take at least one set of tests. Each set of tests shall consist of a slump test, an air test and casting of at least three cylinders for a compressive strength test. There shall be at least three such tests each with a minimum of three cylinders for each project with 300 metres of curb and/or 150 metres of sidewalk. For all other projects there shall be a minimum of one set of tests with a minimum of three cylinders cast for |

each day's pour of a specified strength. Samples shall be obtained, handled and tested in accordance with CSA-CAN3-A23.2.

- .3 For extruded curbing installed by a slip-form curbing machine using a no-slump mix design, the slump test is not required.
- .4 Should a measured slump or air content test fall outside the specified limits, (as stated in section 2.1.5 Materials) the test shall be repeated immediately. In the event of a second failure, the concrete shall be considered to have failed. .
- .5 A compression test is the average of at least two cylinders from the same or adjacent samples of concrete. The minimum compressive strength specified shall be as in paragraph 2.1.5 Materials.
 - .1 The average of all concrete cylinder compression tests for the particular phase of subdivision under construction shall equal or exceed the specified strength.
 - .2 Not more than 15% of all cylinders tested shall fall below the specified strength.
 - .3 No single test shall fall below 80% of the specified strength.
 - .4 No three consecutive tests (based on time of pouring) shall fall below the specified strength.

If concrete fails to meet the minimum requirements of sub-paragraphs .1 and .2, the entire project shall be deemed to be unacceptable. Should it fail to meet .3 or .4, the portion of the project represented by those tests shall be unacceptable. Additional testing of unacceptable portions of curb and/or gutter may be ordered by the Consultant. Should such additional tests also prove unsatisfactory, the unacceptable concrete shall be removed and replaced.

- .6 Should any of the concrete is found to be un acceptable a report by a Professional Engineer shall be submitted to the City for approval detailing the extent of the work required to remove and replace the unacceptable concrete or recommendations for acceptance of the work.

Waterworks **Section 33 11 01**

- 1.7 Scheduling of Work .6 Notify the City Operations Department, Contract Administrator, affected residences and businesses, the fire department and other affected parties when water service will be disrupted, and re-notify the same parties when service is returned to normal operating condition.
(add):
- 2.2 Mainline Pipe, Joints and Fittings .3.10.6 (delete all)
- 2.3 Valves and Valve Boxes (add): .1.5 For pipe under 375mm diameter use gate valves. For pipe 375mm and larger use butterfly valves, unless specified otherwise in Contract Drawings.
- (add): .9 Water Meters:

- .1 Installed in a location approved by the Contract Administrator and according to design standards, manufacturers recommendations and Standard Detail Drawing CR-W11.
- 3.5 Granular Bedding .6 (add): Where native materials are used without granular bedding, marker tape is to be placed 300-450mm above the pipe along the length of the of the trench line.
- 3.10 Service Connect. Installation .7 (delete all):
- 3.13 Thrust Blocks .1 (add): and on Standard Detail Drawing CR-W1A.
- 3.15 Pipe Surround .4 (amend to read): For ductile iron pipes, where native bedding material is used, warning tape shall be laid 300mm to 450mm above the pipe along the length of the of the trench line.
- 3.19 Testing Procedure (add): .7 The proving of valves and leakage tests are required for new water mains. The leakage test shall be performed in accordance with the respective standards and manufacturer's recommendations detailed in section 3.19. Care shall be taken not to exceed the allowable pressure on any main or appurtenance, especially if some parts of the system are much lower than others. In particular, all resilient-seated gate valves and butterfly valves shall not be subjected to pressures in excess of their rated pressures. Subject to those precautions, the hydrostatic pressure for testing shall be as required by the respective standard or manufacturer's recommendation for the pipe under test.
- .1 The proving of valves shall commence with the new mains isolated from the existing system, full of water, with an independent source of water and pump available to raise and maintain pressure in the new mains. All valves not required to be closed shall be open. Hydrant isolating valves shall be open. Pressure shall be raised to the design operating pressure. Each line valve shall be closed, one valve at a time, the downstream main depressurized and the valve proved. (Hydrant isolating valves will be proved later.) The owner may manipulate any valve under test to obtain a tight seal. Any valve which fails to hold pressure shall be repaired or replaced and be retested until a successful test is achieved.
- .2 The maximum length of pipe for each leakage test shall not exceed 300 m. The leakage test shall be carried out in accordance with the standard for the pipe being tested, the test duration shall be at least one hour. The allowable leakage rates are:
- $$\text{PVC/Ductile } L = \frac{ND \sqrt{P}}{130,000}$$
- L= Allowable leakage in L/hr
 N= Number of joints
 D= Pipe inside diameter
 P= Average test pressure in KPa
- .3 The number of joints shall be one joint per length of pipe plus one joint per valve, two per tee and three per cross, based on

the design drawings. Any additional joints introduced by the Owner for purpose of convenience of construction or repair shall not be included in the count.

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| 3.21 | Disinfection and Flushing Procedures | .2 | (add): All new waterworks materials shall be cleaned, installed and the mains and appurtenances constructed and disinfected in accordance with AWWA C651. The requirements for flushing apply, insofar as practicable, to repairs or subsequent work performed in pipes that were previously chlorinated. Those mains previously flushed, disinfected and approved shall remain isolated from other new mains not yet approved. |
| | | .10 | (add): The Owner shall notify the Health Inspector of the Provincial Health Department of any intended chlorination test. Copies of test results shall be submitted to the Contract Administrator. |

Storm Sewers

Section 33 40 01

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|------|--|-------|---|
| 2.4 | Service Connect. | .8 .2 | (amend to read): For connections that are more than two sizes smaller than mainline pipe, use protrusion saddles. Wyes shall be used on all new lines and where ever possible. "Inserta-tees" are permitted. |
| 3.8 | Connections to Existing Mainline Pipes | .3 | (amend to read): For new connections to existing PVC mainline sewers, drill hole in mainline to exact dimension of new connection. Use Daigle saddles for all existing Asbestos Cement and Concrete pipes. |
| | | .4 | (delete): [For connections more than two sizes smaller ...as few ribs as possible] |
| 3.10 | Service Connect. Installation | .2 | (replace with): Install 40 x 90 mm marker stake at service terminus so that top protrudes between 300 - 600 mm above existing grade. Paint and mark as shown on Standard Detail CR-S8. |
| 3.11 | Cleaning and Flushing | .5 | (add): All flushing to be done in accordance with Provincial and Municipal environmental regulations and bylaws. |
| 3.12 | Testing | .1 | (amend to read): Prior to acceptance <u>all</u> storm sewers including those that are existing that service connections are inserted are to be video inspected. Deficiencies found are to be promptly remedied in accordance with 3.13. |

Manholes and Catchbasins

Section 33 44 01

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| 2.1 | Materials | .7 | (add): ...and Standard Detail Drawing S5. |
| 3.3 | Manhole Installation | .10 | (add): No pipe sections are to be left in the manhole channel. |
| 3.7 | Endwall (add): Installation | .4 | Endwalls as required for culverts may also be utilized.. |

- .6 Seeding: to Section 32 92 20 Seeding or 32 92 19 Hydraulic Seeding (note – sodding will be required for erosion control in most swales, subject to the erosion control professional's decision).
- .7 Sodding: refer to Section 32 92 23 Sodding.
- 3.0 EXECUTION
- .1 Isolate the swale or rain garden site from sedimentation during construction, either by use of effective erosion and sediment control measures upstream, or by delaying the excavation of 100mm of material over the final subgrade of the swale or rain garden until after all sediment-producing construction in the drainage area has been completed.
- .2 Prevent natural or fill soils from intermixing with the Infiltration Drain Rock. All contaminated stone aggregate must be removed and replaced.
- .3 Infiltration Drain Rock shall be installed in 300mm lifts and compacted to eliminate voids between the geotextile and surrounding soils.
- .4 Maintain grass areas to mowed height between 50mm and 150mm., but not below the design water level. Landscape Maintenance standards shall be to the BC Landscape Standard, 6th Edition, Maintenance Level 4: Open Space / Play Area.

(Add) Supplementary Specification 3 Pervious Paving

- 1.0 GENERAL
- .1 This section refers to works associated with Pervious Paving in accordance with Section II Design Standards and Section IV Details.
- 2.0 PRODUCTS
- .2 Pavers: Permeable Interlocking Concrete Pavers meeting CSA A231.2, designed and tested by the manufacturer for use as part of a permeable unit paving system with a initial infiltration rate >280mm/hr. and a maintained >28mm/hr infiltration rate over the pavement life (usually 20 years).
- .3 Pervious paver bedding course and joint filling material shall not be sand. Paver bedding course (50mm thick) material shall be in accordance with paver manufacturer's specifications – generally shall be open-graded crush aggregate in the 5mm or smaller size (or ASTM No.8) and a minimum of 75% angular faces. Paver joint filling material shall be in accordance with paver manufacturer's specifications – generally a 3mm clean crush aggregate (or ASTM No 89).
- .4 Reservoir Base course shall be clean crushed stone graded from 5mm to 20mm (approximately 100mm deep or greater – varies with design). In cases where this finer base is not required for water quality treatment, the Reservoir Base may be the same material as the Reservoir Subbase.
- .5 Reservoir Subbase, where required by design, shall be clean crushed stone graded from 10mm to 63mm, with void space ratio >35% (or ASTM No. 57 – approximately 250mm deep or greater – varies with design).

- .6 Pipe: PVC, DR 35, 150 mm min. diameter, with cleanouts. Practical depth of cover over the pipe may be a determinant in depth of base courses.
- .7 Geosynthetics: as per Section 31 32 19, select for filter criteria or from approved local government product lists.
- 3.0 EXECUTION
- .1 Isolate the permeable paving site from sedimentation during construction, either by use of effective erosion and sediment control measures upstream, or by delaying the excavation of 300mm of material over the final subgrade of the pavement until after all sediment-producing construction in the drainage area has been completed.
- .2 The subgrade should be compacted to 95% standard proctor for walk/bike areas, and 95% modified proctor for vehicular areas. Remove and replace soft areas.
- .3 Prevent natural or fill soils from intermixing with the reservoir base, sub-base, or bedding courses and filter cloths. All contaminated stone aggregate and cloth must be removed and replaced.
- .4 Reservoir drain rock sub base and base courses shall be installed in 100 to 150mm lifts and compacted with at least 4 passes with a minimum 9 T steel drum roller.
- .5 When all base courses are compacted the surface should be topped with filter cloth and a layer of bedding aggregate, and the surface graded carefully to final slopes, as the bedding aggregate will compact down much less than sand. Unit pavers shall be placed tightly butt jointed according to manufacturers specifications. Blocks should be vibrated with a vibrating plated compactor. Following a first pass, a light dressing of joint filling clean stone should be applied to the surface and brushed in, approximately 2 kg/m². Blocks should again be vibrated and any debris brushed off.
- .6 For maintenance, the surface should be brushed at least twice a year with a mechanical suction brush (vacuum sweeper) – in the spring and in autumn after leaf fall.

(Add) Supplementary Specification 4 Infiltration Trench

- 1.0 GENERAL
- .1 This section refers to works associated with Infiltration Trench in accordance with Section II Design Standards and Section IV Details S40 and S41.
- 2.0 PRODUCTS
- .1 Infiltration Drain Rock: clean round stone or crushed rock, 75mm max, 38mm min, 40% porosity.
- .2 Pipe: PVC, DR 35, 100 mm min. dia. with cleanouts.
- .3 Geosynthetics: as per Section 31 32 19, select for filter criteria or from approved local government product lists.
- .4 Sand: Pit Run Sand as per Section 31 05 17.

		.5	Growing Medium over trench: As per Section 32 91 21 Topsoil and Finish Grading, Table 2.
		.6	Seeding: to Section 32 92 20 Seeding or 32 92 19 Hydraulic Seeding (note – sodding will be required for erosion control in most swales, subject to the erosion control professionals decision).
		.7	Sodding: to Section 32 92 23 Sodding.
3.0	EXECUTION	.1	Isolate the infiltration site from sedimentation during construction, either by use of effective erosion and sediment control measures upstream, or by delaying the excavation of 300mm of material over the final subgrade until after all sediment-producing construction in the drainage area has been completed.
		.2	Prevent natural or fill soils from intermixing with the Infiltration Drain Rock. All contaminated stone aggregate must be removed and replaced.
		.3	Infiltration Drain Rock shall be installed in 300mm lifts and compacted to eliminate voids between the geotextile and surrounding soils.

**Planting of Trees, Shrubs
and Ground Cover**

Section 32 93 01

2.0	PRODUCTS :		
2.6	Guying Collar (add):	.1	When tree staking is used rather than guying, the tree ties shall be two flexible ties (e.g. ArborTie or equal).
		.2	Tree Support - Stakes shall be in good condition and shall securely support the trees. Ties shall be placed around the trunk to provide adequate support and prevent damage. All tree support methods shall be such that they do not damage the tree.
2.13	Root Barrier (add):	.1	Root Barrier shall be a poly, ribbed device designed specifically for root barrier purposes (e.g. Deep Root Barrier or equal).
2.14	Structural Soils (add):	.1	Structural Soils shall be supplied and installed in accordance with Supplementary Specification 5 Structural Soils
2.15	Tree Grate and Frame (add):	.1	Tree grates and frames shall be subject to approval of the City, based on shop drawings provided at the time of design submission.
2.16	Planting Standards (add):	.1	Planting must be as per Drawing No. CR-L1, CR-L2, CR-L3, CR-L4, CR-L5, and/or CR-L6 as specified on the drawings.

(Add) Supplementary Specification 5 Structural Soils

1.0	GENERAL		
1.1	Scope of Work	.1	This section applies to structural soils installed around trees located in pedestrian paving areas. The intent is to form a two phase system: a rigid, high bearing capacity stone structure and a viable rooting zone for planted material suspended within the voids of the stone structure. The material is designed to function as a sub-base material under

pavements for pedestrian traffic or light vehicular traffic with the ability to withstand loading of emergency and/or maintenance vehicles. Its intended purpose is for establishing trees in areas where the tree is totally surrounded by pavement and space limitations or other factors preclude the use of non-paved tree zones or large tree planting containerized areas.

2.0 PRODUCTS

- 2.1 Crushed Stone .1 Angular crushed stone granite greater than 19mm and less than 50 mm in size. Acceptable aggregate dimensions will not exceed 2.5:1 for any two dimensions chosen. Minimum 90 percent with one fractured face, minimum 75 percent with two or more fractured faces.

ASTM Sieve Desigr	% Passing
40.0 mm	90 – 100
25.0 mm	20 - 55
10.0 mm	10

- 2.2 Soil .1 Soil component should be growing medium for trees and large shrubs as described in Section 32 91 21 Topsoil and Finish Grading.

- 2.3 Soil Stabilizer .1 Shall be a non-toxic organic binder, e.g. The Natural Solution as available from Sport Turf Inc 604 850 7857, or Hydrogel - a potassium propenoate-propenamamide copolymer. Hydrogel is manufactured by Gelscape by Amereq Corporation. (800) 832-8788 or equivalent.

- 2.4 Filter Fabric .1 After adequate compaction of the structural soil is inspected by the Consultant and confirmed, non-woven filter fabric is to be installed as a separation layer directly above the compacted structural soil mixture. Provide 600mm overlaps at all joints.

- .2 Filter fabric to conform to the following ASTM designations:
 - .1 Grab Tensile Strength: ASTM D-4632, .400 kN
 - .2 Tensile Elongation: ASTM D-4632, 50%
 - .3 Mullen Burst: ASTM D-3786, 1270 kPa
 - .4 Flow Rate: ASTM D-4491, 6300 l/min/m2

3.0 EXECUTION

- 3.1 Mixing Structural Soils .1 Prepare sample Structural Soil mixes to determine the ratio of mix components. Submit for approval.
- .2 All Structural Soil mixing shall be performed off-site using appropriate soil measuring, mixing and shredding equipment of sufficient capacity and capability to assure proper quality control and consistent mix ratios. No mixing of Structural Soil at the project site shall be permitted.
- .3 Mix Crushed Stone 100 units dry weight with Growing Medium, as determined by the test of the mix, (Approx. 20 units), and Soil Stabilizer 0.03 units dry weight.

- .4 The Contractor shall prepare a sample of the proposed mix ratio options and submit for approval. Additional Structural Soil mix ratio samples may be requested.
- .5 Maintain adequate moisture content during the mixing process. Soils and mix components shall easily shred and break down without clumping. Soil clods shall easily break down into a fine crumbly texture. Soils shall not be overly wet or dry. The contractor shall measure and monitor the amount of soil moisture at the mixing site periodically during the mixing process.
- .6 On a flat asphalt or concrete paved surface, spread an 8 inch to 12 inch layer of crushed stone with a front end loader. Spread evenly over the stone the specified amount of dry tackifier. Spread over the dry tackifier and crushed stone a proportional amount of growing medium according to the mix design. Blend the entire amount by turning, using a front-end loader or other suitable equipment until a consistent blend is produced. Alternatively, use batch mixing plant at quarry.
- .7 Add moisture gradually and evenly during the blending and turning operation as required to achieve the required moisture content.
- .8 The Contractor shall mix sufficient material in advance of the time needed at the job site to allow adequate time for final quality control testing as required by the progress of the work.
- .9 Storage piles shall be protected from rain and erosion by covering with plastic sheeting.
- 3.2 Delivery, Storage and Handling
- .1 Do not over-handle material in a way that allows separation of the growing medium from the stone. Batches with separated materials will be rejected.
- .2 Do not deliver or place soils in frozen, wet, or muddy conditions. Material shall be delivered at or near optimum compaction moisture content. Do not deliver or place materials in an excessively moist condition
- .3 Protect soils and mixes from absorbing excess water and from erosion at all times. Do not store materials unprotected from large rainfall events. Do not allow excess water to enter site prior to compaction. If water is introduced into the material after grading, allow material to drain or aerate to optimum compaction moisture content.
- 3.3 Examination of Conditions
- .1 All areas to receive Structural Soil shall be inspected by the Contractor before starting work and all defects such as incorrect grading, compaction, inadequate drainage etc. shall be reported to the Consultant prior to beginning this work.
- .2 The Contractor shall be responsible for judging the full extent of work requirements involved, including but not limited to the potential need for temporary storage and staging of soils, including moving soil stock piles at the site to accommodate scheduling of other work and the need to protect installed soils from compaction, erosion and contamination.
- 3.4 Site Preparation
- .1 Do not proceed with the installation of the Structural Soil material until all walls, curb footings and utility work in the area have been installed.

- .2 Excavate the proposed sub-grade to depths, slopes and widths as shown on the drawings. Maintain all required angles of repose of the adjacent materials as shown on the drawings. Do not over excavate compacted sub-grades of adjacent pavement or structures.
 - .3 Confirm that the sub-grade is at the proper elevation and compacted as required.
 - .4 Clear the excavation of all construction debris, trash, rubble and any foreign material. In the event that fuels, oils, concrete washout silts or other material harmful to plants have been spilled into the sub-grade material, excavate the soil sufficiently to remove the harmful material. Fill any over excavation with approved fill and compact to the required sub-grade compaction.
 - .5 Protect adjacent walls, walks and utilities from damage or staining by the soil. Use 1/2" plywood and or plastic sheeting as directed to cover existing concrete, metal and masonry work and other items as directed during the progress of the work.
 - .6 Any damage to the paving or architectural work caused by the soils installation Contractor shall be repaired at the Contractor's expense.
- 3.5 Installation of Structural Soil Material
- .1 Install Structural Soil in 6 inch lifts and compact each lift to 95% Modified Proctor Density.
 - .2 Bring Structural Soils to finished grades as shown on the drawings. Immediately protect the Structural Soil material from contamination by toxic materials, trash, debris, water containing cement, clay, silt or materials that will alter the particle size distribution of the mix with plastic or plywood or as directed by the Consultant.
 - .3 The Consultant may periodically check the material being delivered and installed at the site for consistency with the approved sample provided by the Contractor as part of the submittal for Structural Soil. In the event that the installed material varies significantly from the approved sample, the Consultant may request that the Contractor test the installed Structural Soil. Any soil that varies significantly from the approved testing results, as determined by the Consultant, shall be removed and new Structural Soil installed that meets these specifications.

(Add) Supplementary Specification 6 Irrigation

- 1.0 GENERAL
- 1.1 Scope of Work
- .1 Irrigation work required includes supply of all plant, labor and equipment to install a complete and operational irrigation system as specified herein and as shown on the drawings including:
 - .2 Excavation, piping, valves, heads, controller, and complete installation, testing, maintenance, adjustment and guarantee of the system.
 - .3 Connection to metered water service, backflow prevention including supply, excavation and installation.

		.4	Low voltage electrical wiring including supply, excavation and installation.
		.5	Restoration of all existing landscape areas to condition prior to commencement of work on site, to the satisfaction of the Consultant.
1.2	Permits and Fees	.2	Obtain all permits and pay required fees to any governmental agency having jurisdiction over the work. Inspections required by local ordinances during the course of construction shall be arranged as required. On completion of the work, satisfactory evidence shall be furnished to the Consultant to show that all work has been installed in accordance with the ordinances and code requirements, including certificates from the Electrical Inspector.
1.3	Standards	.1	Work shall be in accordance with mechanical (plumbing) and electrical standards, codes and regulations including the following: The National Building Code of Canada and its supplements. Current C.S.A. and A.S.T.M. Specifications for pipe and fittings, including: copper pipe: ASTM B42. PVC water pipe: CSA B137.3 or ASTM D2241. PVC fittings: ASTM D2466 or ASTM D2467. PVC solvent cement: ASTM D2564. The B.C. Plumbing Code.
		.2	The Irrigation installer should have Certified Irrigation Contractor – Turf /Commercial status with the Irrigation Association of British Columbia. A company employee should be a certified cross-connection control tester. A company employee should have a low voltage electrical ticket.
1.4	Delivery and Storage	.1	Shipping and handling and installation of materials shall be to manufacturer's recommended instructions, and best workmanship. Particular care shall be taken to avoid scratches and nicks on the plastic pipe. Pipe must be properly stacked and stored in a clean place on the site, keeping dirt out of the pipe at all times.
1.5	"As-Built" Irrigation Drawings and Operation Instructions	.1	Prepare "As-Built" documents.
		.2	Supply drawings (2 copies) on blueline prints in red ink which shall include the following information: Deviations from the bid documents made during construction affecting the main line pipe, controller and valve locations, and all laterals and sprinkler heads. Indicate approved substitutions including size, material and manufacturer's name and model name and catalog number. Documents shall be delivered to the Consultant before final acceptance of work.
		.3	After the system has been completed, the Contractor shall instruct the Owner (Maintenance Department) in the proper use of the equipment and submit written maintenance instructions (3 copies) to the Consultant.
		.4	The Consultant shall professionally draft as-builts and shall submit as built and maintenance manuals to the City.

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| 1.6 | Final Acceptance | .1 | Final acceptance of the work may be obtained from the Consultant upon the satisfactory completion of all work, at the end of the one year maintenance and guarantee period. |
| 1.7 | Guarantee and Maintenance | .1 | All work shall be guaranteed and maintained for one year from the date of Substantial Performance of the project overall, or completion of the landscape construction , whichever is later, against all defects in material, equipment and workmanship. |
| | | .2 | Guarantee shall also cover repair of damage to any part of the premises resulting from leaks or other defects in material, equipment, and workmanship to the satisfaction of the Consultant. Repairs, if required, shall be done promptly at no cost to the Owner. Maintenance shall include required minor adjustments for adequate water distribution and irrigation coverage of landscape areas, winterization, and spring start-up. |
| 1.8 | Workmanship | .1 | Lay out work as accurately as possible to the drawings. The drawings, though carefully drawn, are generally diagrammatic. Swing joints, offsets and all fittings are not shown. |
| | | .2 | Mainline locations are diagrammatic. The contractor shall not wilfully install irrigation pressure mainlines as a literal interpretation of the plans. Mainlines shall be installed so as not to interfere with structures concrete formwork and foundations. |
| | | .3 | The Contractor shall be responsible for full and complete irrigation distribution and coverage of all irrigated areas. |
| 2.0 | PRODUCTS | | |
| 2.1 | Plastic Piping | .1 | Plastic pipe shall be semi-rigid, extruded from PVC resin type 1 grade 2 normal impact in accordance with applicable codes and standards. |
| | | .2 | All polyvinyl chloride (PVC) plastic pipe and fittings must be marked as to size and class and their pressure and strength rating must exceed that of the working pressure of the system. |
| | | .3 | All PVC pipe in diameter sizes of 31.25 mm (1 1/4") and larger shall be a minimum of Class 315, smaller sizes shall be Class 200. |
| | | .4 | Velocities shall always be considered to minimize head loss and should not exceed 1.52 metres per second (5 ft. per second). |
| 2.2 | Plastic Fittings | .1 | All plastic fittings shall be a minimum of schedule 40 PVC molded fittings. |
| 2.3 | Swing Joint Assemblies | .1 | Triple swing joint assemblies for all sprinklers shall consist of:
3 schedule 40 PVC street elbows (MIPT x FIPT)
1 schedule 80 PVC threaded nipple, length to suit (MIPT x MIPT)
1 schedule 40 PVC threaded tee (slip x slip x FIPT) |
| | | .2 | Triple swing joint assemblies for quick coupler valves shall consist of:
1 schedule 40 PVC threaded tee
2 galvanized threaded nipples, length to suit (MIPT x MIPT)
2 galvanized threaded elbows (FIPT x FIPT)
1 galvanized threaded street elbow (MIPT x FIPT) |

			1 galvanized threaded riser, 100 mm (4") length, (MIPT x MIPT)
		.3	Alternate swing joint assemblies (e.g. funny pipe or flexible fittings) shall be subject to the approval of the City prior to installation.
2.4	Metal Pipe & Fittings	.1	All exposed pipe and fittings, above-ground or in vaults or chambers shall be copper.
2.5	Solvent Cement	.1	Solvent cement shall be a type and make recommended by the pipe manufacturer.
2.6	Sprinkler Head Risers	.1	Where risers are not of the pop-up type, sprinkler head risers shall be schedule 80 PVC pipe. Pipe shall be cut in a standard pipe cutting tool with sharp cutters. Ream only to full diameter of pipe and clean all rough edges or burrs. Cut all threads accurately with sharp dies. Not more than three (3) full threads shall show beyond fittings when pipe is made up. Use teflon tape on all PVC threaded connections.
2.7	Bedding Material	.1	Bedding material shall be native material, selected to be 19 mm minus. If select native material is not available that is 19mm minus, bedding shall be sand.
		.2	Bedding material for pipes installed under hard surface and structures shall be bedded in sand unless carried by a sleeve.
2.8	Sprinkler Heads	.1	Sprinkler heads shall be as shown on irrigation plans. See legend and notes for correct model numbers and operating pressures.
		.2	Sprinklers shall perform to manufacturer's specifications including diameter of throw and gallonage at specified pressures.
2.9	Valves	.1	Valves as shown on irrigation plans. See legend and notes for correct model numbers.
2.10	Supply Connections	.1	Water and electrical supply connections shall be as noted on the irrigation and mechanical plans.
2.11	Sleeves	.1	When sidewalk is set back from the curb to provide a boulevard between the curb and the sidewalk, install two 100mm diameter sleeves crossing the sidewalk at the centre of the lot and/or away from driveways, to accommodate future irrigation of the boulevard by the adjacent landowner.
		.2	Under sidewalk, through walls or driveway paving, SDR 35 pipe.
		.3	Sleeves shall be at a minimum twice the size of the combined diameter of the carried pipe(s), unless otherwise specified on the drawings.
		.4	Where sleeves are installed across roadways, an additional redundant sleeve of the same size shall be installed under all roadways for future use.
		.5	The Contractor shall be responsible for locating all sleeves.
2.12	Controllers	.1	Controller model numbers shall be as noted on the irrigation plans.
		.2	Automatic controllers shall provide all necessary features for programming as is shown on the irrigation design plan. Controllers

			shall be encased in a sturdy, lockable, mounting box and must be easily accessible for maintenance. All electrical controllers should be as shown on plans and approved by local electrical authorities.
2.13	Mounting and Housing	.1	Controller mounting and housing shall be as noted on the irrigation plan, or in accordance with Drawing CR-I5 if not shown on the plan.
2.14	Valve Boxes	.1	All in-line valves shall be grouped wherever possible and installed in NDS Pro Series 356 x 483 mm (14"x19") valve boxes (or pre-approved equivalent) with a locking lid. Quantity as required; see irrigation plan.
2.15	Backflow Prevention Device	.1	Backflow prevention unit shall supplied and installed as noted on the irrigation plan, or if not shown on the drawing, in accordance with Drawing CR-I1 or CR-I2 depending on the size of the water supply connection. Such devices shall meet or exceed all local ordinances and requirements governing such a cross connection. The contractor shall have the City approve backflow prevention devices prior to construction.
		.2	All exposed pipe and fittings, above ground or in vaults or chambers shall be copper.
2.16	24 Volt Control Wiring	.1	24-volt electric control lines from controller to automatic valves shall be CSA approved direct burial minimum (#14 AWG TWU-40) wire of a different colour than the 110-volt power to controllers.
		.2	Splicing shall be minimized with such splices made waterproof with the use of water-proof Scotchlok or Pen-Tite kits.
		.3	All 24-volt wiring shall be buried a minimum of 300 mm (12") as per the amended B.C. Electrical Code.
2.17	Power Wiring	.1	All 110-volt AC wiring shall be installed in accordance with local electrical codes and buried a minimum depth of 600 mm.
		.2	All splices in wiring shall be made watertight using approved methods. All wire splices shall occur within valve boxes or installed in a separate accessible junction box.
2.18	Gate Valves	.1	Gate valves 100 mm (4") or larger shall be bronze or cast iron. Gate valves smaller than 100 mm (4") in size shall be bronze.
		.2	Gate valves or approved quarter turn ball valves shall also be used in any case where a manual drain valve is required.
2.19	Quick Coupling Valves	.1	Quick coupling valves and keys shall be #3 quick coupler c/w iron pipe to hose bib, #33k key, SHO swivel elbow.
		.2	Internal parts to be removable and with adjustable flow control.
2.19	Acceptable Products	.1	The irrigation system of solenoid valves, heads, and controllers has been designed based on Irrigation Products as listed in the irrigation legend of the irrigation plan.
		.2	Only irrigation products listed on the City of Campbell River Approved Products List may be used.
3.0	EXECUTION		

- 3.1 Existing Conditions .1 Ensure that existing site features and improvement areas are disturbed as little as possible. Protect existing vegetation throughout installation and do not damage root systems. Return landscape areas to prior condition immediately after irrigation installation and testing.
- .2 Prior to excavation, the Contractor shall satisfy himself as to the finished grade elevations and density of compaction in existing lawn and planting areas, to ensure restoration of disturbed areas to grades and compaction matching existing.
- .3 Existing sod removed to accommodate irrigation installation shall be preserved and replaced subsequent to installation and backfilling.
- .4 If trenching is required through paved areas, the Contractor shall saw-cut and remove paving to the width of the trench. Removal and replacement of paving to match existing shall be the responsibility of the Contractor.
- .5 Where trenching for piping or wiring is required through paved areas, provide minimum SDR 35 sleeves with minimum 600 mm (24") cover. Extend sleeves minimum 300 mm (12") into soft landscape areas.
- 3.2 Excavation and Trenching .1 Excavated materials shall be carefully placed adjacent to the trench in separate piles to avoid contamination of topsoil and excavated materials.
- .2 Perform all excavations as required for the installation of the work included under this section, including shoring of earth banks to prevent cave-ins. Restore all surfaces, existing underground installations, etc., damaged or cut as a result of the excavations to their original condition and in a manner approved by the Consultant.
- .3 Excavations through landscape areas shall be carried out such that adjacent areas are not contaminated with excavated materials. Backfilling and replacement of topsoil shall be performed in accordance with the specifications such that all existing planting areas are restored to their original condition.
- .4 Trenches shall be made wide enough to allow a minimum of 50 mm (2") between parallel pipe lines. Trenches for pipe lines shall be made of sufficient depths to provide the minimum cover from finish grade as follows:
450 mm (18") minimum cover over main lines
300 mm (12") minimum cover over lateral lines to heads.
- .5 Maintain all warning signs, shoring, barricades, flares and red lanterns as required.
- 3.3 Supply Connection .1 Connection to potable water supply and all electrical supply connections must comply with local building by-laws.
- .2 The contractor shall confirm the available static pressure at the metered water service and advise the Consultant immediately of any discrepancy from the designed system pressure requirements.
- .3 Contractor shall have a qualified Electrician connect the controllers to the electrical supply, if this connection is included in the scope of work.

- 3.4 Pipe Line Assembly and Installation
- .1 Do not drag pipe along ground whether single lengths or assembled sections. Damaged pipe shall be rejected and replaced by new pipe and couplings.
 - .2 Keep pipes clean at all times, blow out with compressed air or water on completion.
 - .3 Plastic pipe that is not in sleeves shall be laid on bedding materials as per clause 2.7 installed compacted to a depth of 50 mm (2"). A further 50 mm (2") depth of bedding material shall be placed and compacted over plastic pipe prior to trench backfilling.
 - .4 Plastic pipe and fittings shall be solvent welded using solvents and methods as recommended by manufacturer of the pipe, except where threaded connections are required. Pipe and fittings shall be thoroughly cleaned of dirt, dust and moisture before applying solvent with a non-synthetic bristle brush.
 - .5 Pipe may be assembled and welded on the surface. Snake pipe slightly from side to side to allow for expansion and contraction.
 - .6 Install no irrigation line directly over another such line or a line of another trade.
 - .7 Leave minimum clearance of 50 mm (2") between lines laid in a common trench.
 - .8 Make all connections between plastic pipe and metal valves with threaded fittings using plastic male adapters.
 - .9 Screw fittings shall be carefully tightened with strap wrenches or by other means that do not mark the plastic pipe or plastic fittings.
 - .10 Pipe wrenches shall not be used on plastic fittings, unless the fittings are a type designed for use with a pipe wrench. Should the Contractor wish to use a lubricant it shall be a type manufactured for this purpose, such as Permatex No. 2 or Pipe Tite Stick.
- 3.5 Valves and Control Wiring
- .1 Install valve boxes such that top of structure is at finished grade, accessible for maintenance.
 - .2 Coil additional 600 mm (24") length of each electrical wire within valve box as extra material.
- 3.6 Sprinkler Heads
- .1 Install all sprinklers according to manufacturer's specifications.
 - .2 Use pipe joint compound on galvanized iron fittings.
- 3.7 Closing of Pipe and Flushing Lines
- .1 Cap or plug all openings as soon as lines have been installed to prevent the entrance of materials that would obstruct the pipe. Leave in place until removal is necessary for completion of installation.
 - .2 Thoroughly flush out all water lines before installing heads, valves and other hydrants.
 - .3 Test in accordance with paragraph on Hydrostatic Tests.

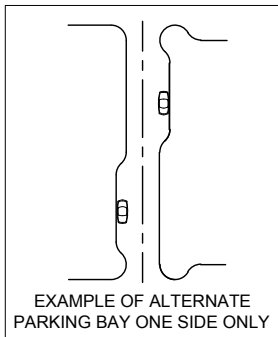
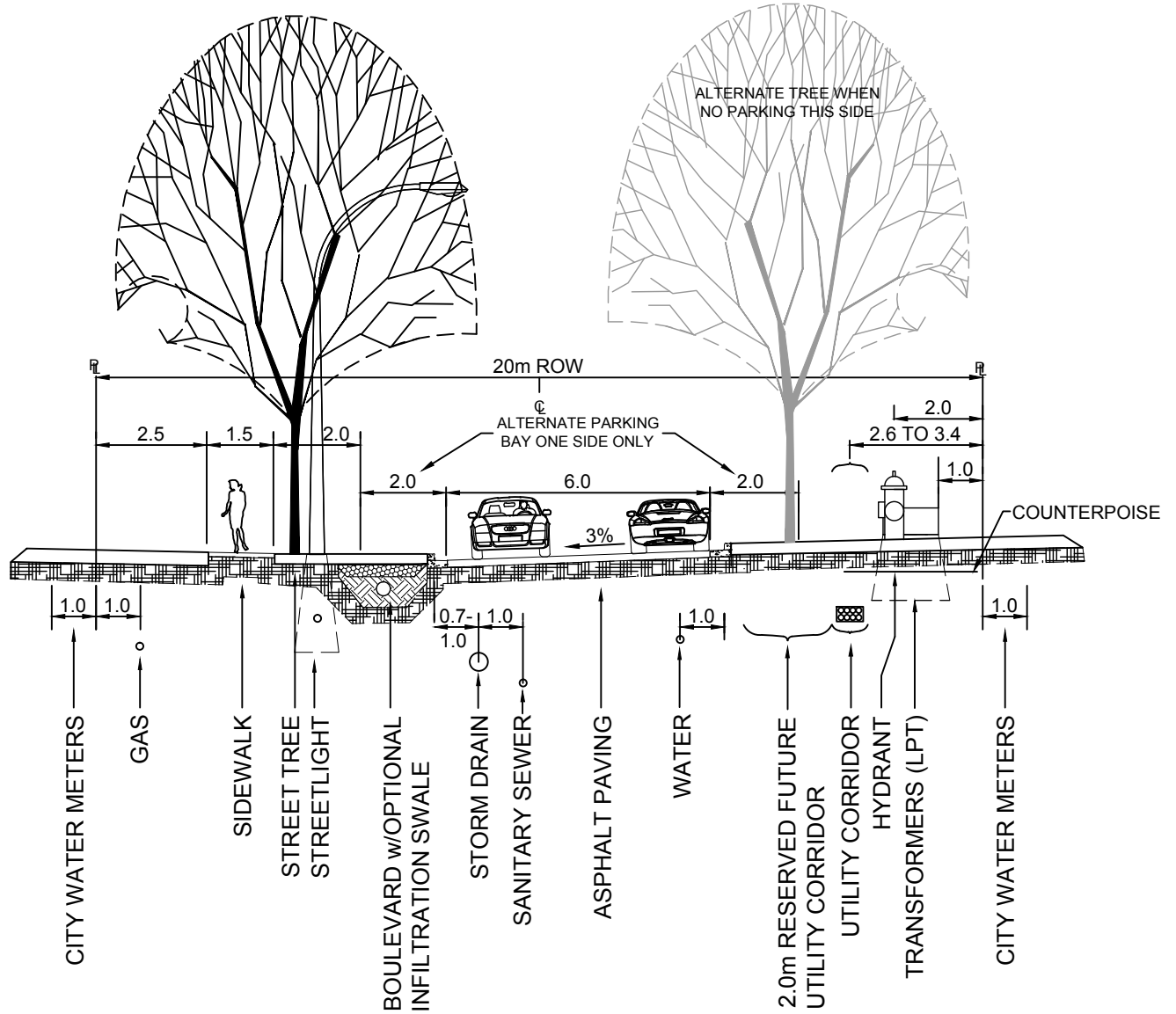
- .4 Upon completion of the testing, the Contractor shall complete assembly and adjust sprinkler heads for proper distribution.
- 3.8 Hydrostatic Tests
- .1 Request the presence of the Consultant at least 48 hours in advance of testing.
- .2 Testing to be accomplished at the expense of the Contractor and in the presence of the Consultant.
- .3 Center load piping with small amount of backfill to prevent arching or slipping under pressure.
- .4 After welded plastic joints have cured at least 24 hours, fill test section with water and expel all air and cap risers for an additional 24 hours prior to testing. Contractor shall pre-test the circuits, and call the Consultant for a supervised test once the circuits to be demonstrated meet the test requirements. Contractor shall supply and temporarily install, until tests are approved, a pressure gauge and hose bib to each main and circuit to be tested. Tests to be conducted at maximum pressure (continuous and static water pressure of 90 psi) in the presence of the Consultant as follows:
- .5 Main lines and sub-mains to be tested for 1 hours
- .6 Lateral lines to be tested for 1/4 hour.
- .7 Repair leaks resulting from tests by cutting out and replacing fittings. Leaks shall not be repaired by patching. Maintain test pressure for a minimum of one hour after replacement of defective parts and re-inspect as per Clause 3.8.4 above.
- .8 After approval by the Consultant, backfill excavations, maintaining pressure in the lines. If there is any indication of a leak, the defective section shall be located and replaced. Flush out the system to remove dirt and then attach the sprinklers using a non-setting pipe thread compound.
- 3.9 Backfill and Compacting
- .1 After system is operating and required tests and inspections have been made, backfill excavations and trenches.
- .2 All sprinkler head excavations shall be backfilled with compacted native soil free of rocks up to within 50 mm (2") of finish grade.
- .3 After bedding material is in place and approved by the Consultant, the balance of the trench shall be backfilled with pre-approved material free of stones, debris, and objects greater than 25 mm (1") at widest point, compacting to same density as adjacent undisturbed soil to eliminate differential settlement.
- .4 Compact trenches in areas to be planted by thoroughly flooding the backfill. Jetting process may be used in those areas.
- .5 Ensure that lawn and planting areas are disturbed as little as possible.
- .6 Dress off all areas to finish grades.

- | | | | |
|------|---------------------------|----|---|
| 3.10 | Clean-Up | .1 | Remove from the site all debris and surplus material resulting from work of this section. |
| 3.11 | Balancing and Adjustments | .1 | Balance and adjust all components of the system to achieve the most efficient system operation, with attention to water conservation and city water restriction bylaws. Balancing and adjustment to include seasonal adjustments of controllers in spring, summer and fall at a minimum, synchronization of controllers, adjustments to pressure regulators, pressure relief valves, sprinkler heads and individual station adjustments on controllers. |
| | | .2 | Lawn sprinkler heads shall be set flush with the final turf grade by shortening or lengthening the riser as required. During the guarantee period, return twice and adjust the heads as required to be flush with the final turf grade. These call backs shall be done within five (5) days of notification by the Owner and shall be considered part of the Contract. |
| 3.12 | Final Acceptance | .1 | The Consultant's Certificate of Substantial Performance shall be issued for the irrigation system and landscape work when the system has been installed as specified, adjustments and submittals have been made to the satisfaction of the Consultant and maintenance instructions have been provided as specified. |
| | | .2 | Repair any settling of backfilled trenches occurring during the guarantee period after Substantial Performance at no cost to the Owner. Include complete restoration or replacement of all damaged planting, paving or other improvements. |
| 3.13 | Maintenance | .1 | Maintenance of irrigation system shall include monitoring of irrigation controller scheduling including adjustments in spring, summer and fall seasons at a minimum to provide water conservation, periodic adjustment as required, and winterization of the system at the close of the growing season. |
| | | .2 | Winterization shall include flushing, draining and shut-off of all system components. |
| | | .3 | The system shall be turned on, checked and adjusted at the start of the growing season in the spring. |

CITY OF CAMPBELL RIVER**SECTION IV SUPPLEMENTARY STANDARD DETAIL DRAWINGS****Drawing No. Description**

CR-R101	Urban Local Low Density
CR-R102	Urban Local High Density
CR-R103	Local Urban Commercial
CR-R104	Urban Local Industrial
CR-R105	Urban Collector Minor
CR-R106	Urban Collector Major
CR-R107	Urban Arterial 3 Lane
CR-R108	Urban Arterial 4 Lane
CR-R109	Rural Local Residential Underground Utilities
CR-R110	Rural Local Residential Overhead Utilities
CR-R111	Rural Local Commercial/Industrial
CR-R112	Rural Collector
CR-R113	Curbing Options at Infiltration Swales
CR-R114	Urban Local Pavement Structure and Slopes
CR-R115	Urban Collector Pavement Structure and Slopes
CR-R116	Urban Arterial Pavement Structure and Slopes
CR-R117	Rural Local Residential Pavement Structure and Slopes
CR-R118	Gravel Road Cross Section
CR-R119	Cul-de-sac Typical Utility Locations
CR-R120	Temporary Gravel Cul-de-sac
CR-R121	Service Locations
CR-R122	Preferred Locations of Building Services
CR-C12a	Fixed Restriction Post
CR-W1	Thrust Blocking
CR-W1a	Thrust Blocking
CR-W2a	Standard Water Meter Service (Property) Box
CR-W2e	Standard Concrete Meter Box (For 19 Dia. Meters)
CR-W2f	Standard Concrete Service Box (For Service 25-50 Dia. Meters)
CR-S1a	Manhole Lid Grouting Detail
CR-S11	Catch Basin
CR-S101	Infiltration Swale Profile & Plan
CR-S102	Partial Infiltration Swale with Reservoir & Subdrain
CR-S103	Full Infiltration Swale with Reservoir
CR-S104	Full Infiltration Swale
CR-S105	Full Infiltration Swale Weir
CR-S106	Partial Infiltration Rain Garden
CR-S107	Full Infiltration Rain Garden with Reservoir
CR-S108	Full Infiltration Rain Garden
CR-S109	Partial Infiltration Rain Garden with Flow Restrictor
CR-S110	Pervious Pavers Partial Infiltration
CR-S111	Pervious Pavers Full Infiltration
CR-S112	Pervious Pavers Partial Infiltration with Flow Restrictor
CR-S113	Infiltration Trench with Dispersed Input Facilities
CR-S114	Diagram of Sedimentation Manhole and Infiltration Shaft

CR-S115	Sedimentation Manhole
CR-S116	Infiltration Shaft
CR-S117	Storm Drain Outfall Structure – Headwall Type 1
CR-S118	Storm Drain Outfall Structure – Headwall Type 2
CR-S119	Storm Drain Outfall Structure – Headwall Type 3
CR-S120	Storm Drain Outfall Structure – Headwall Type 4
CR-S121	Storm Water Management – Wet Detention Pond – Access Road
CR-S122	Storm Water Management – Wet Detention Pond – Section
CR-S123	Storm Water Management – Wet Detention Pond – Plan View
CR-S124	Storm Water Management – Wet Detention Pond – Vegetation Zones
CR-ES101	Erosion and Sediment Controls – Interceptor Ditch
CR-ES102	Surface Roughening
CR-ES103	Straw Anchoring
CR-ES104	Compost Blankets
CR-ES105	Erosion Blankets & Turn Reinforcement Mats Slope Installation
CR-ES106	Straw Rolls
CR-ES107	Rock Check Dam
CR-ES108	Sandbag Ditch Dam
CR-ES109	Straw Bail Ditch Dam
CR-ES110	Rock Lined Channel
CR-ES111	Erosion Blankets & Turn Reinforcement Mats Channel Installation
CR-ES112	Slope Drain
CR-ES113	Energy Dissipater
CR-ES114	Polyethylene Sheeting on Slopes
CR-ES115	Sediment Fence Typical Placement - Two Slopes
CR-ES116	Sediment Fence Placement for Perimeter Control
CR-ES117	Sediment Fence Trench Method Option
CR-ES118	Compost Berm Placement for Perimeter Control
CR-ES119	Temporary Gravel Construction Entrance/Exit
CR-ES120	Block and Gravel Drop Inlet Sediment Barrier
CR-ES121	Curb Inlet Sediment Barrier (Sandbags)
CR-ES122	Erosion and Sediment Controls – Sediment Control Basin – Section
CR-ES123	Erosion and Sediment Controls – Sediment Control Basin – Plan View
CR-L101	Tree Planting Root Zone Volume
CR-L102	Shrub in Planting Bed
CR-L103	Tree Planting – Grass Boulevard Application
CR-L104	Street Tree in Pavement Type 1
CR-L105	Street Tree in Pavement Type 2
CR-L106	Street Tree by Structural Soil Breakout
CR-L107	Street Tree by Structural Soil Channel
CR-I101	Irrigation Backflow Preventer and Point of Connection Type 1
CR-I102	Irrigation Backflow Preventer and Point of Connection Type 2
CR-I103	Valve Box Schematic Piping Configuration at Valve Cluster
CR-I104a	Deep Root Bubbler System at Tree
CR-I104b	Deep Root Watering System at Tree (June to October)
CR-I105	Irrigation Controller Cabinet Details
CR-G101	Street Name and Stop Sign
CR-G102	Recommended Signage for Signalized Intersections



ALL DIMENSIONS IN METRES UNLESS NOTED OTHERWISE



City of
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River**

SCALE:
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APPROVED:
CCR

DATE:
APRIL 2010

URBAN LOCAL
LOW DENSITY

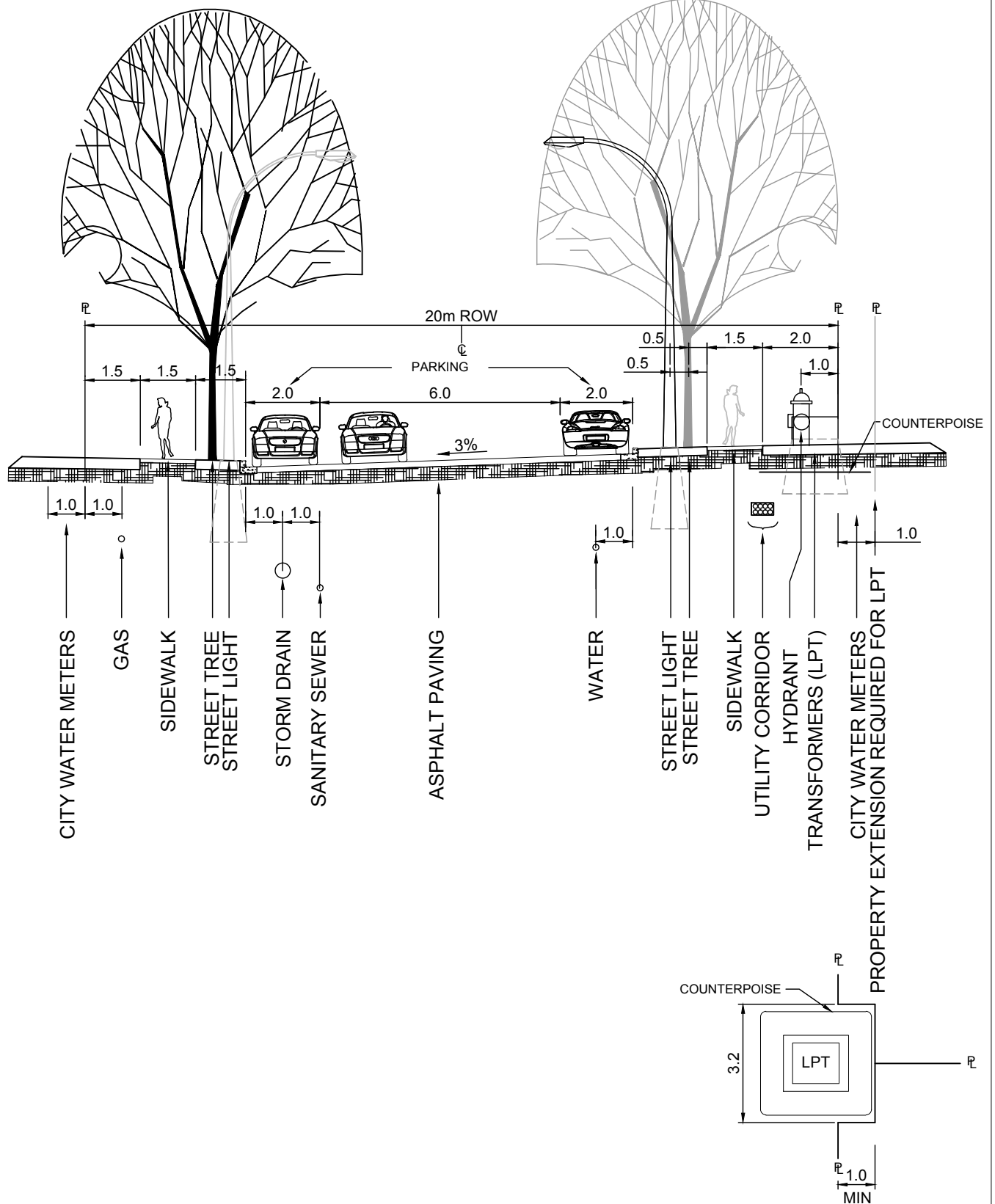
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CR-R101

DISK REF.

SHEET OF

REV. 1

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NOTCH AT PROPERTY CORNER FOR TRANSFORMER AND COUNTERPOISE.



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URBAN LOCAL
HIGH DENSITY

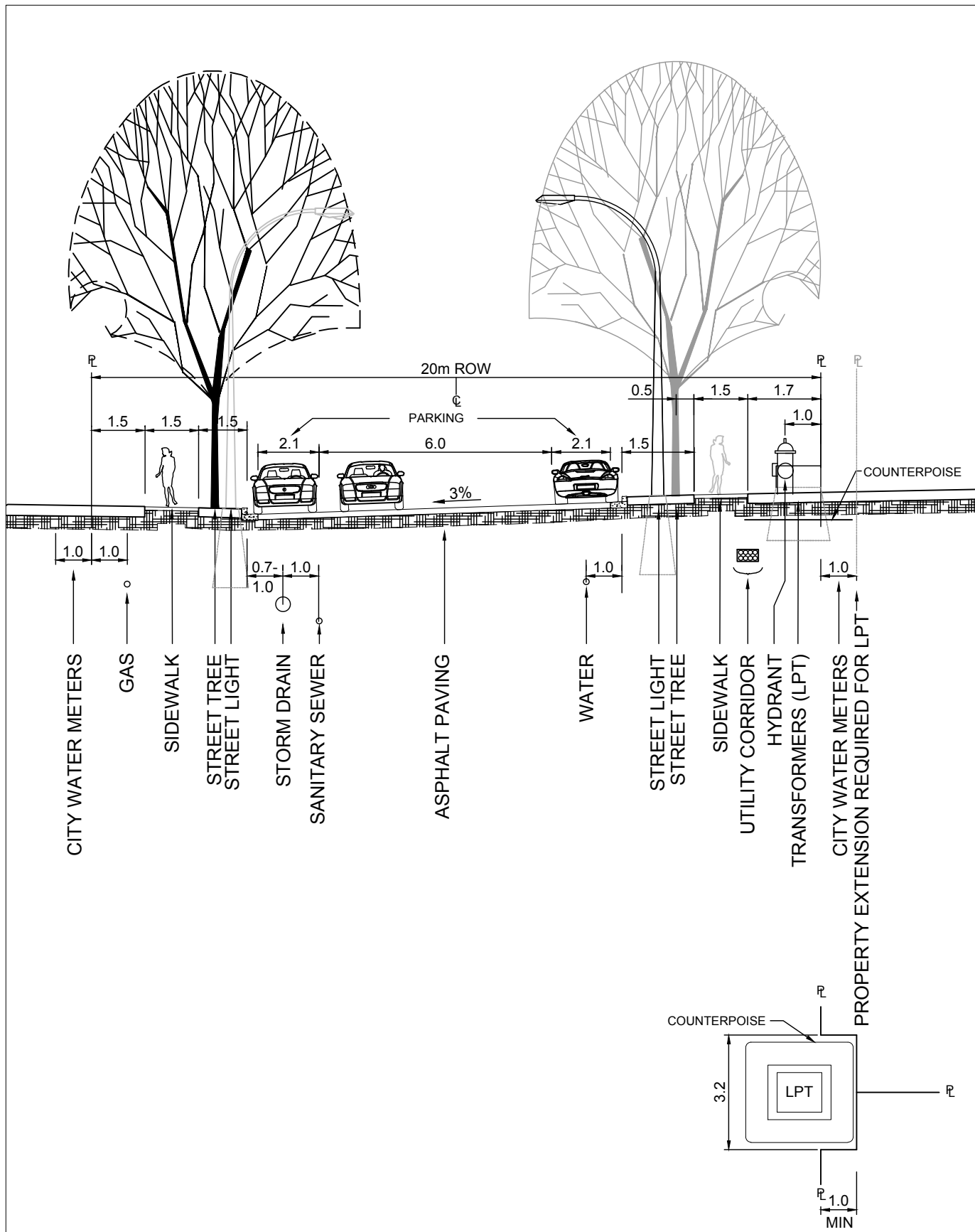
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URBAN LOCAL
COMMERCIAL

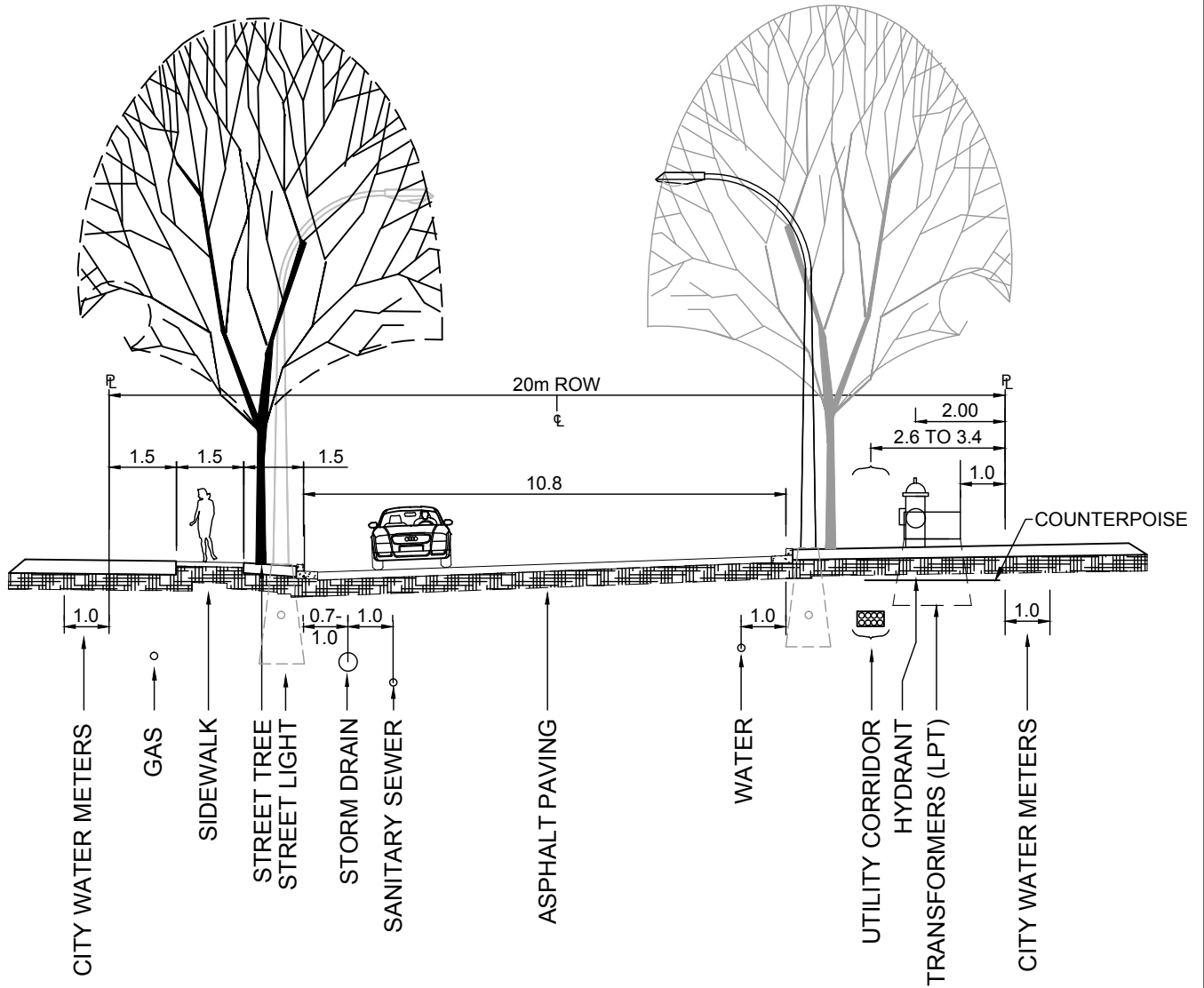
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URBAN LOCAL
INDUSTRIAL

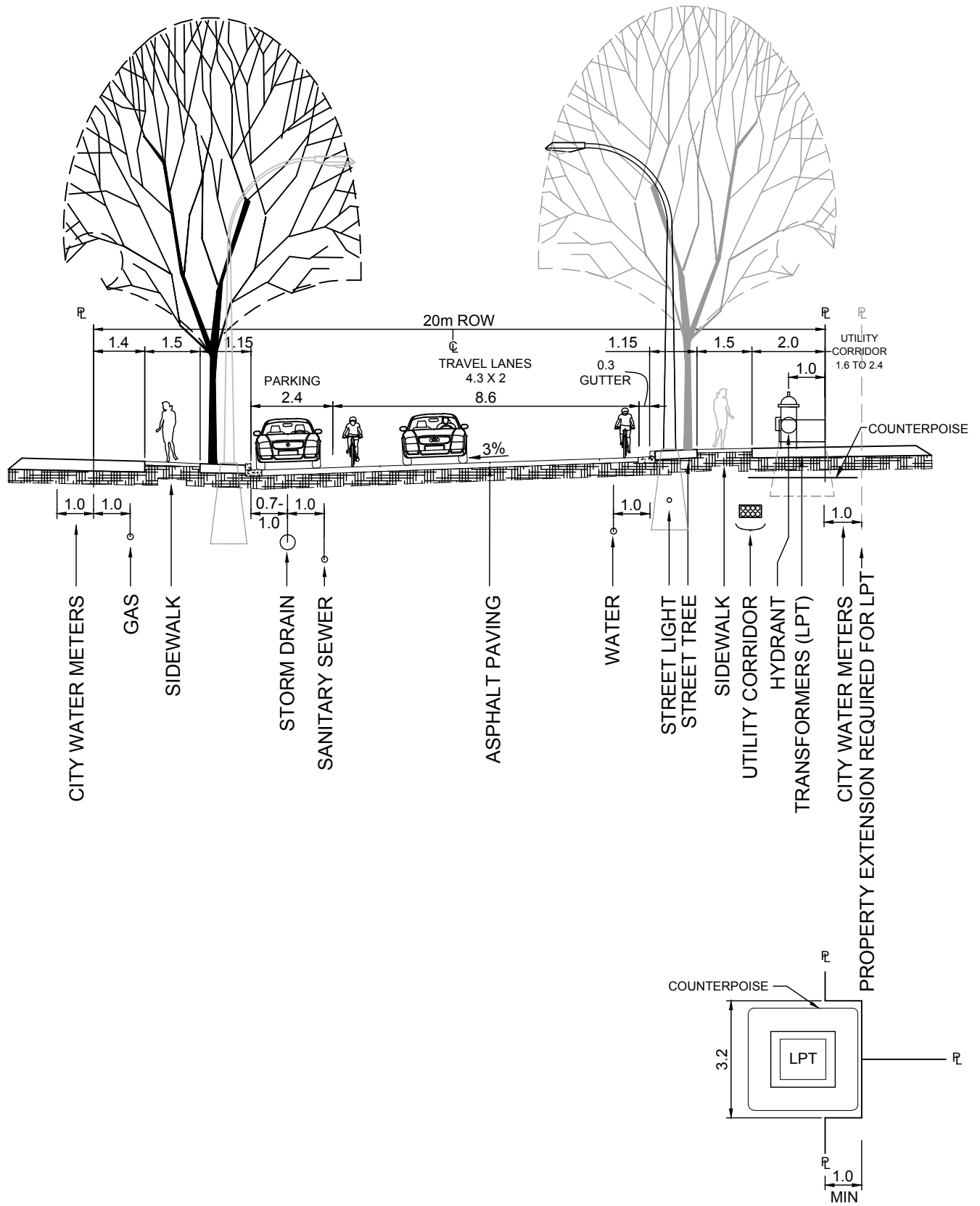
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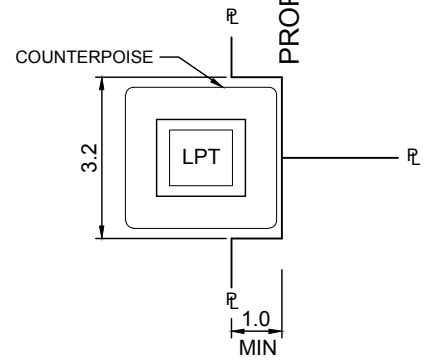
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NOTCH AT PROPERTY CORNER FOR TRANSFORMER AND COUNTERPOISE.



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APRIL 2010

URBAN COLLECTOR
MINOR

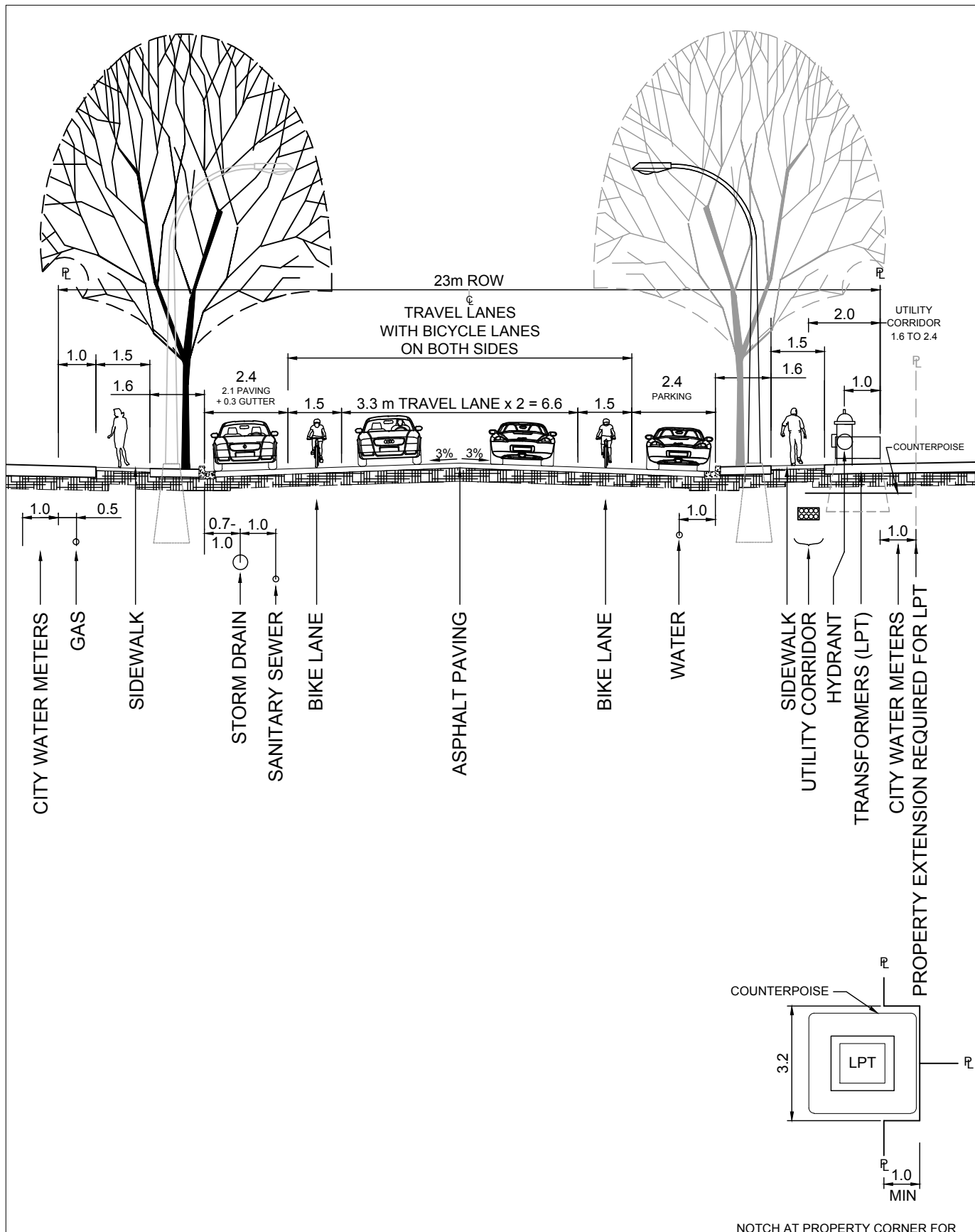
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REV. 1

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NOTCH AT PROPERTY CORNER FOR TRANSFORMER AND COUNTERPOISE.



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URBAN COLLECTOR
MAJOR

DRAWING NO.
CR-R106

DISK REF.

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REV. 1



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River

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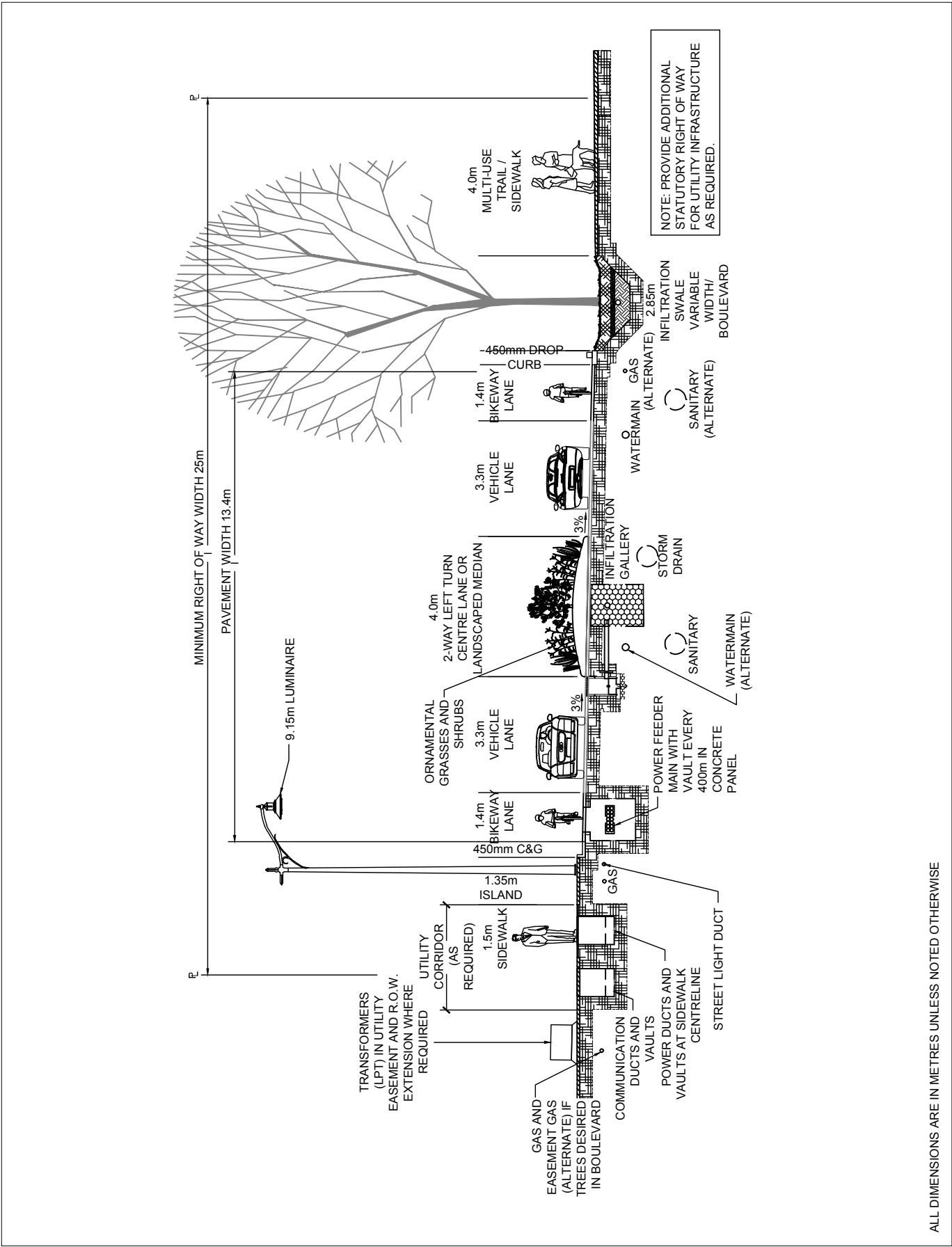
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APRIL 2010

URBAN ARTERIAL
3 LANE

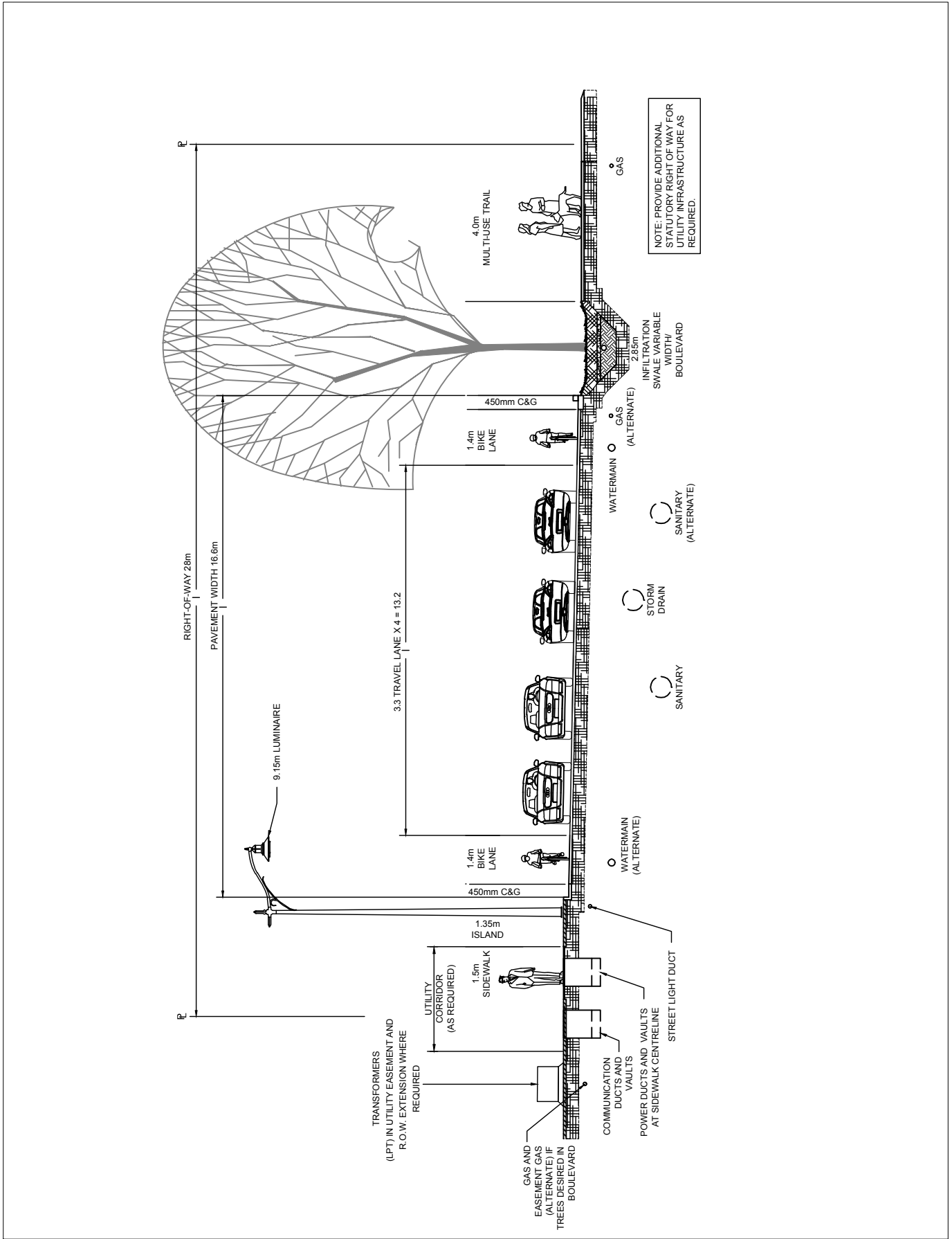
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CR-R107

DISK REF.

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DATE:
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URBAN ARTERIAL
4 LANE

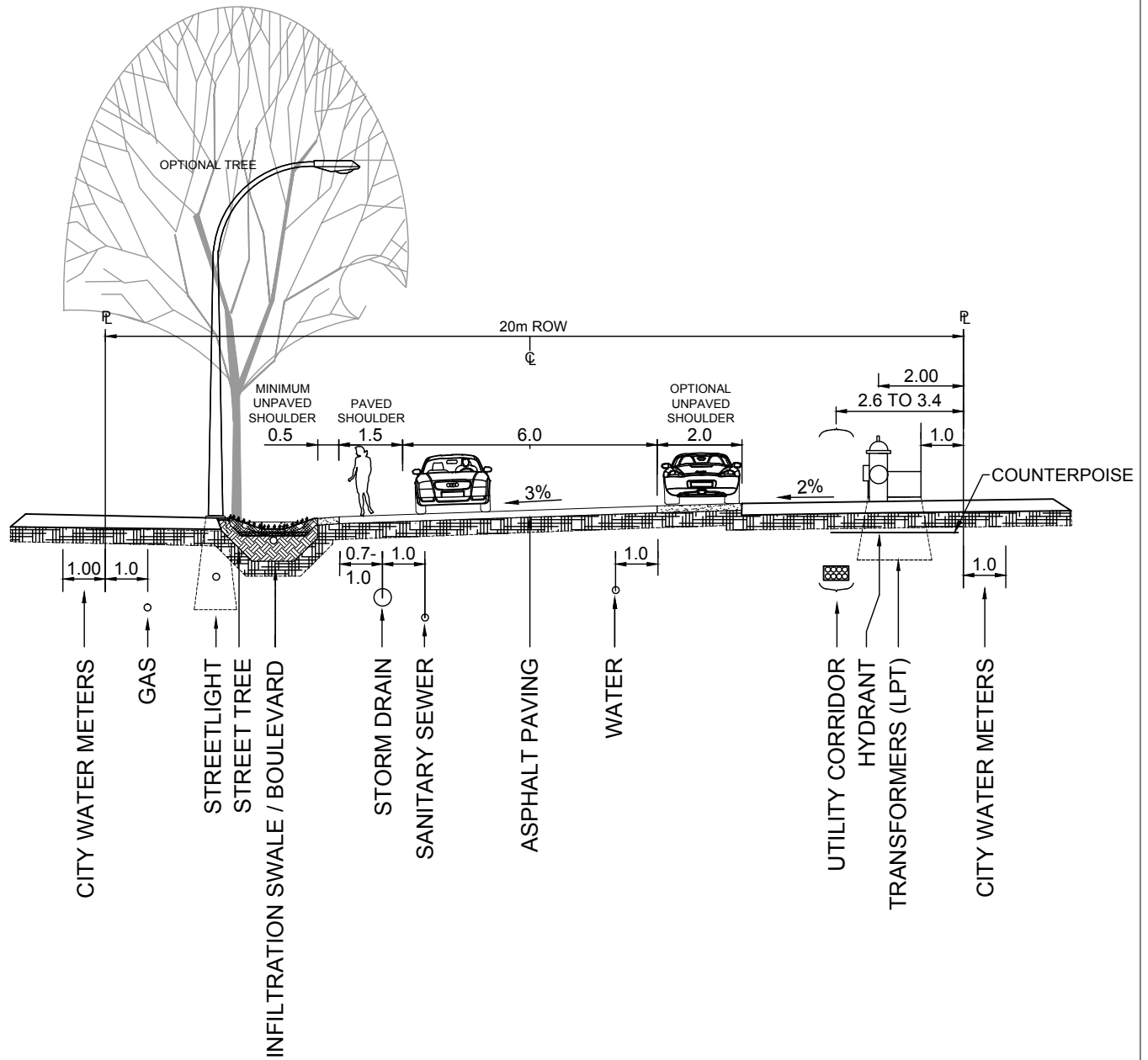
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REV. 1

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DATE:
APRIL 2010

RURAL LOCAL
RESIDENTIAL
UNDERGROUND UTILITIES

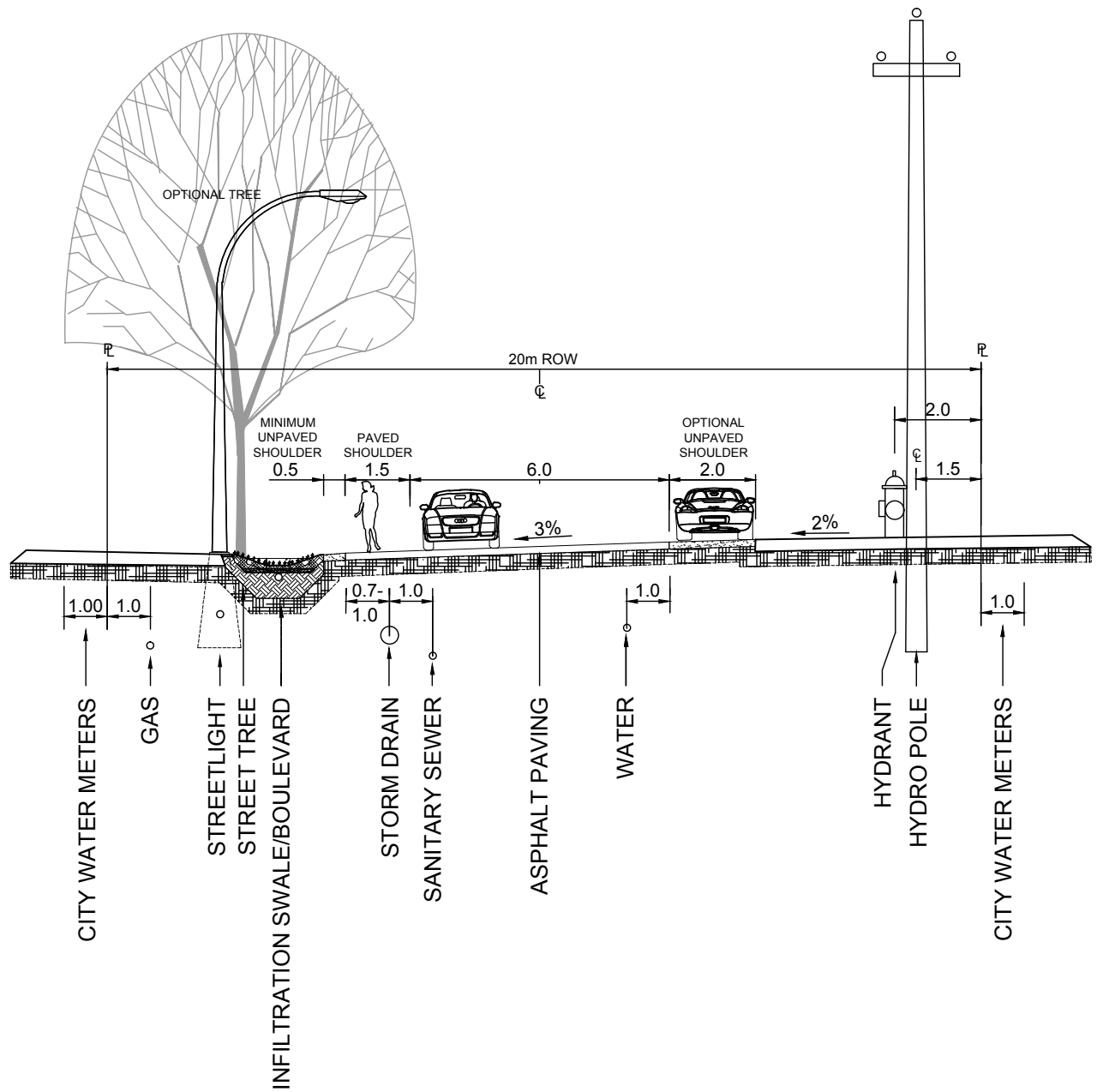
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CR-R109

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REV. 1

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NOTE:
 1. BOULEVARD MUST BE GRADED @ 2% TO 1.0m BEYOND ANY KIOSK, VAULT OR HYDRANT.

ALL DIMENSIONS IN METRES UNLESS NOTED OTHERWISE



City of
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DATE:
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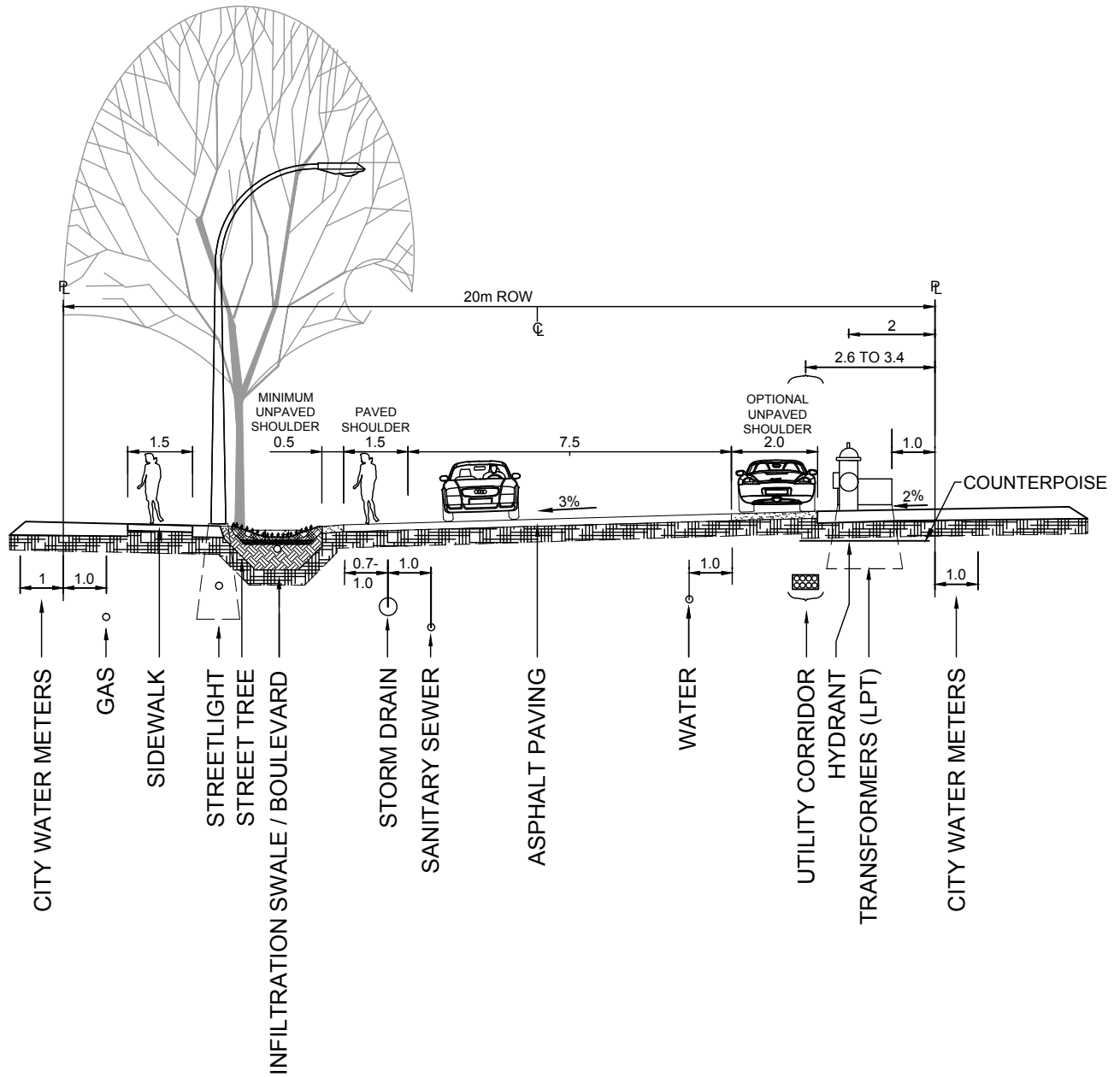
RURAL LOCAL
 RESIDENTIAL
 OVERHEAD UTILITIES

DRAWING NO.
CR-R110

DISK REF.

SHEET OF

REV. 1



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APRIL 2010

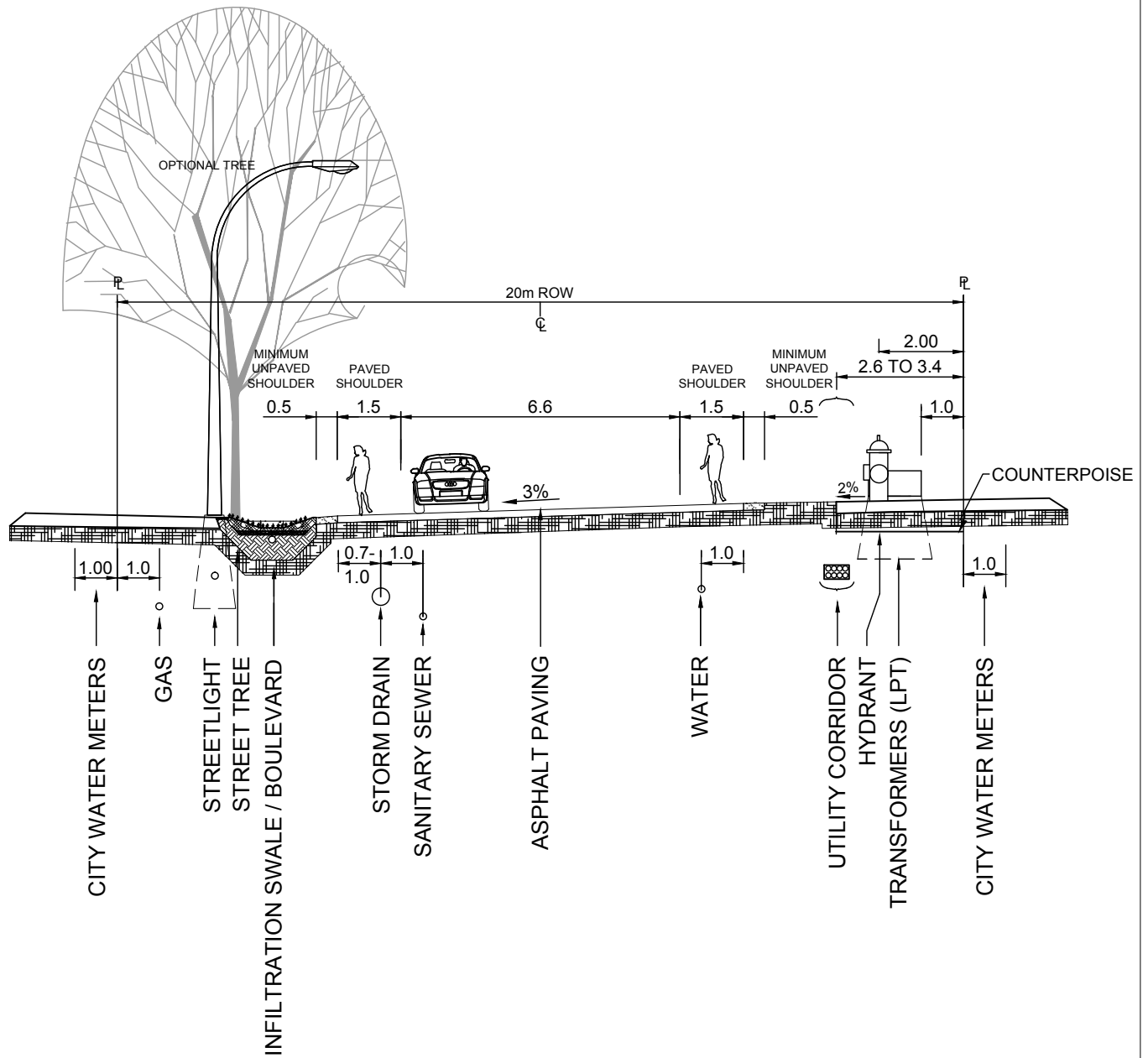
RURAL LOCAL
COMMERCIAL/INDUSTRIAL

DRAWING NO.
CR-R111

DISK REF.

SHEET OF

REV. 1



ALL DIMENSIONS IN METRES UNLESS NOTED OTHERWISE



City of
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River

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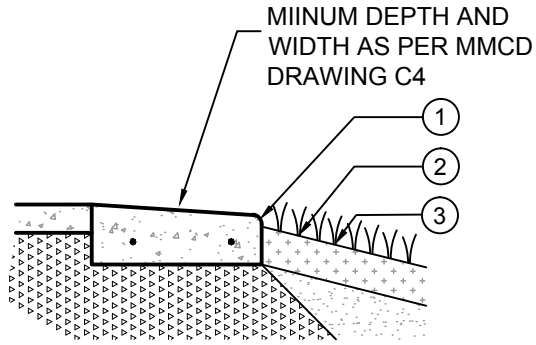
RURAL COLLECTOR

DRAWING NO.
CR-R112

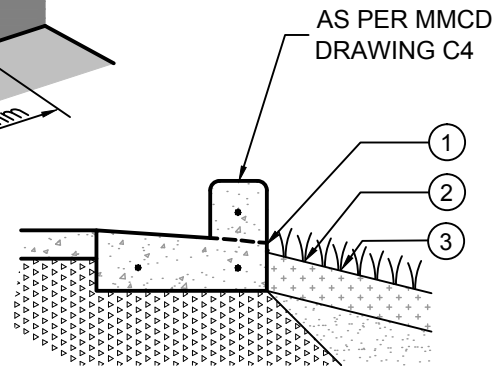
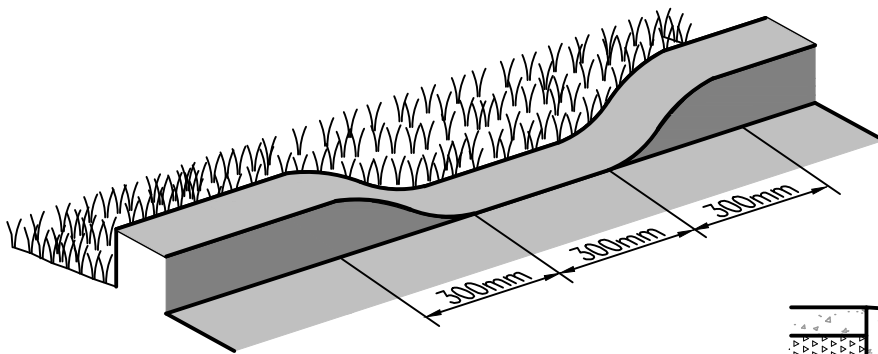
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REV. 1



FLUSH CURB



DROP CURB

- ① 0.025m VERTICAL DROP (TYP).
- ② 4:1 MAX. SLOPE FOR FIRST 0.5m (TYP.)
- ③ FINISHED WITH EROSION RESISTANT TREATMENT (EG. SODDED GRASS OR EROSION CONTROL FABRIC) TYP.

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DATE:
APRIL 2010

**CURBING OPTIONS AT
INFILTRATION SWALES**

DRAWING NO.
CR-R113

DISK REF.

SHEET OF

REV. 1

NOTES:

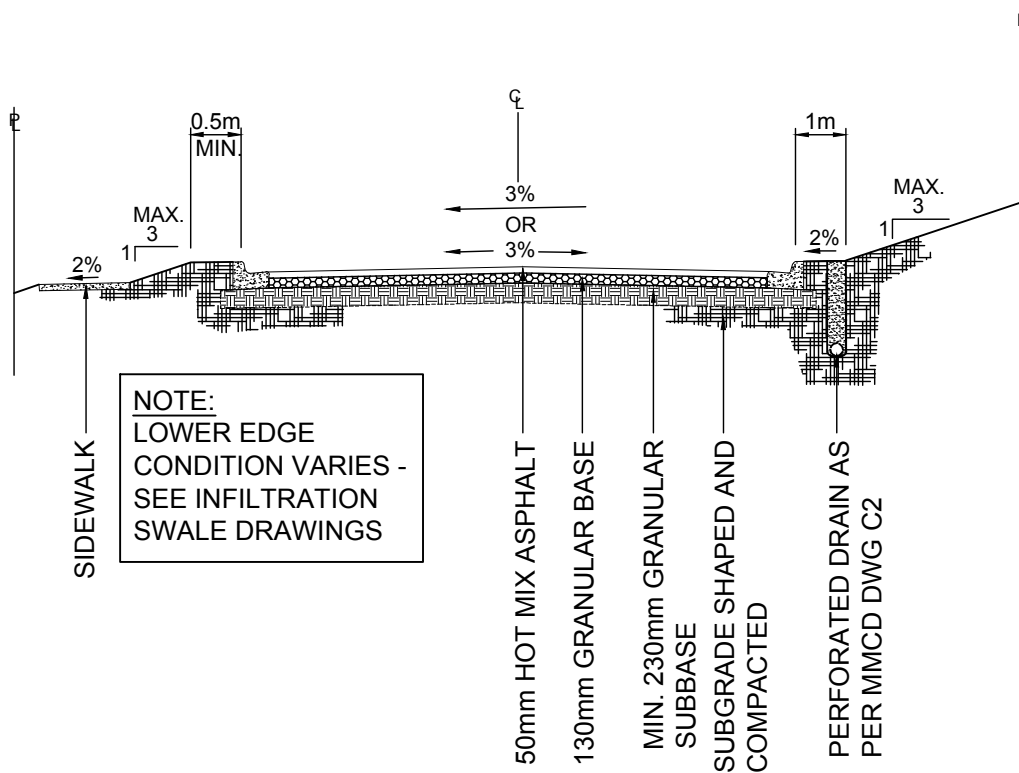
WHERE REQUIRED BY THE CITY, ROAD TO BE CONSTRUCTED TO COLLECTOR STANDARDS

SECTION SHOWN FOR TYPICAL URBAN LOCAL COLLECTOR WITHOUT INFILTRATION SWALE

BOULEVARD TO BE FINISHED WITH MIN. 200mm GROWING MEDIUM

BOULEVARD MUST BE GRADED AT 2.0% TO 1.0m BEYOND ANY KIOSK, VAULT OR HYDRANT

FILTER CLOTH SOCK TO BE INSTALLED AROUND PERFORATED PIPE



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City of
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SCALE:
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DATE:
APRIL 2010

URBAN LOCAL
PAVEMENT
STRUCTURE AND
SLOPES

DRAWING NO.
CR-R114

DISK REF.

SHEET OF

REV. 1

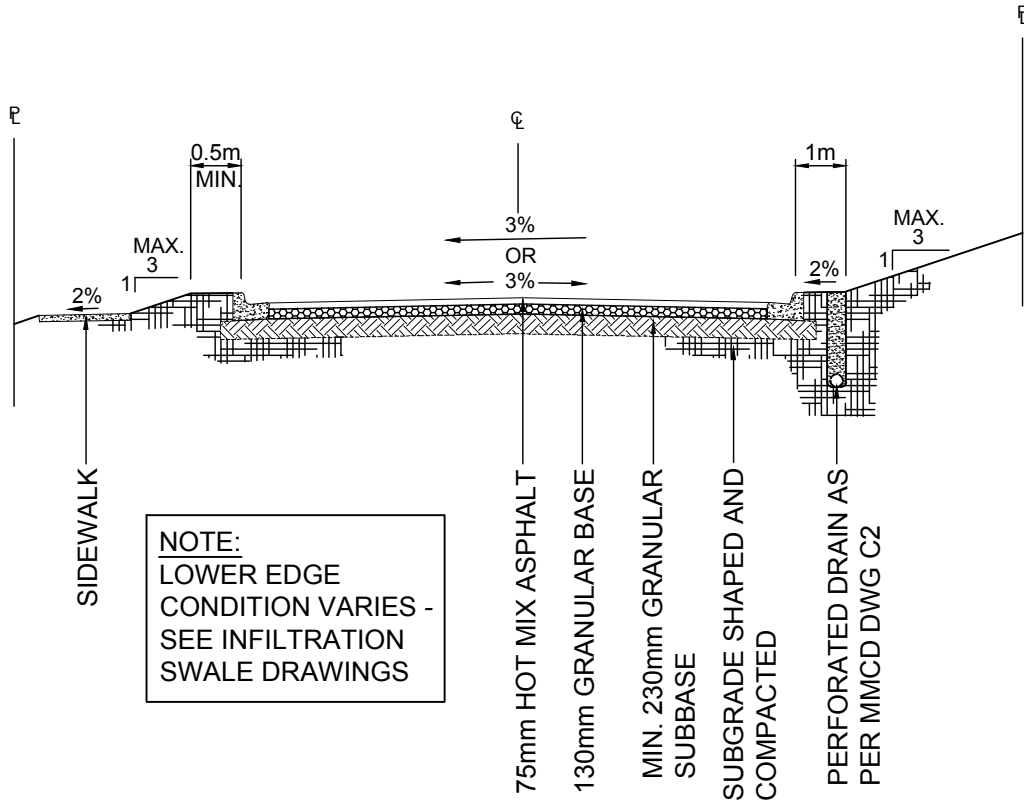
NOTES:

SECTION SHOWN FOR TYPICAL URBAN COLLECTOR HIGHWAY WITHOUT INFILTRATION SWALE

BOULEVARD TO BE FINISHED WITH MIN. 200mm GROWING MEDIUM

BOULEVARD MUST BE GRADED AT 2.0% TO 1.0m BEYOND ANY KIOSK, VAULT OR HYDRANT

FILTER CLOTH SOCK TO BE INSTALLED AROUND PERFORATED PIPE



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City of
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River**

SCALE:
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CCR

DATE:
APRIL 2010

URBAN COLLECTOR PAVEMENT
STRUCTURE AND SLOPES

DRAWING NO.
CR-R115

DISK REF.

SHEET OF

REV. 1

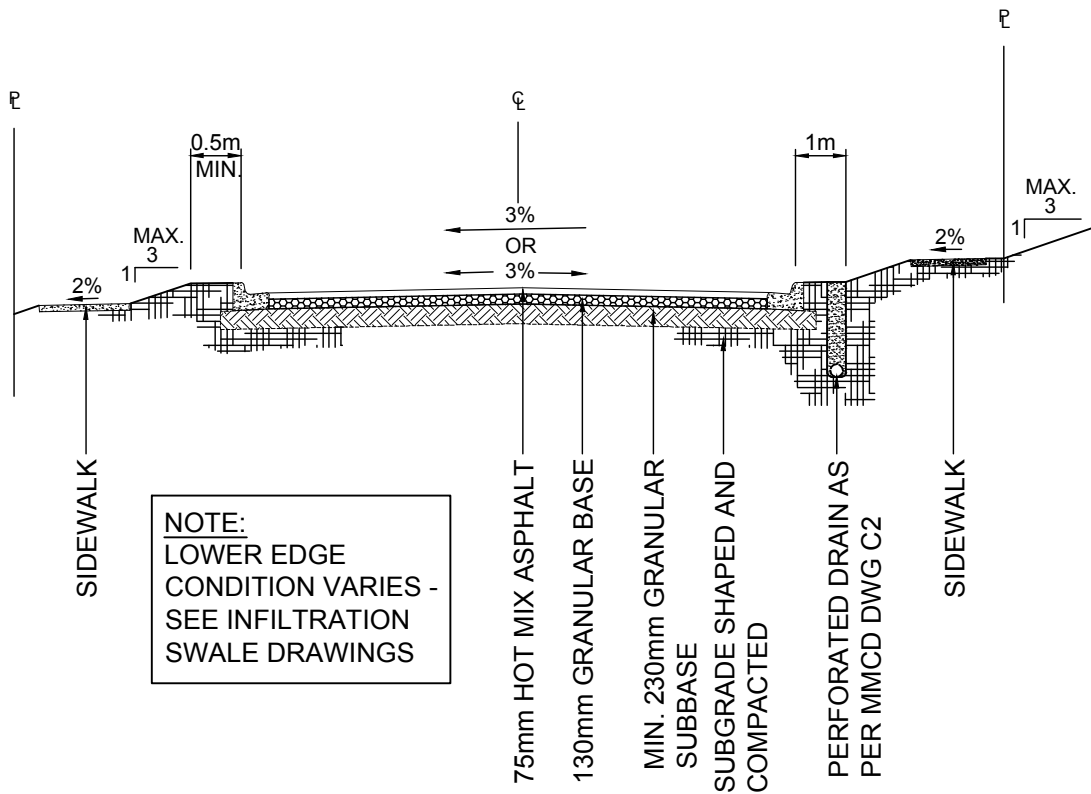
NOTES:

SECTION SHOWN FOR TYPICAL URBAN ARTERIAL HIGHWAY WITHOUT INFILTRATION SWALE

BOULEVARD TO BE FINISHED WITH MIN. 200mm GROWING MEDIUM

BOULEVARD MUST BE GRADED AT 2.0% TO 1.0m BEYOND ANY KIOSK, VAULT OR HYDRANT

FILTER CLOTH TO BE INSTALLED AROUND PERFORATED PIPE



NOTE:
LOWER EDGE
CONDITION VARIES -
SEE INFILTRATION
SWALE DRAWINGS

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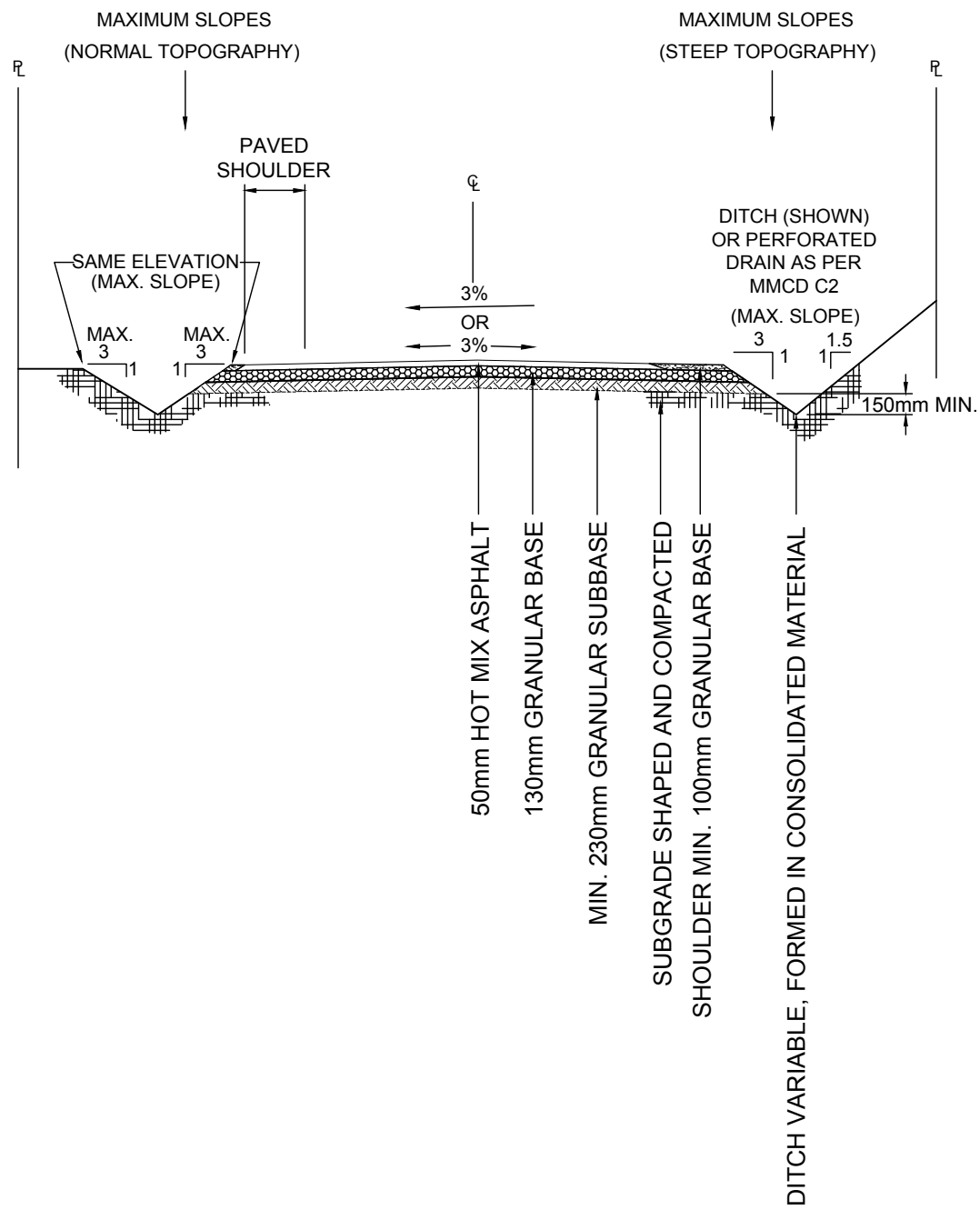
City of
**Campbell
River**

SCALE:
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DATE:
APRIL 2010

URBAN ARTERIAL
PAVEMENT
STRUCTURE AND
SLOPES

DRAWING NO.
CR-R116
DISK REF.
SHEET OF
REV. 1

NOTES:
 SECTION SHOWN FOR TYPICAL RURAL LOCAL HIGHWAY WITHOUT INFILTRATION SWALE
 BOULEVARD TO BE FINISHED WITH MIN. 200mm GROWING MEDIUM
 BOULEVARD MUST BE GRADED AT 2.0% TO 1.0m BEYOND ANY KIOSK, VAULT OR HYDRANT



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City of
**Campbell
 River**

SCALE:
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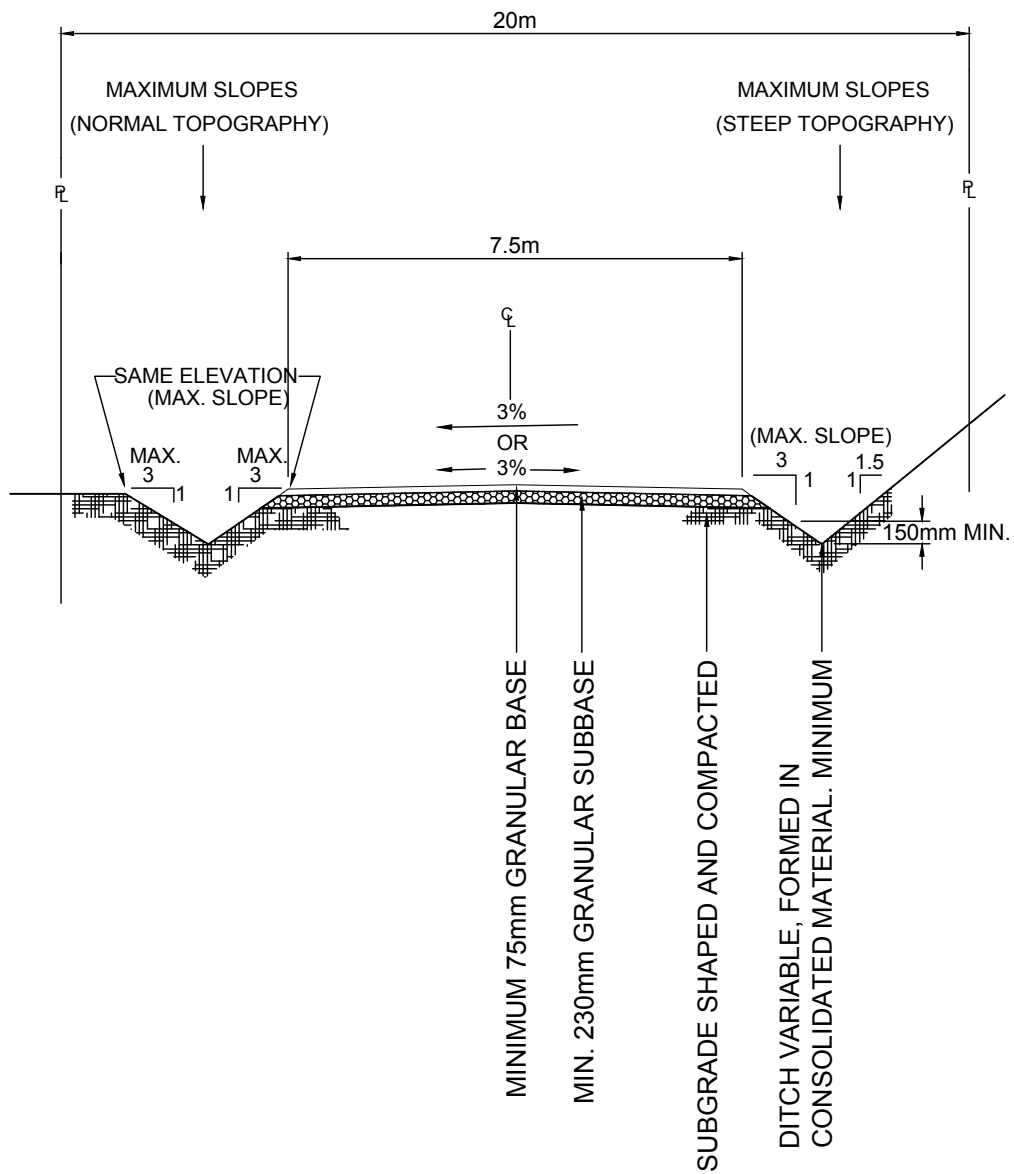
RURAL LOCAL RESIDENTIAL
 PAVEMENT STRUCTURE
 AND SLOPES

DRAWING NO.
CR-R117
 DISK REF.
 SHEET OF
 REV. 1

NOTES:

THIS PLAN IS INTENDED TO PROVIDE A SUITABLE ROADWAY DESIGN WITH ADEQUATE SUBGRADE AND GRANULAR BASE SO THAT THE SURFACE MAY BE UPGRADED TO RURAL LOCAL RESIDENTIAL STREET X-SECTIONS (DRAWING CR-R110) WITHOUT FURTHER EXCAVATION AND BACKFILL.

ALL AGGREGATES SHALL BE TO MMCD SECTION 31 05 17 AGGREGATES AND GRANULAR MATERIALS.



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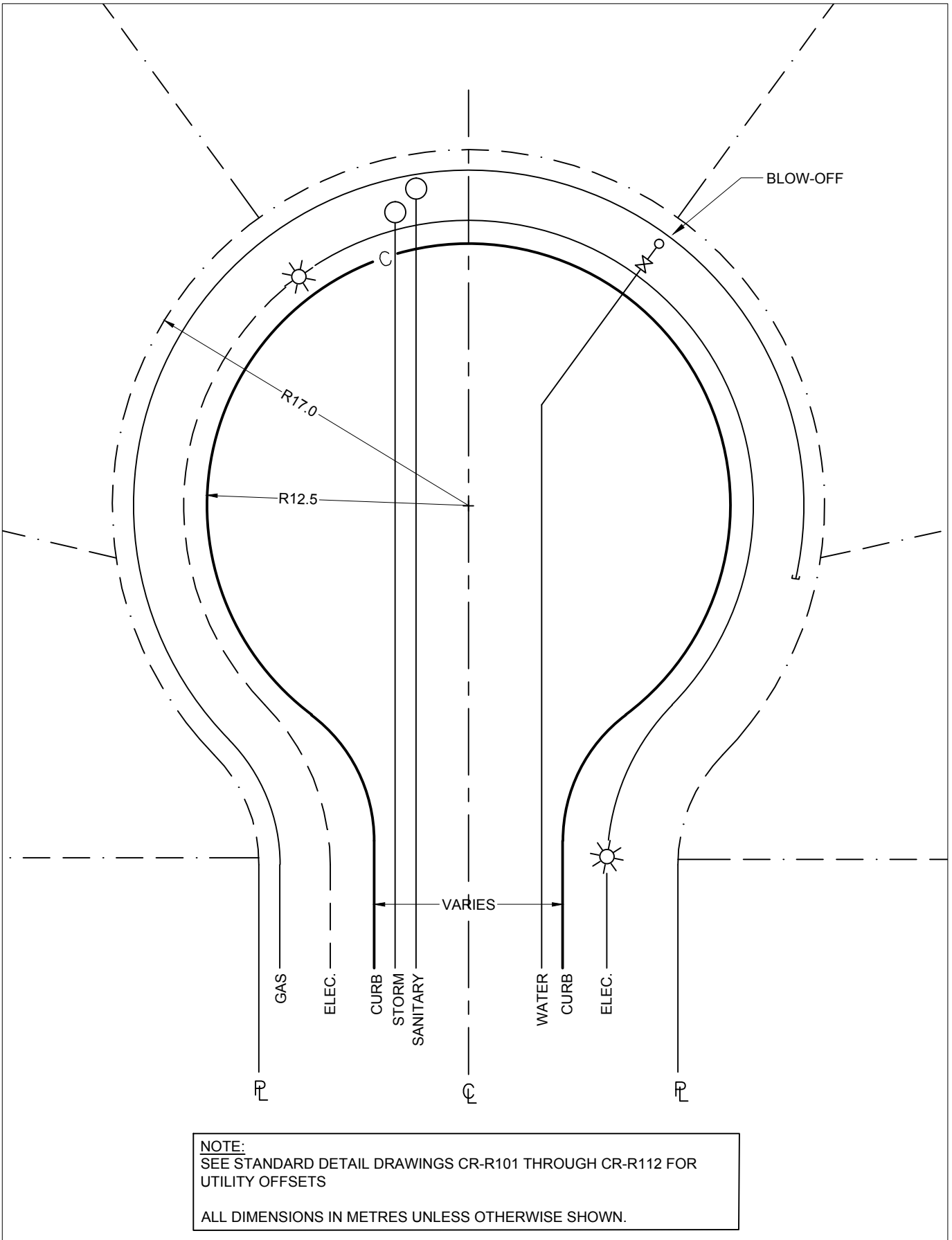
City of
**Campbell
River**

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DATE:
APRIL 2010

GRAVEL ROAD CROSS SECTION

DRAWING NO.
CR-R118
DISK REF.
SHEET OF
REV. 1

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NOTE:
 SEE STANDARD DETAIL DRAWINGS CR-R101 THROUGH CR-R112 FOR
 UTILITY OFFSETS
 ALL DIMENSIONS IN METRES UNLESS OTHERWISE SHOWN.



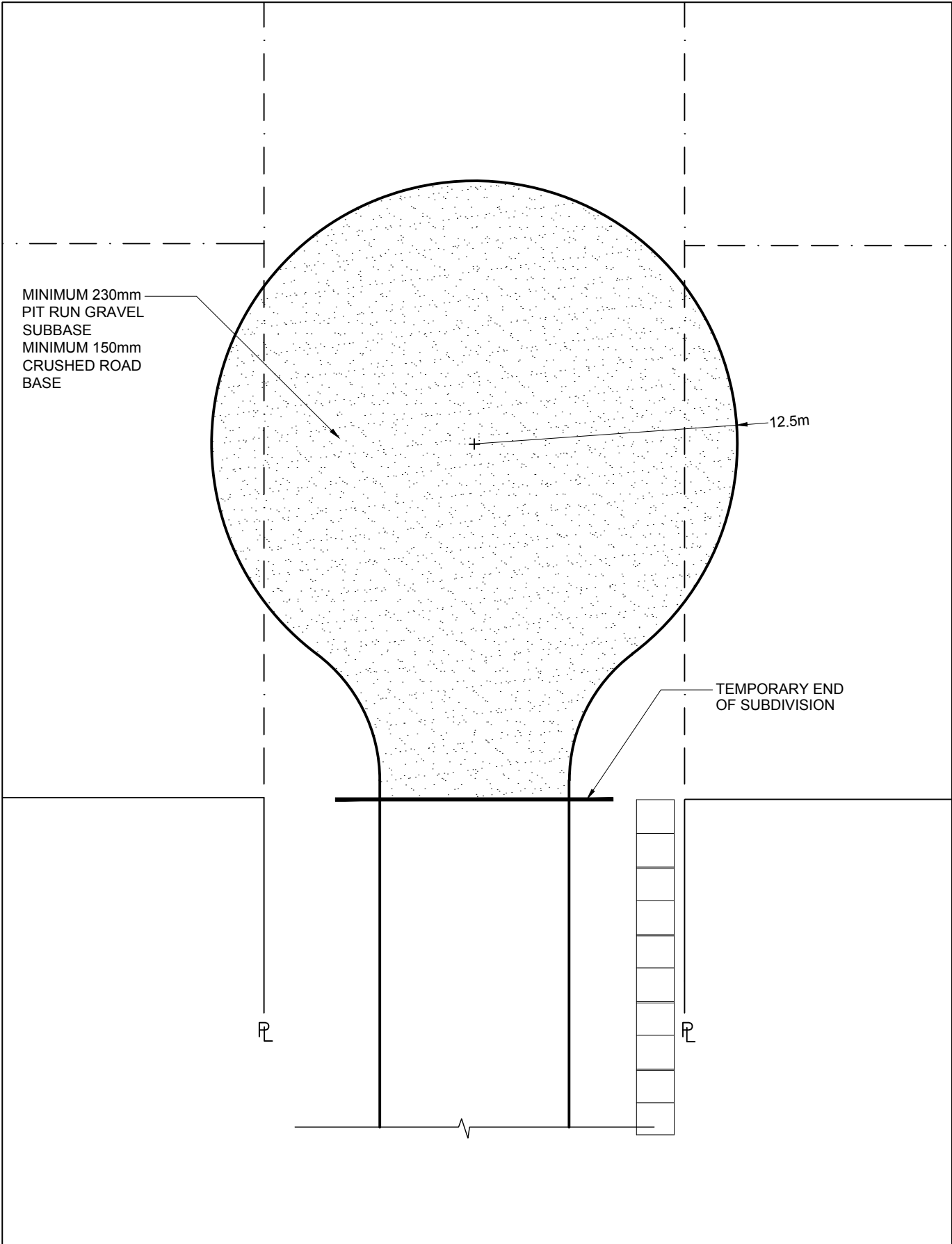
City of
**Campbell
 River**

SCALE:
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 CCR
 DATE:
 APRIL 2010

**CUL-DE-SAC
 TYPICAL UTILITY LOCATIONS**

DRAWING NO.
CR-R119
 DISK REF.
 SHEET OF
 REV. 1

O:\CAD\5210-00-R393 Standards\Rev-DWG\CR-R120.dwg May 05, 2010 8:20:26am



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TEMPORARY GRAVEL CUL-DE-SAC

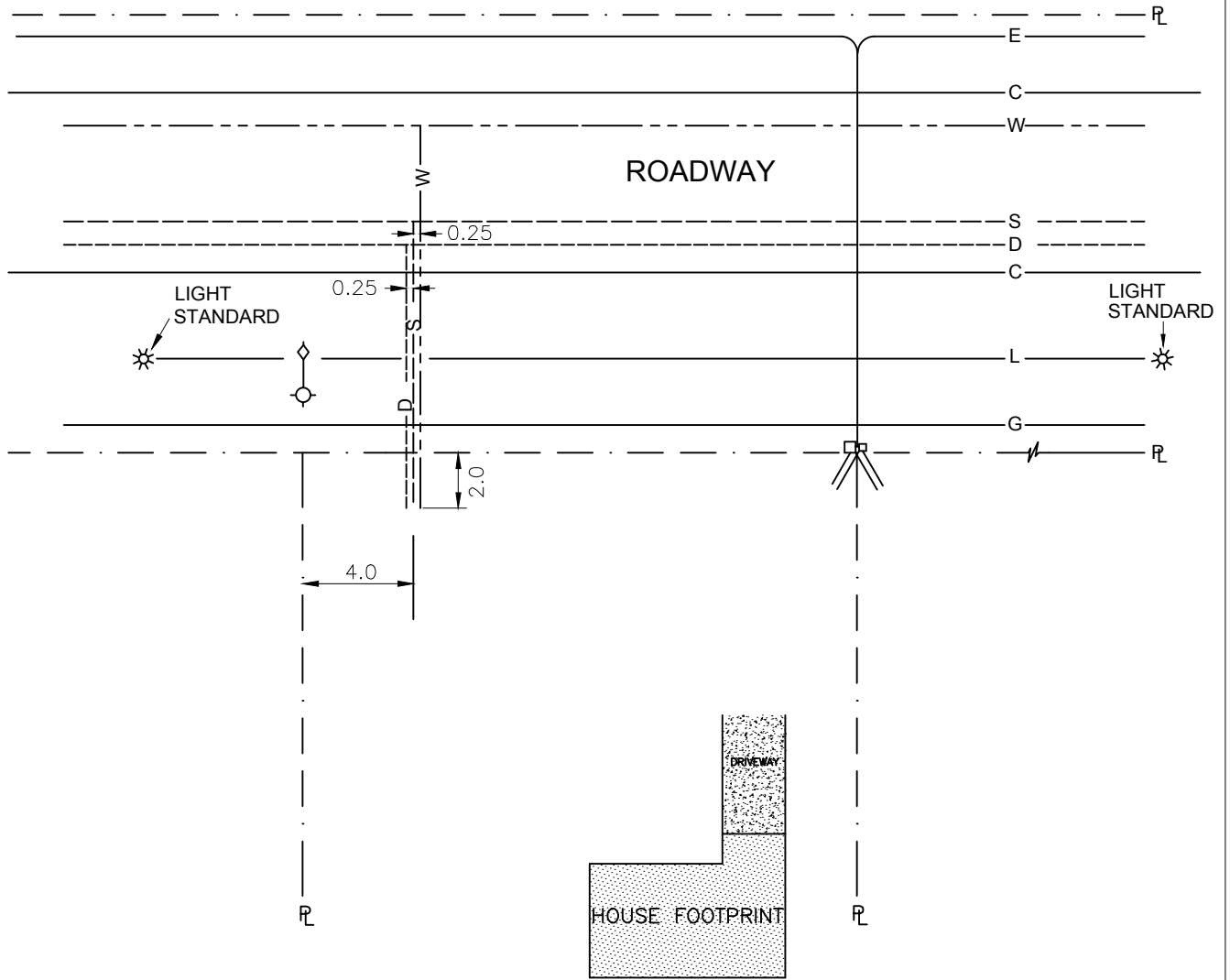
DRAWING NO.
CR-R120

DISK REF.

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- ALL DIMENSIONS IN METRES UNLESS OTHERWISE SHOWN.



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APRIL 2010

SERVICE LOCATIONS

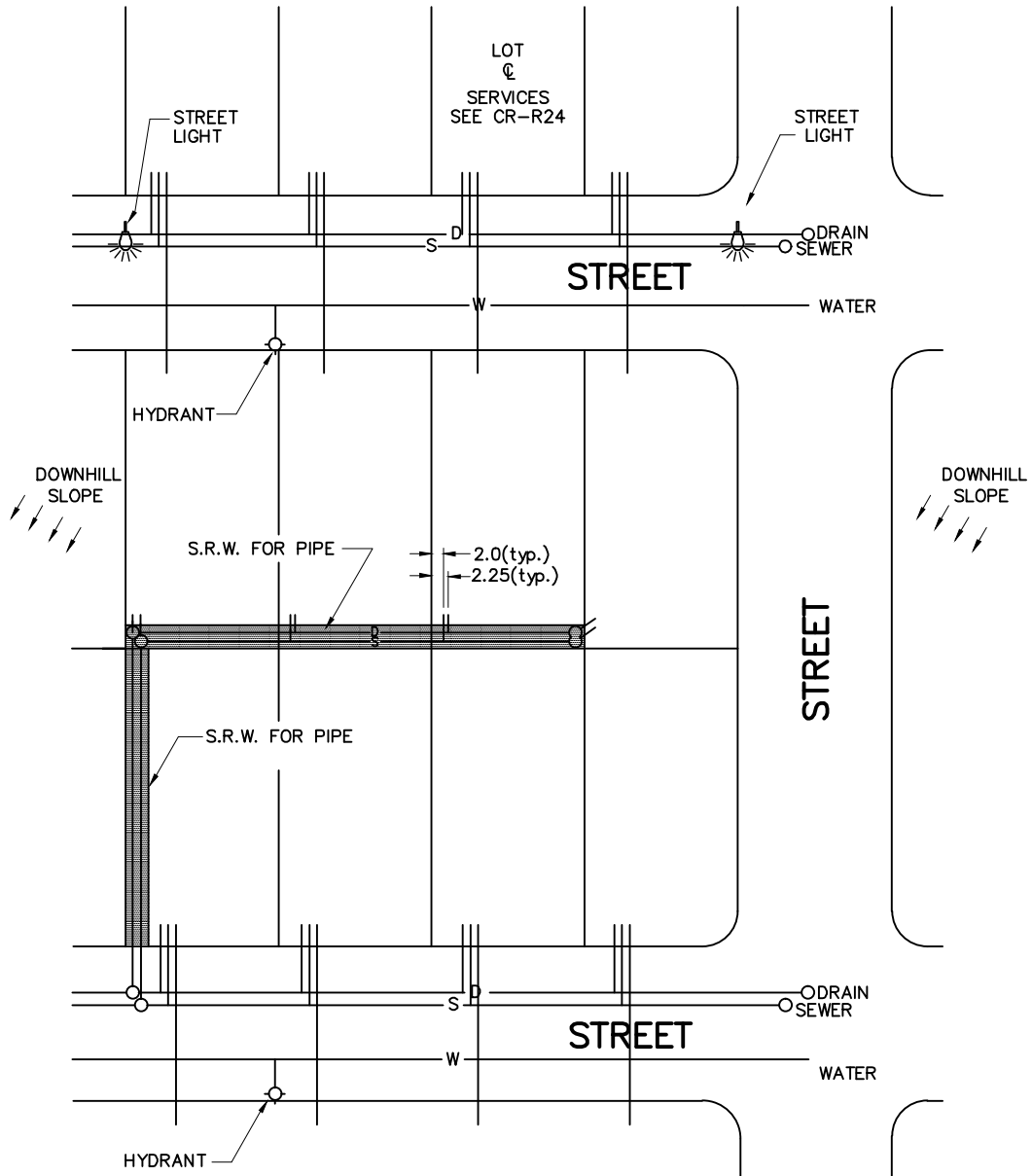
DRAWING NO.
CR-R121

DISK REF.

SHEET OF

REV.

O:\CAD\5210-00-R393 Standards\Rev-DWGs\CR-R122.dwg May 05, 2010 8:22:50am



MAXIMUM DEPTH OF WATER SERVICE TO BE 1.0m
ALL DIMENSIONS IN METRES UNLESS OTHERWISE SHOWN.



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PREFERRED LOCATIONS OF
BUILDING SERVICES

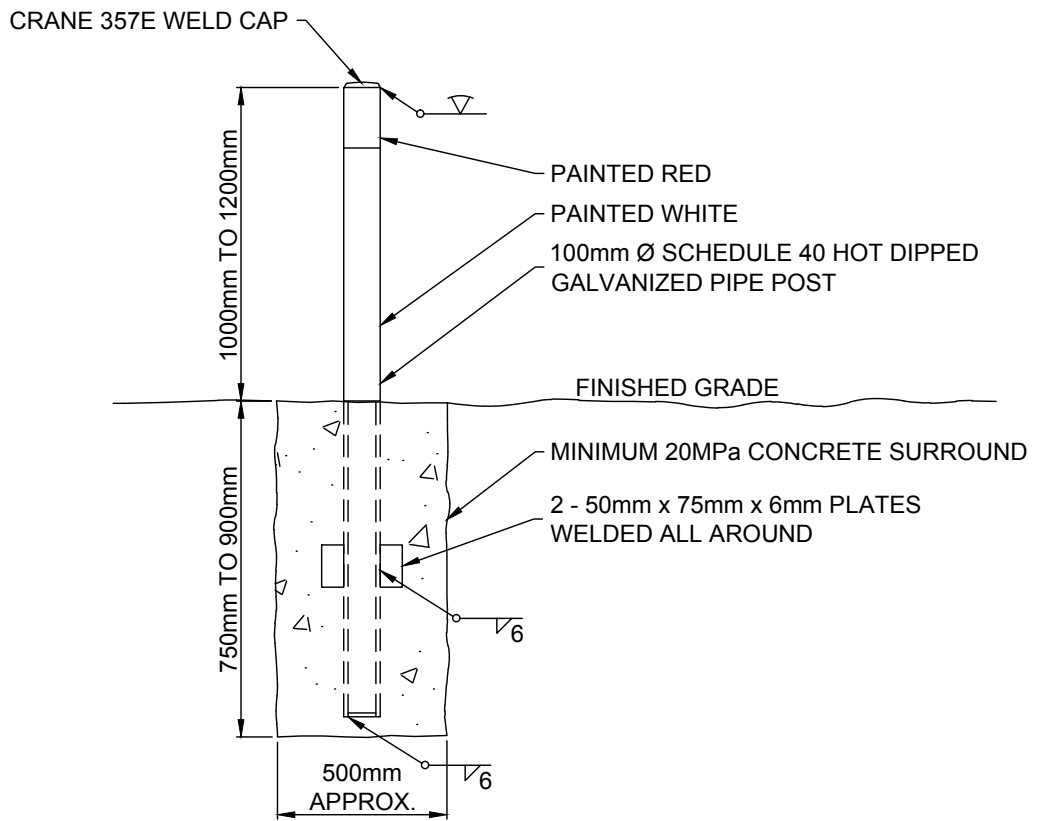
DRAWING NO.
CR-R122

DISK REF.

SHEET OF

REV. 1

O:\CAD\5210-00-R393 Standards\Rev-DWGs\CR-C12a.dwg Apr 26, 2010 9:49:14am



RATIO OF 3/4 FOR BURY OF POST/EXPOSED POST



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APRIL 2010

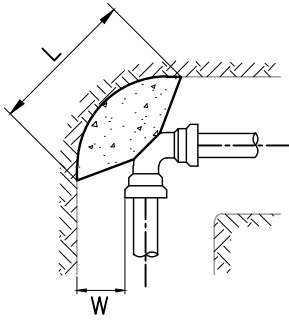
FIXED RESTRICTION POST

DRAWING NO.
CR-C12a

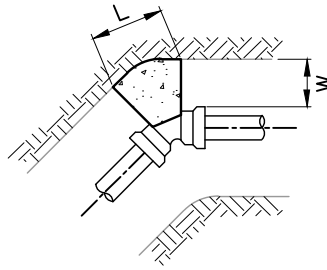
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SHEET OF

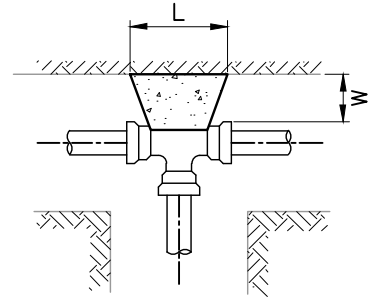
REV. 1



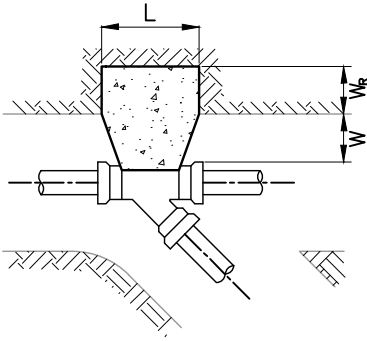
HORIZONTAL 90° BEND



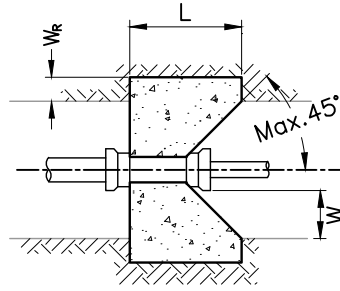
HORIZONTAL 45° BEND



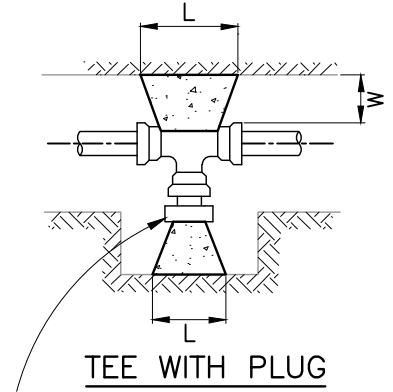
TEE



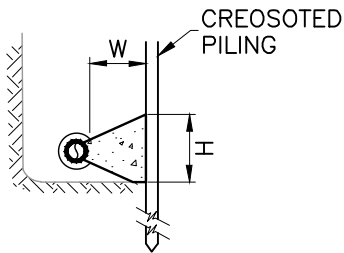
WYE



REDUCER

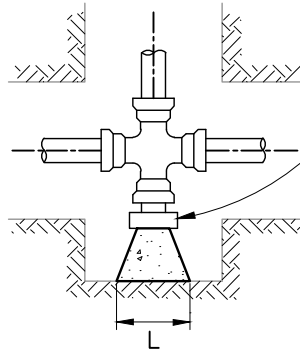


TEE WITH PLUG



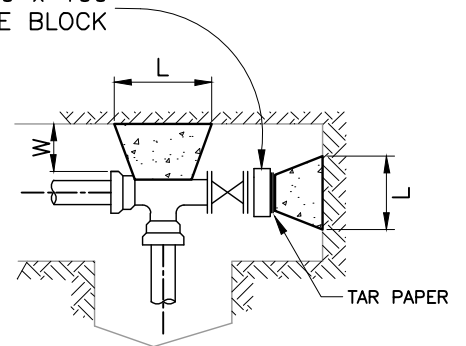
Note: WHERE GROUND CANNOT BE EXCAVATED TO FREE STANDING UNDISTURBED SOIL. SMALL PLANK SHEET PILING SHALL BE DRIVEN TO PROVIDE UNDISTURBED THRUST AREA. PILING TO BE DRIVEN PRIOR TO EXCAVATING FOR THRUST BLOCK. PILING SHOULD BE USED ONLY BELOW THE PERMANENT WATER TABLE.

BLOCK & PILING



CROSS WITH PLUG

300 x 300 x 100
CONCRETE BLOCK



TEE WITH VALVE

- CONCRETE TO HAVE A 28 DAY COMPRESSIVE STRENGTH OF 20 MPa.
- SEE DRAWING CR-W1A FOR DIMENSION VALUES L,W,H & W
- ALL DIMENSIONS IN MILLIMETRES, UNLESS OTHERWISE SHOWN.



MINIMUM THRUST AREAS FOR FITTINGS AT 1030kPa PRESSURE AND FOR SOILS WITH MINIMUM BEARING PRESSURE OF 96kPa

(NOT TO BE USED FOR SOFT CLAY, MUCK, PEAT ETC.)

* DIMENSIONS APPLY TO THE LARGER DIAMETER END OF FITTING

TYPE OF FITTING	FITTING SIZE	OUTSIDE OF FITTING TO BEARING PLACE	RECESS IN TRENCH WALL	LENGTH	HEIGHT
	D	W	W _R	L	H
90° BEND	150	300	/	920	400
	200	350		1070	610
	250	380		1450	760
	300	400		1650	920
45° BEND	150	300	/	460	460
	200	350		610	610
	250	380		760	760
	300	400		920	920
22.5° BEND	150	300	/	460	230
	200	350		610	300
	250	380		840	460
	300	400		920	460
TEE	150	300	/	610	460
	200	350		760	610
	250	380		990	760
	300	400		1220	920
CROSS	150	300	/	610	460
	200	350		760	610
	250	380		990	760
	300	400		1220	920
45° WYE	150	300	300	460	460
	200	350	400	610	610
	250	380	500	760	760
	300	400	600	920	920
REDUCER	150	300	150	460	460
	200	350	200	610	610
	250	380	250	760	760
	300	400	300	920	920
CAPS&PLUGS (if not bolted)	150	300	/	460	460
	200	350		610	610
	250	380		760	760
	300	400		920	920

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City of
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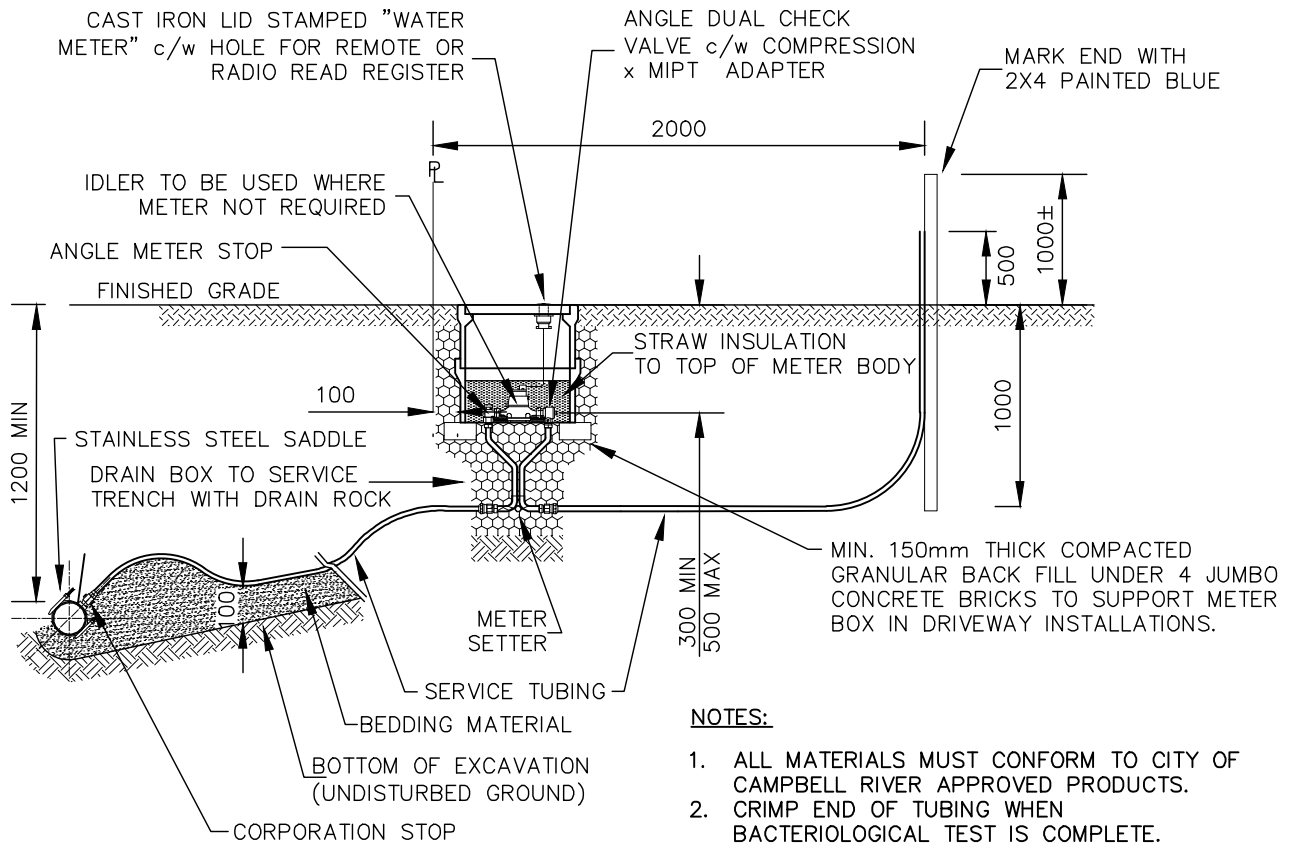
THRUST BLOCKING

DRAWING NO.
CR-W1a

DISK REF.

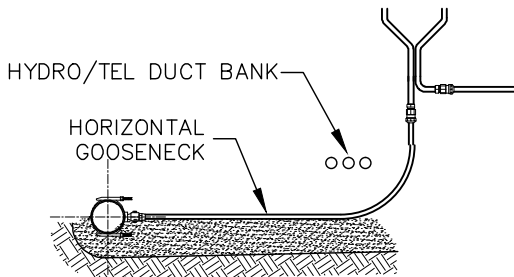
SHEET OF

REV. 1



NOTES:

1. ALL MATERIALS MUST CONFORM TO CITY OF CAMPBELL RIVER APPROVED PRODUCTS.
2. CRIMP END OF TUBING WHEN BACTERIOLOGICAL TEST IS COMPLETE.
3. REFER TO SECTION 33 11 01 FOR DESIGN SPECIFICATIONS.



ALTERNATE FOR HYDRO/TEL SIDE

O:\CAD\5210-00-R393 Standards\Rev-DWGs\CR-W2a.dwg May 05, 2010 9:08:01am



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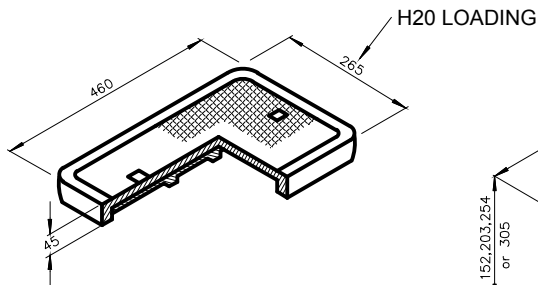
**STANDARD WATER METER
SERVICE (PROPERTY) BOX
c/w 16 - 19mm (5/8 - 3/4") SETTER
TYPICAL INSTALLATION**

DRAWING NO.
CR-W2a

DISK REF.

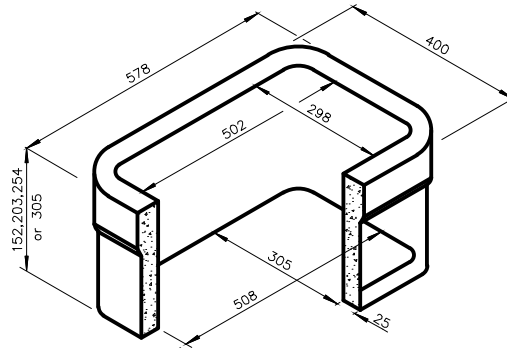
SHEET OF

REV. 1

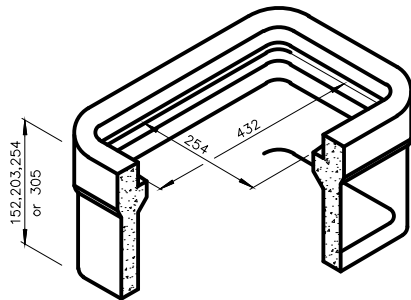


**CAST IRON TRAFFIC COVER
MARKED WATER METER**

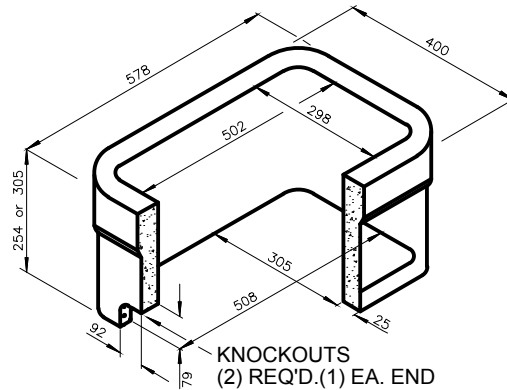
C/W 45mm Ø UN -RECESSED
HOLE FOR TOUCH READ AND
RADIO READ PIT LID ADAPTER
(WITH PLUG)



EXTENSION



TOP



BOTTOM

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS SHOWN OTHERWISE
2. ONLY PRODUCTS APPROVED BY THE CITY AND LISTED IN THE CITY OF CAMPBELL RIVER APPROVED PRODUCTS LIST WILL BE ACCEPTED FOR INSTALLATION.

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APRIL 2010

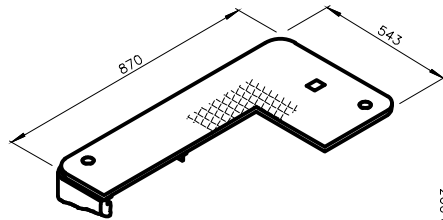
**STANDARD CONCRETE
METER BOX
(FOR 19 DIA. METERS)**

DRAWING NO.
CR-W2e

DISK REF.

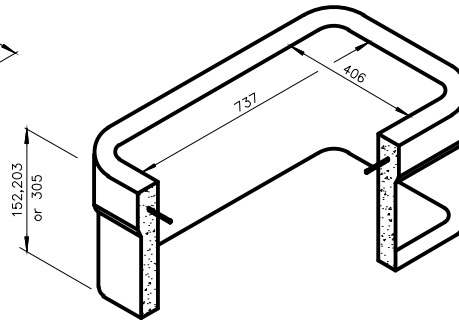
SHEET OF

REV. 1

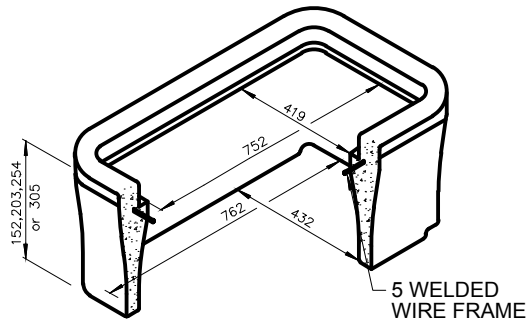


**STEEL TRAFFIC COVER
MARKED WATER**

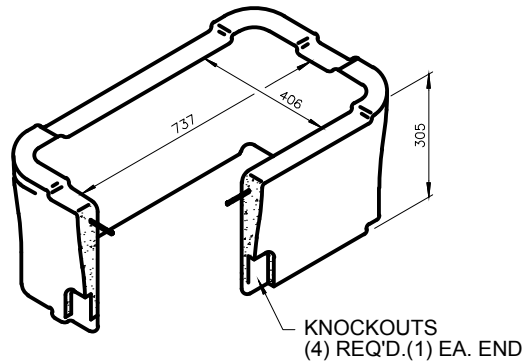
1/2" 45mm Ø UN-RECESSED
HOLE FOR TOUCH READ AND
RADIO READ PIT LID ADAPTER
(WITH PLUG)



EXTENSION



TOP



BOTTOM

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS SHOWN OTHERWISE
2. ONLY PRODUCTS APPROVED BY THE CITY AND LISTED IN THE CITY OF CAMPBELL RIVER APPROVED PRODUCTS LIST WILL BE ACCEPTED FOR INSTALLATION.

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City of
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APRIL 2010

STANDARD CONCRETE METER BOX
(FOR 25-50 DIA. METERS)

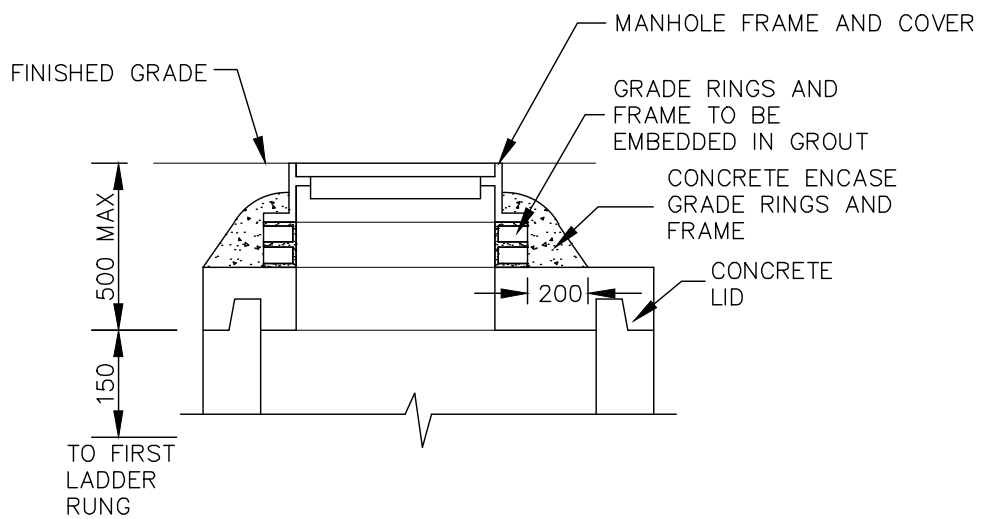
DRAWING NO.
CR-W2f

DISK REF.

SHEET OF

REV. 1

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City of
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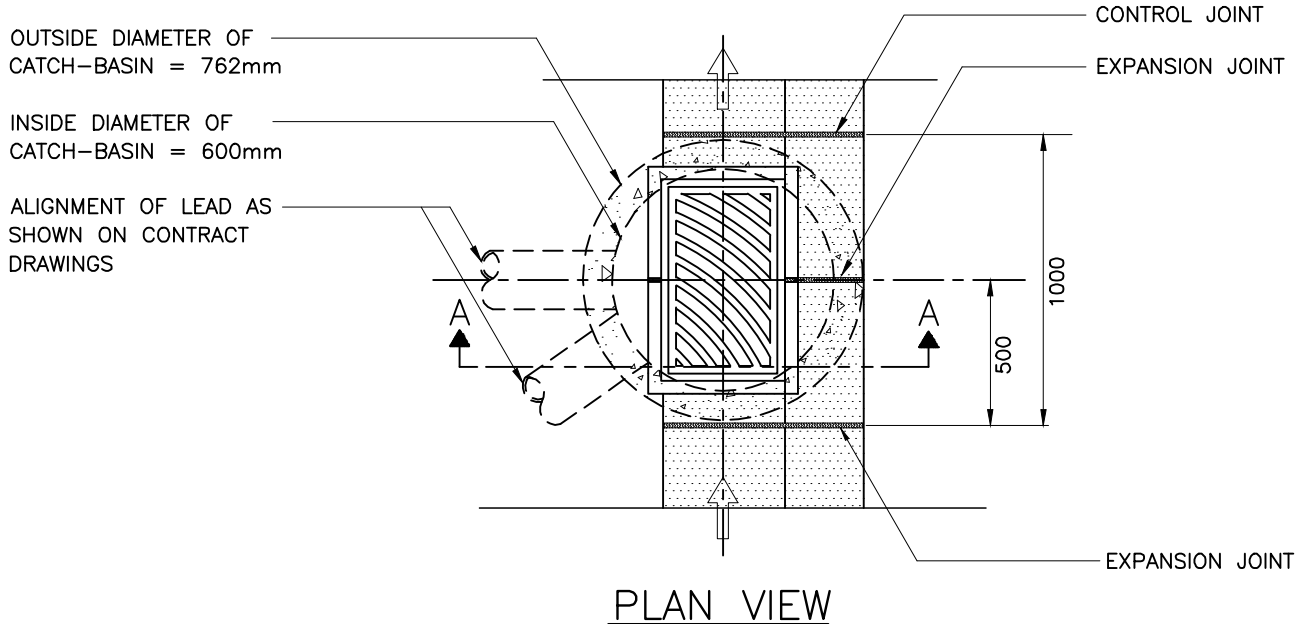
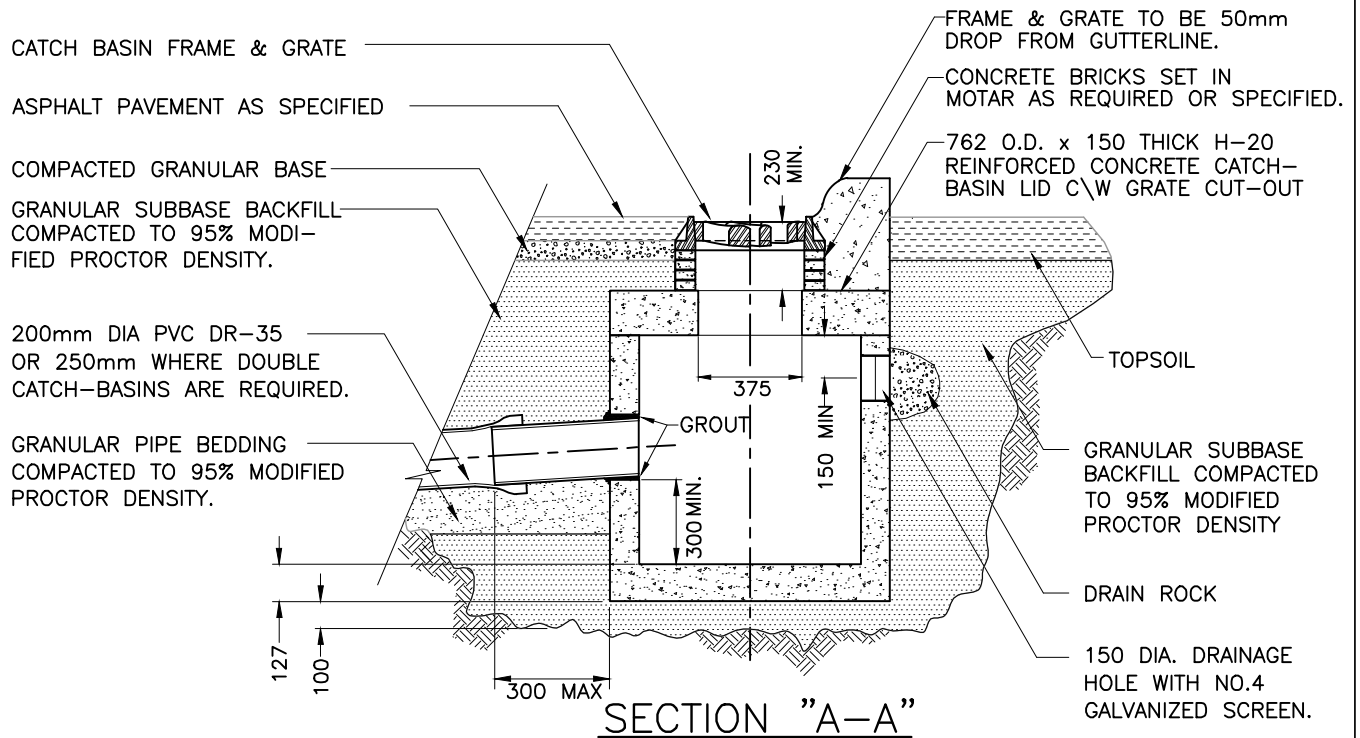
MANHOLE LID GROUTING DETAIL

DRAWING NO.
CR-S1a

DISK REF.

SHEET OF

REV. 1



- DETAILS ARE DRAWN FOR PRECAST RISERS ON CAST-IN PLACE BASES. PRECAST UNITS C/W BASE APPROVED BY ENGINEER ARE ACCEPTABLE.
- REFER TO CONTRACT DRAWINGS AND MMCD SECTION 33 44 01 FOR DETAILED SPECIFICATIONS.
- GRATING SET IN ACCORDANCE WITH FLOW PATTERN OF RUNOFF IN THE GUTTER.
- ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE SHOWN.

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CATCHBASIN

DRAWING NO.
CR-S11

DISK REF.

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REV. 1



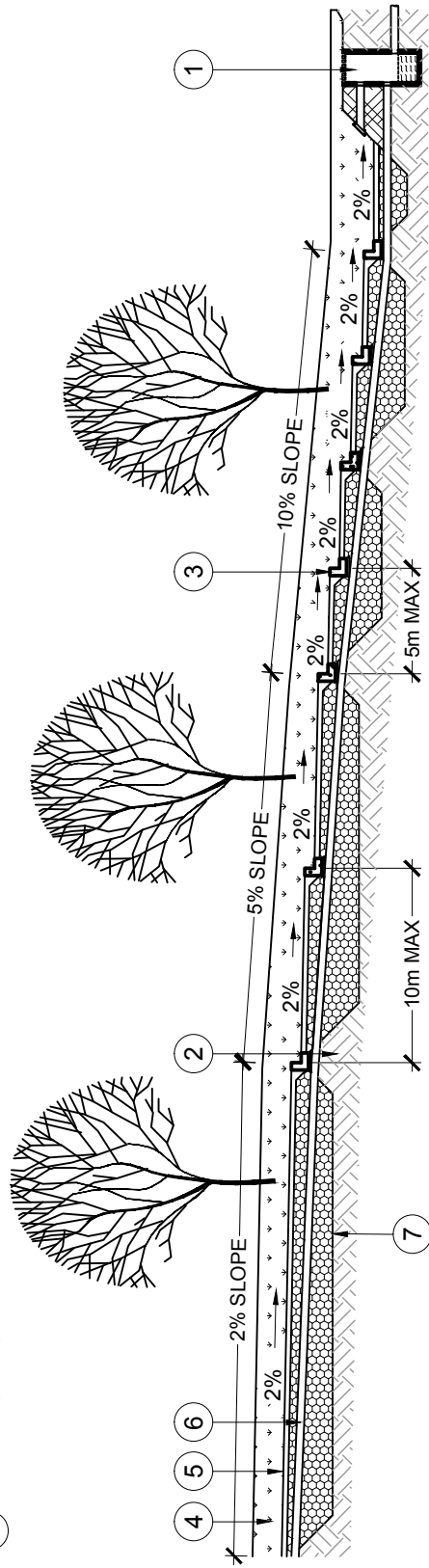
City of
Campbell
River

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DATE:
APRIL 2010

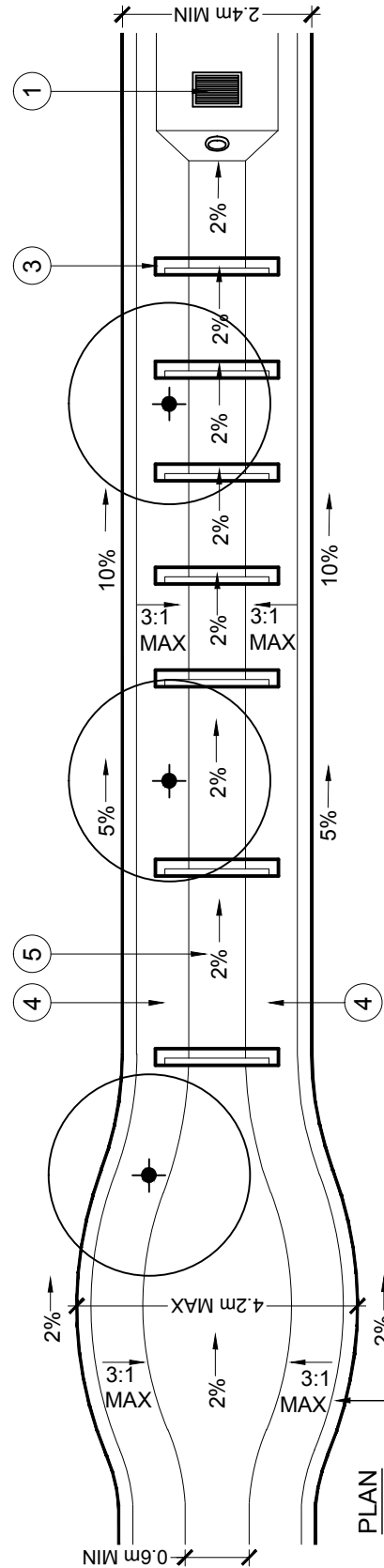
INFILTRATION SWALE PROFILE & PLAN

DRAWING NO.
CR-S101
DISK REF.
SHEET OF
REV. 1

- ① OUTLET TO PIPE SYSTEM OR WATERCOURSE
- ② DAM OF COMPACTED NATIVE MATERIAL OR EQUIVALENT TO CREATE SUBSURFACE BASIN
- ③ LEVEL WEIR KEYED INTO SWALE SIDE SLOPE
- ④ 3:1 MAX SIDE SLOPE
- ⑤ BOTTOM OF SWALE
- ⑥ PERFORATED DRAIN PIPE 150mm DIA. MIN
- ⑦ LEVEL BOTTOM DRAIN ROCK RESERVOIR

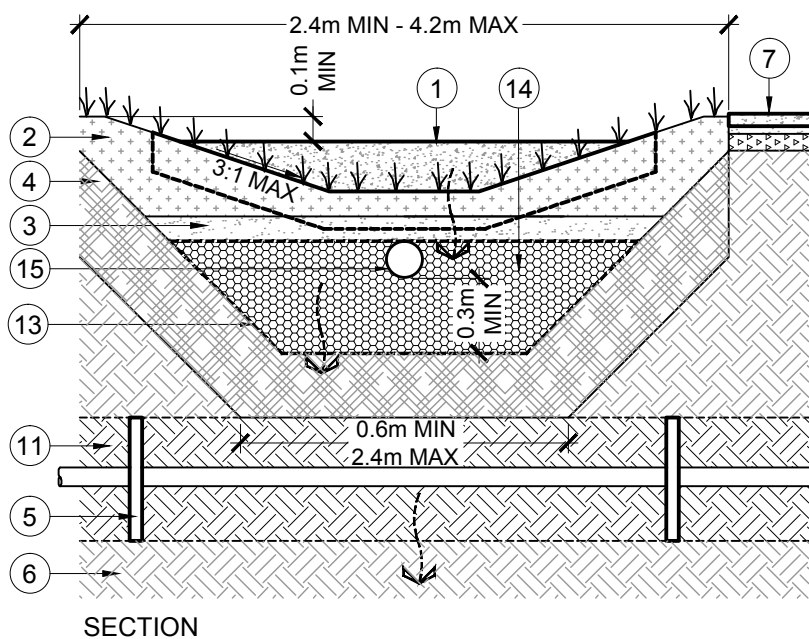
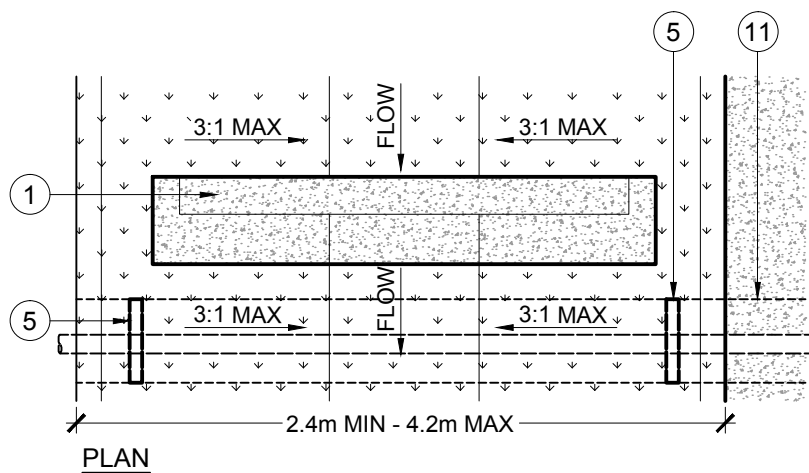
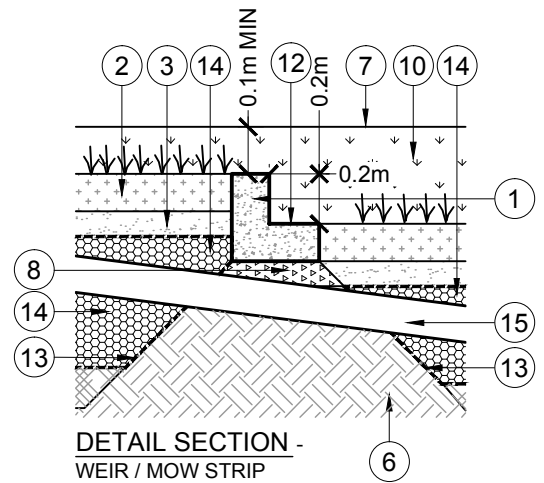
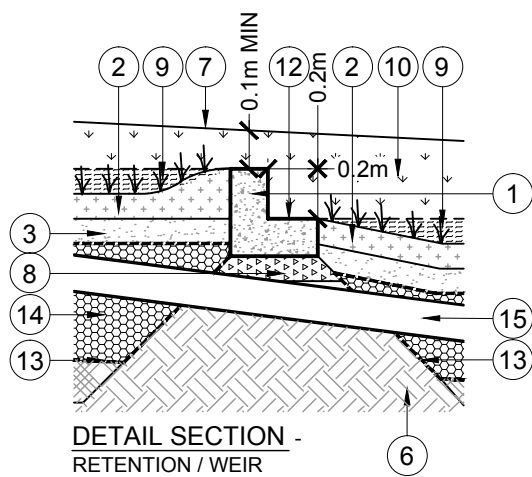


PROFILE



PLAN

NOTE: MINIMUM SWALE SIDE SLOPE MUST BE GREATER SLOPE THAN ROAD PROFILE



- ① LEVEL WEIR KEYED INTO SWALE SIDE SLOPE
- ② GROWING MEDIUM
- ③ SAND
- ④ EXISTING SCARIFIED SUBSOIL
- ⑤ TRENCH DAMS AT ALL UTILITY CROSSINGS
- ⑥ UNDISTURBED SUBSTRATE
- ⑦ ADJACENT GRADE
- ⑧ GRANULAR BASE
- ⑨ WATER BODY
- ⑩ 3:1 MAX SLOPE
- ⑪ UTILITY TRENCH
- ⑫ MOW STRIP (OPTIONAL)
- ⑬ GEOTEXTILE ALONG ALL SIDES OF DRAIN ROCK RESERVOIR
- ⑭ DRAIN ROCK RESERVOIR (0.3m MIN)
- ⑮ PERFORATED UNDERDRAIN (0.15m DIA. MIN)

NOTE:
PROVIDE EROSION CONTROL ALONG SIDES OF WEIR AND AT DRAINAGE INLETS.

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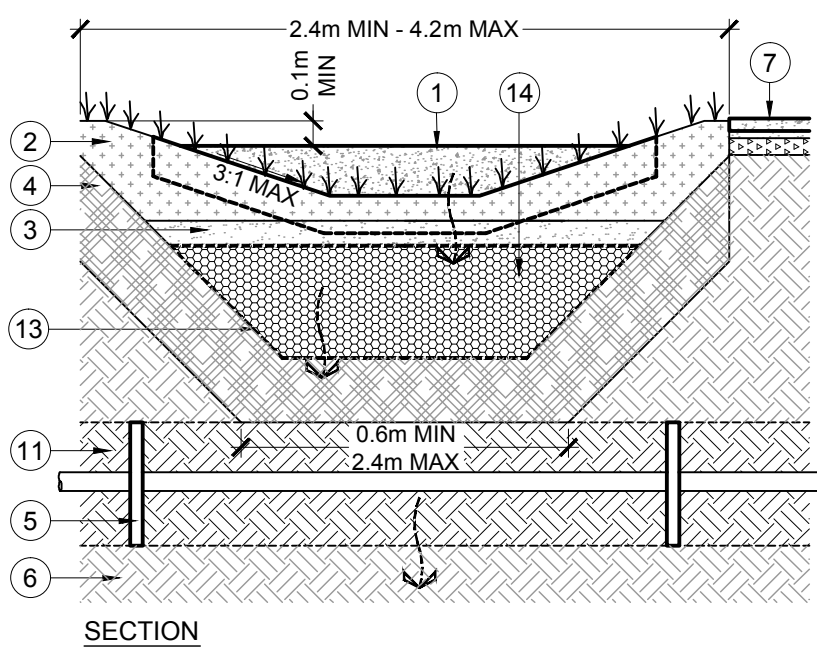
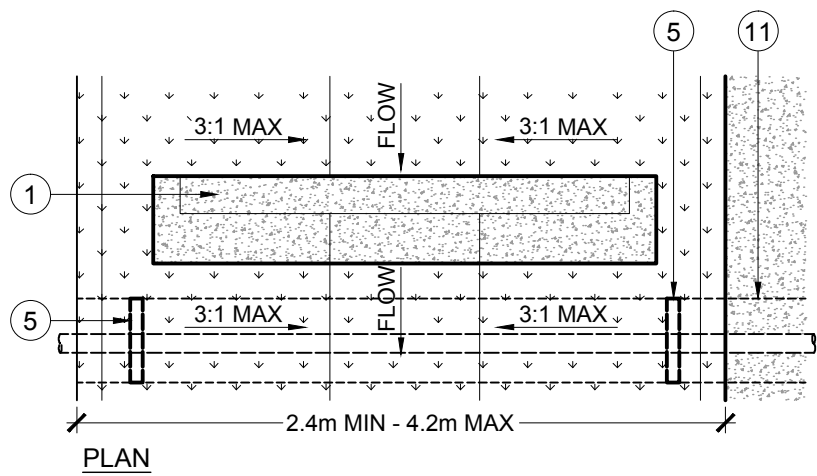
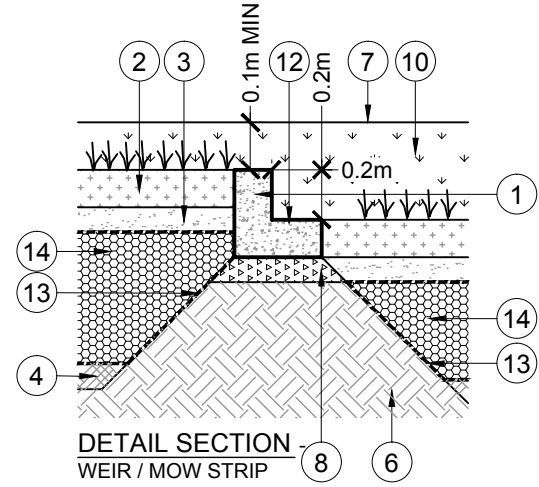
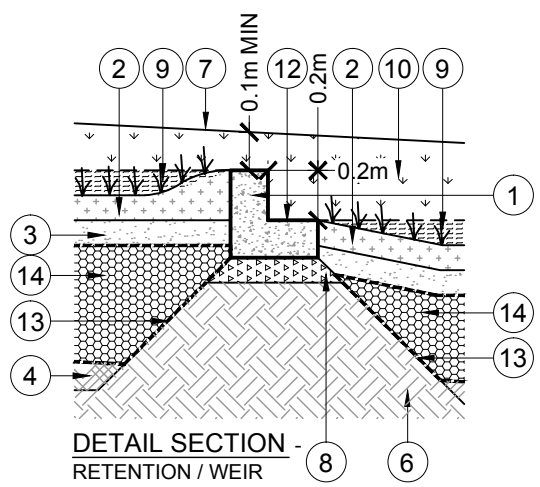
PARTIAL INFILTRATION SWALE WITH
RESERVOIR & SUBDRAIN

DRAWING NO.
CR-S102

DISK REF.

SHEET OF

REV. 1



- ① LEVEL WEIR KEYED INTO SWALE SIDE SLOPE
- ② GROWING MEDIUM
- ③ SAND
- ④ EXISTING SCARIFIED SUBSOIL
- ⑤ TRENCH DAMS AT ALL UTILITY CROSSINGS
- ⑥ UNDISTURBED SUBSTRATE
- ⑦ ADJACENT GRADE
- ⑧ GRANULAR BASE
- ⑨ WATER BODY
- ⑩ 3:1 MAX SLOPE
- ⑪ UTILITY TRENCH
- ⑫ MOW STRIP (OPTIONAL)
- ⑬ GEOTEXTILE ALONG ALL SIDES OF DRAIN ROCK RESERVOIR
- ⑭ DRAIN ROCK RESERVOIR (0.3m MIN)

NOTE:
 PROVIDE EROSION CONTROL ALONG SIDES OF WEIR AND AT DRAINAGE INLETS.

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City of
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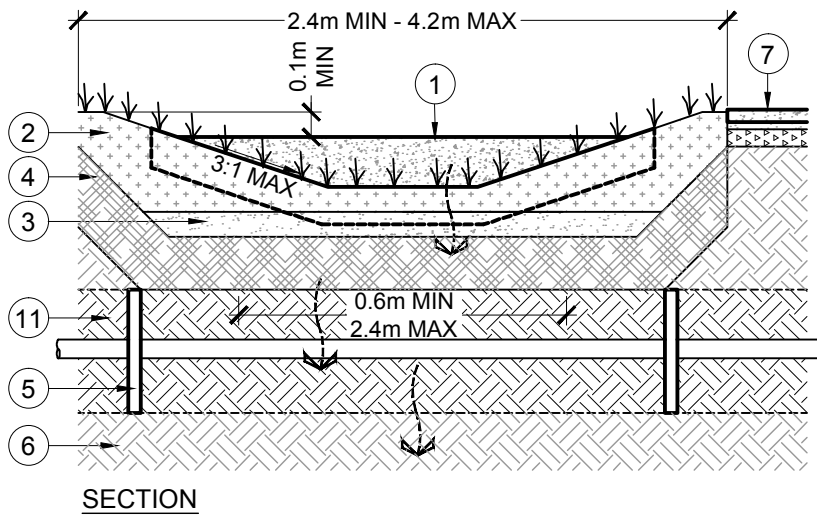
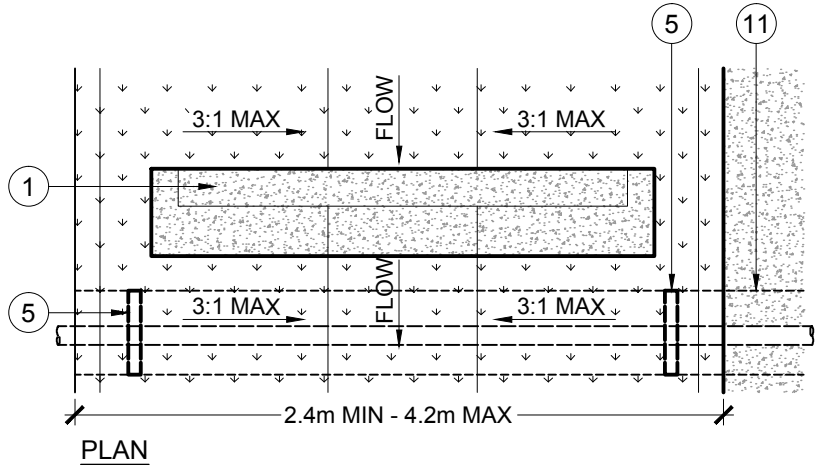
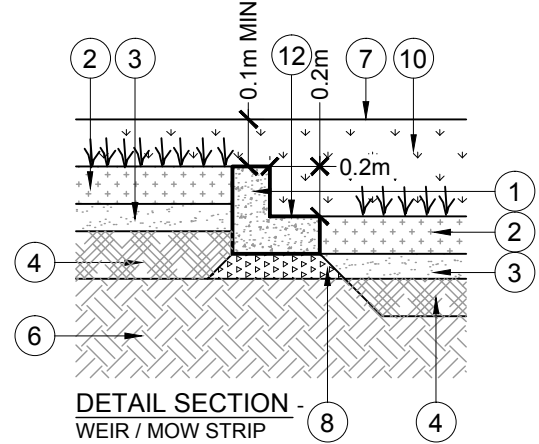
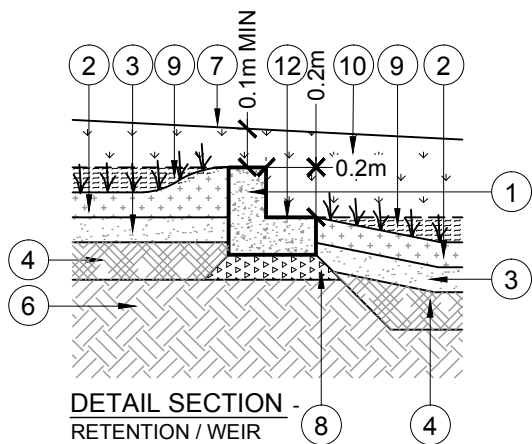
FULL INFILTRATION SWALE WITH
 RESERVOIR

DRAWING NO.
CR-S103

DISK REF.

SHEET OF

REV. 1



- ① LEVEL WEIR KEYED INTO SWALE SIDE SLOPE
- ② GROWING MEDIUM
- ③ SAND
- ④ EXISTING SCARIFIED SUBSOIL
- ⑤ TRENCH DAMS AT ALL UTILITY CROSSINGS
- ⑥ UNDISTURBED SUBSTRATE
- ⑦ ADJACENT GRADE
- ⑧ GRANULAR BASE
- ⑨ WATER BODY
- ⑩ 3:1 MAX SLOPE
- ⑪ UTILITY TRENCH
- ⑫ MOW STRIP (OPTIONAL)

NOTE:
PROVIDE EROSION CONTROL ALONG SIDES OF WEIR AND AT DRAINAGE INLETS.

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APRIL 2010

FULL INFILTRATION SWALE

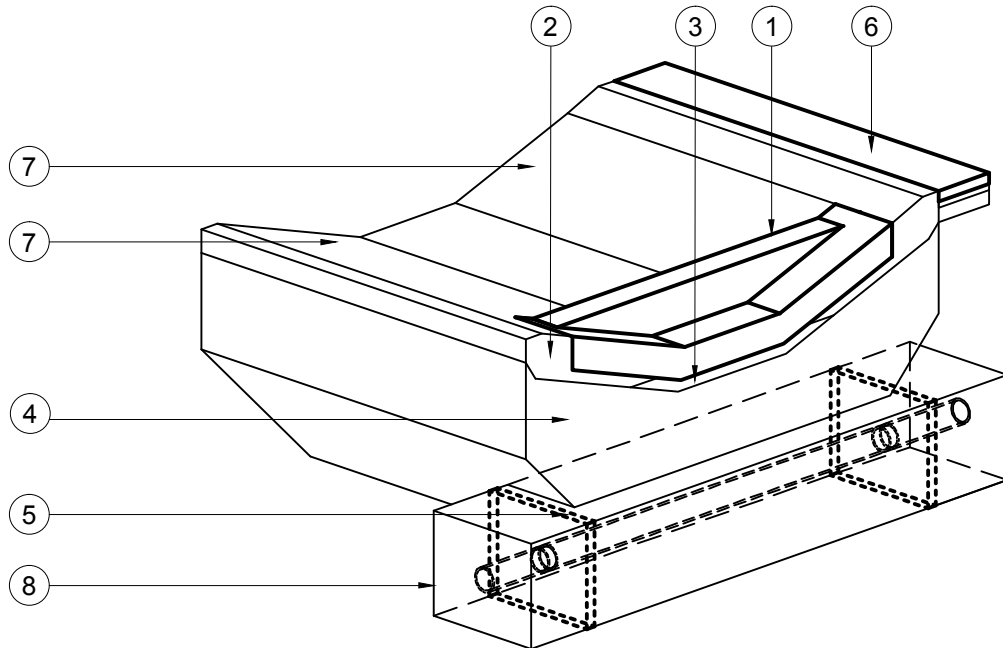
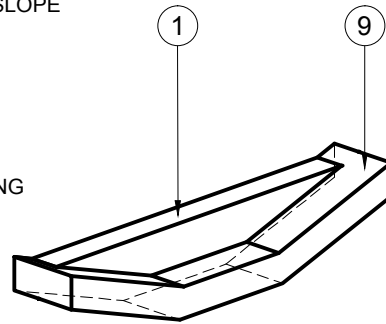
DRAWING NO.
CR-S104

DISK REF.

SHEET OF

REV. 1

- ① LEVEL WEIR KEYED INTO SWALE SIDE SLOPE
- ② GROWING MEDIUM
- ③ SAND
- ④ EXISTING SCARIFIED SUBSOIL
- ⑤ TRENCH DAMS AT ALL UTILITY CROSSING
- ⑥ ADJACENT GRADE
- ⑦ 3:1 MAX SLOPE
- ⑧ UTILITY TRENCH
- ⑨ MOW STRIP (OPTIONAL)



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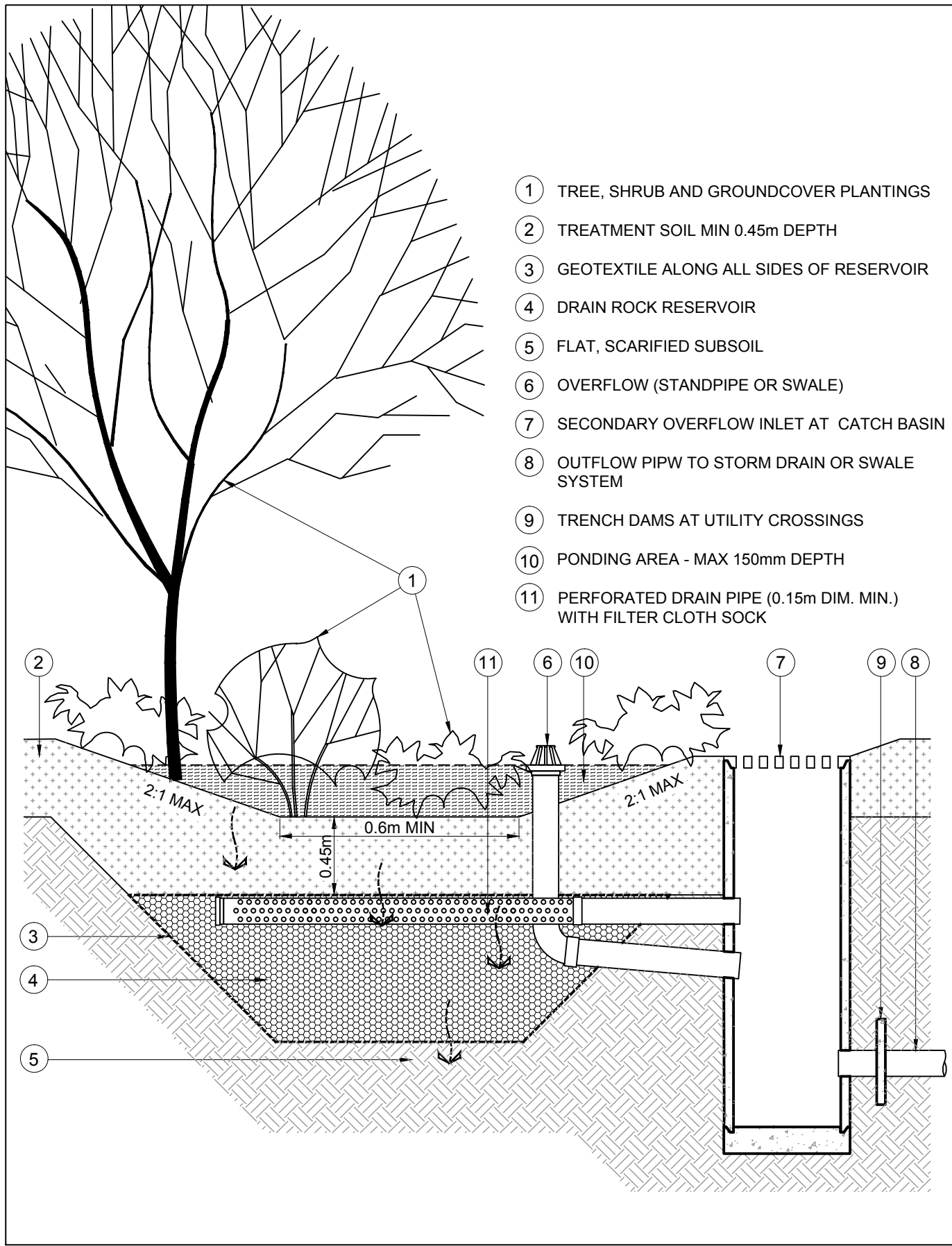
FULL INFILTRATION SWALE WEIR

DRAWING NO.
CR-S105

DISK REF.

SHEET OF

REV. 1



- ① TREE, SHRUB AND GROUNDCOVER PLANTINGS
- ② TREATMENT SOIL MIN 0.45m DEPTH
- ③ GEOTEXTILE ALONG ALL SIDES OF RESERVOIR
- ④ DRAIN ROCK RESERVOIR
- ⑤ FLAT, SCARIFIED SUBSOIL
- ⑥ OVERFLOW (STANDPIPE OR SWALE)
- ⑦ SECONDARY OVERFLOW INLET AT CATCH BASIN
- ⑧ OUTFLOW PIPW TO STORM DRAIN OR SWALE SYSTEM
- ⑨ TRENCH DAMS AT UTILITY CROSSINGS
- ⑩ PONDING AREA - MAX 150mm DEPTH
- ⑪ PERFORATED DRAIN PIPE (0.15m DIM. MIN.) WITH FILTER CLOTH SOCK

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City of
**Campbell
River**

SCALE:
N.T.S.

APPROVED:
CCR

DATE:
APRIL 2010

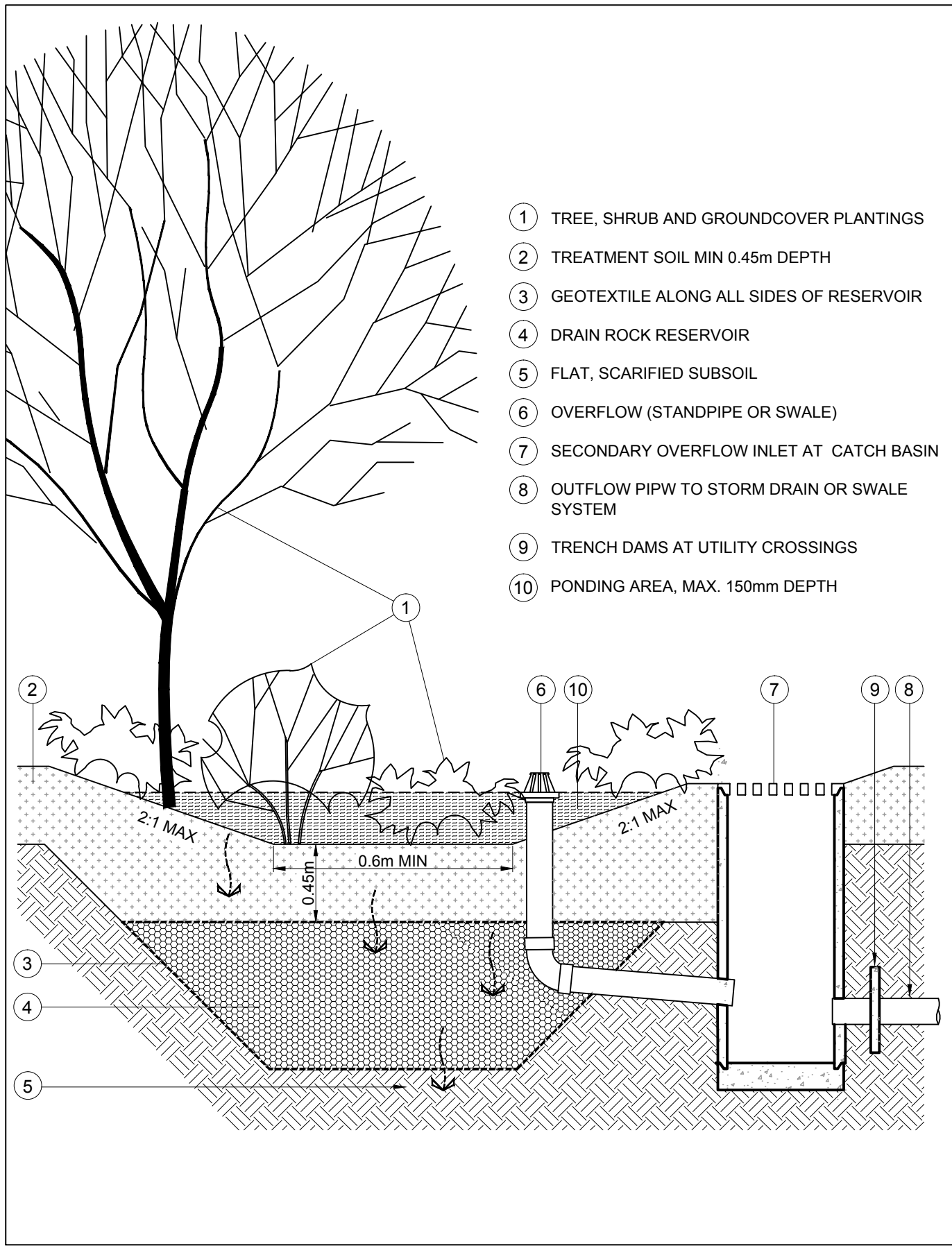
PARTIAL INFILTRATION RAIN GARDEN

DRAWING NO.
CR-S106

DISK REF.

SHEET OF

REV. 1



- ① TREE, SHRUB AND GROUNDCOVER PLANTINGS
- ② TREATMENT SOIL MIN 0.45m DEPTH
- ③ GEOTEXTILE ALONG ALL SIDES OF RESERVOIR
- ④ DRAIN ROCK RESERVOIR
- ⑤ FLAT, SCARIFIED SUBSOIL
- ⑥ OVERFLOW (STANDPIPE OR SWALE)
- ⑦ SECONDARY OVERFLOW INLET AT CATCH BASIN
- ⑧ OUTFLOW PIPW TO STORM DRAIN OR SWALE SYSTEM
- ⑨ TRENCH DAMS AT UTILITY CROSSINGS
- ⑩ PONDING AREA, MAX. 150mm DEPTH

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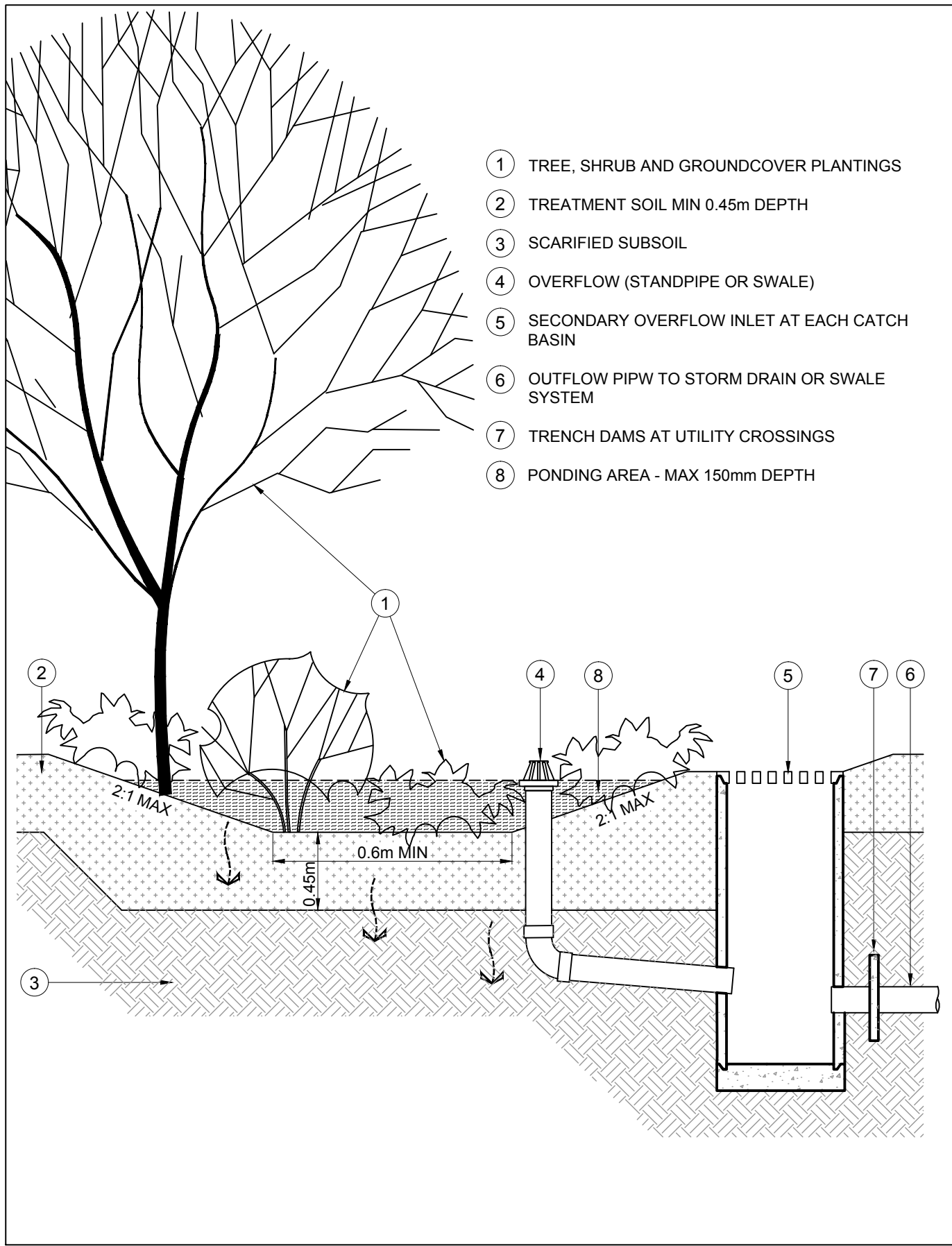
City of
**Campbell
 River**

SCALE:
 N.T.S.
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 DATE:
 APRIL 2010

**FULL INFILTRATION RAIN GARDEN
 WITH RESERVOIR**

DRAWING NO.
CR-S107
 DISK REF.
 SHEET OF
 REV. 1

- ① TREE, SHRUB AND GROUNDCOVER PLANTINGS
- ② TREATMENT SOIL MIN 0.45m DEPTH
- ③ SCARIFIED SUBSOIL
- ④ OVERFLOW (STANDPIPE OR SWALE)
- ⑤ SECONDARY OVERFLOW INLET AT EACH CATCH BASIN
- ⑥ OUTFLOW PIPW TO STORM DRAIN OR SWALE SYSTEM
- ⑦ TRENCH DAMS AT UTILITY CROSSINGS
- ⑧ PONDING AREA - MAX 150mm DEPTH



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FULL INFILTRATION RAIN GARDEN

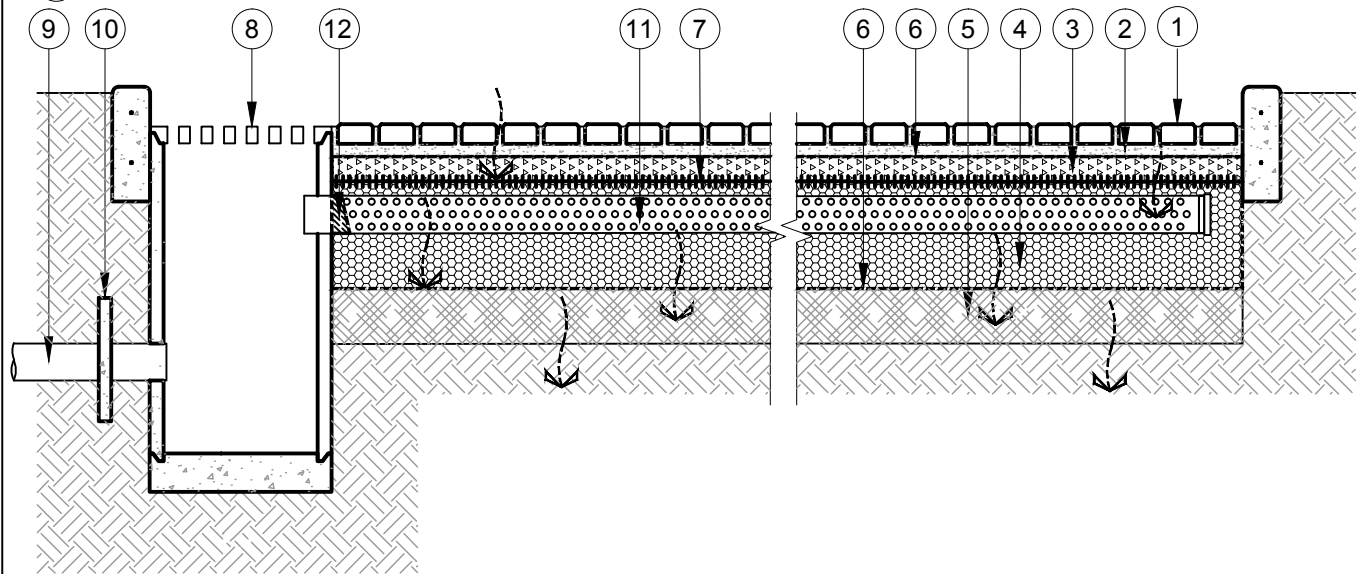
DRAWING NO.
CR-S108

DISK REF.

SHEET OF

REV. 1

- ① PERMEABLE PAVERS (MIN. 80mm THICKNESS)
- ② AGGREGATE BEDDING COURSE - NOT SAND (50mm DEPTH)
- ③ OPEN GRADED BASE (DEPTH VARIES BY DESIGN APPLICATION)
- ④ OPEN GRADED SUB-BASE (DEPTH VARIES BY DESIGN APPLICATION)
- ⑤ SUBSOIL - FLAT AND SCARIFIED IN INFILTRATION DESIGNS
- ⑥ GEOTEXTILE ON ALL SIDES OF RESERVOIR
- ⑦ OPTIONAL REINFORCING GRID FOR HEAVY LOADS
- ⑧ SECONDARY OVERFLOW INLET AT CATCH BASIN
- ⑨ OUTLET PIPE TO STORM DRAIN OR SWALE SYSTEM. LOCATE CROWN OF PIPE BELOW OPEN GRADED BASE (NO. 3) TO PREVENT HEAVING DURING FREEZE/THAW CYCLE
- ⑩ TRENCH DAMS AT ALL UTILITY CROSSINGS
- ⑪ PERFORATED DRAIN PIPE 150mm DIA. MIN
- ⑫ GEOTEXTILE ADHERED TO DRAIN AT OPENING



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APRIL 2010

PERVIOUS PAVERS
PARTIAL INFILTRATION

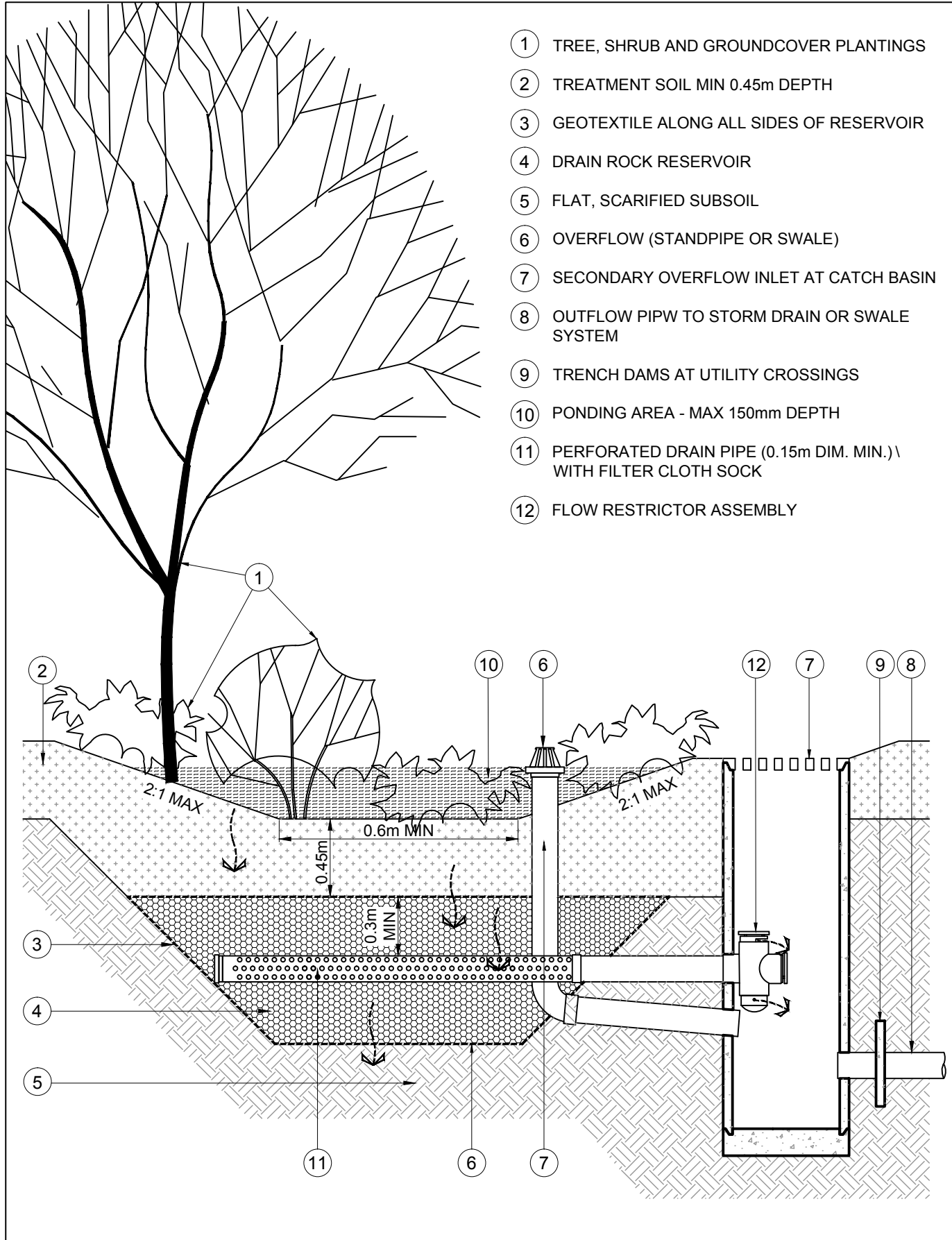
DRAWING NO.
CR-S110

DISK REF.

SHEET OF

REV. 1

- ① TREE, SHRUB AND GROUND COVER PLANTINGS
- ② TREATMENT SOIL MIN 0.45m DEPTH
- ③ GEOTEXTILE ALONG ALL SIDES OF RESERVOIR
- ④ DRAIN ROCK RESERVOIR
- ⑤ FLAT, SCARIFIED SUBSOIL
- ⑥ OVERFLOW (STANDPIPE OR SWALE)
- ⑦ SECONDARY OVERFLOW INLET AT CATCH BASIN
- ⑧ OUTFLOW PIPW TO STORM DRAIN OR SWALE SYSTEM
- ⑨ TRENCH DAMS AT UTILITY CROSSINGS
- ⑩ PONDING AREA - MAX 150mm DEPTH
- ⑪ PERFORATED DRAIN PIPE (0.15m DIM. MIN.) WITH FILTER CLOTH SOCK
- ⑫ FLOW RESTRICTOR ASSEMBLY



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**PARTIAL INFILTRATION RAIN GARDEN
WITH FLOW RESTRICTOR**

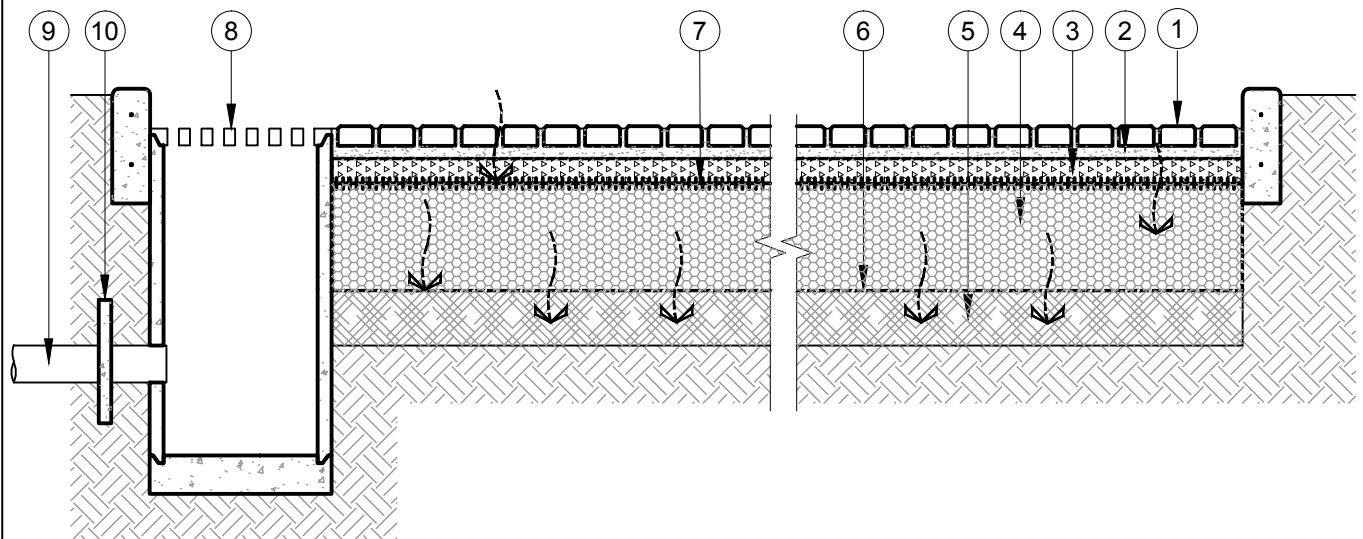
DRAWING NO.
CR-S109

DISK REF.

SHEET OF

REV. 1

- ① PERMEABLE PAVERS (MIN. 80mm THICKNESS)
- ② AGGREGATE BEDDING COURSE - NOT SAND (50mm DEPTH)
- ③ OPEN GRADED BASE (DEPTH VARIES BY DESIGN APPLICATION)
- ④ OPEN GRADED SUB BASE (DEPTH VARIES BY DESIGN APPLICATION)
- ⑤ SUBSOIL - FLAT AND SCARIFIED IN INFILTRATION DESIGNS
- ⑥ GEOTEXTILE ON ALL SIDES OF RESERVOIR
- ⑦ OPTIONAL REINFORCING GRID FOR HEAVY LOADS
- ⑧ SECONDARY OVERFLOW INLET AT CATCH BASIN
- ⑨ OUTLET PIPE TO STORM DRAIN OR SWALE SYSTEM. LOCATE CROWN OF PIPE BELOW OPEN GRADED BASE (NO. 3) TO PREVENT HEAVING DURING FREEZE/THAW CYCLE
- ⑩ TRENCH DAMS AT ALL UTILITY CROSSINGS



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PERVIOUS PAVERS FULL
INFILTRATION

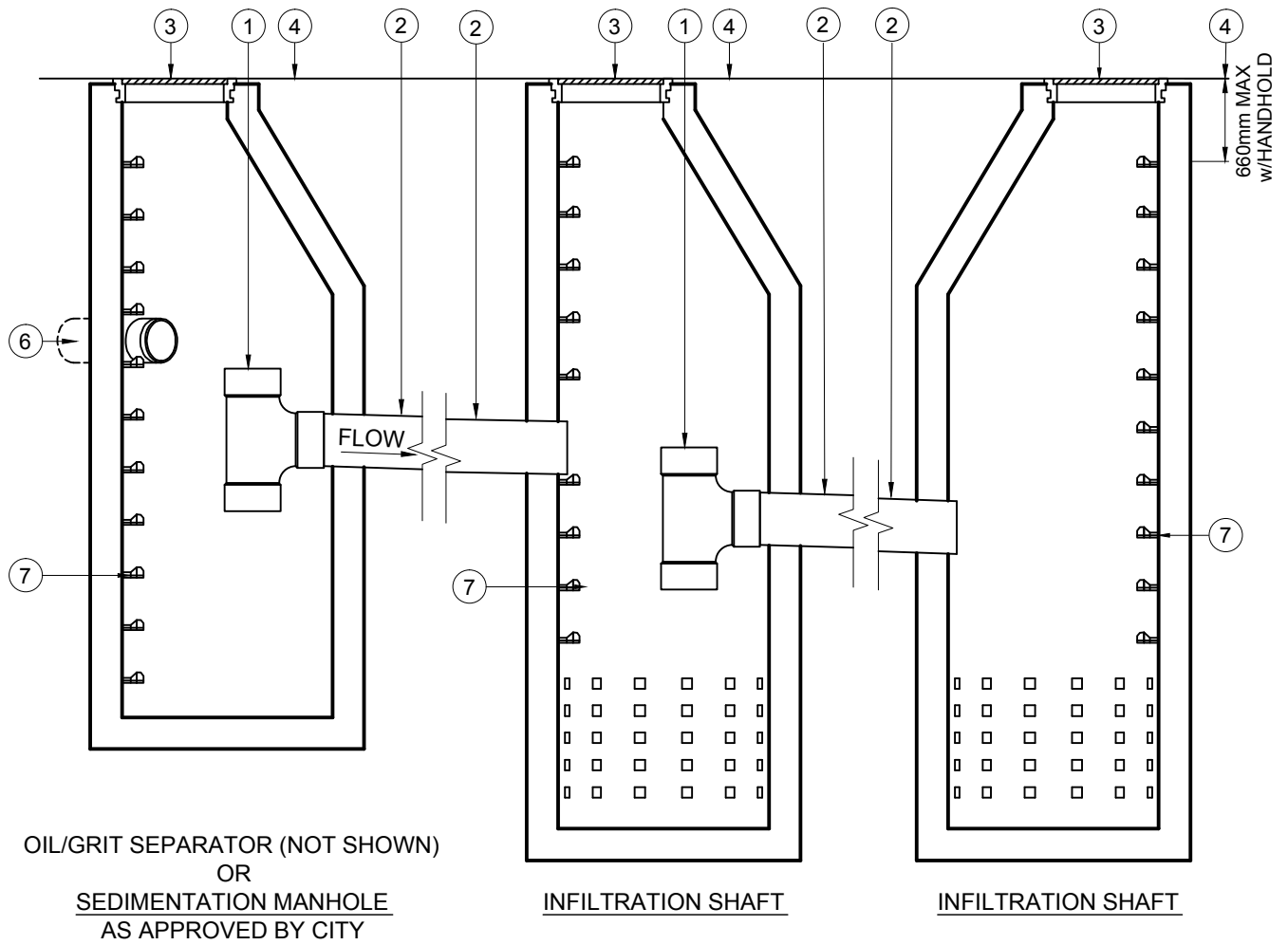
DRAWING NO.
CR-S111

DISK REF.

SHEET OF

REV. 1

- ① 100mm DIA PVC SOLID PIPE C/W OUTLET TEE
- ② INTERCONNECTING PVC SOLID PIPE
- ③ STANDARD MANHOLE FRAME AND COVER
- ④ FINISH GRADE
- ⑤ SEAL JOINTS WITH CEMENT GROUT OR APPROVED MASTIC
- ⑥ STREET INLET CONNECTION
- ⑦ LADDER RUNG



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DIAGRAM OF SEDIMENTATION
MANHOLE AND INFILTRATION SHAFT

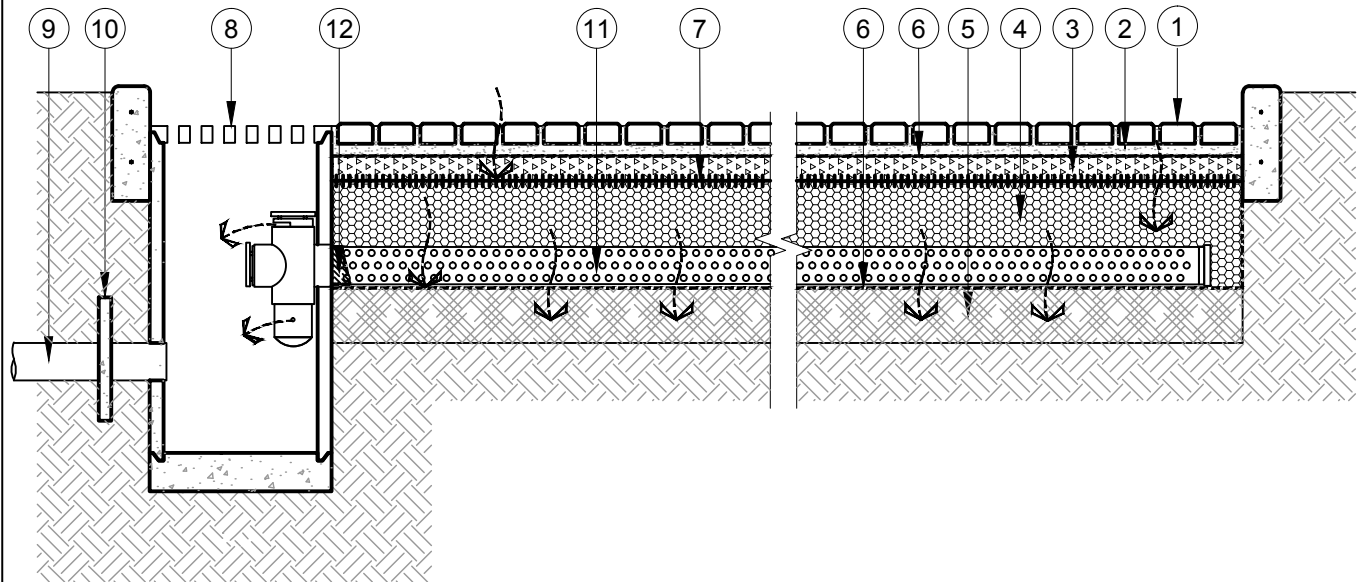
DRAWING NO.
CR-S114

DISK REF.

SHEET OF

REV. 1

- ① PERMEABLE PAVERS (MIN. 80mm THICKNESS)
- ② AGGREGATE BEDDING COURSE - NOT SAND (50mm DEPTH)
- ③ OPEN GRADED BASE (DEPTH VARIES BY DESIGN APPLICATION)
- ④ OPEN GRADED SUB-BASE (DEPTH VARIES BY DESIGN APPLICATION)
- ⑤ SUBSOIL - FLAT AND SCARIFIED IN INFILTRATION DESIGNS
- ⑥ GEOTEXTILE ON ALL SIDES OF RESERVOIR
- ⑦ OPTIONAL REINFORCING GRID FOR HEAVY LOADS
- ⑧ SECONDARY OVERFLOW INLET AT CATCH BASIN
- ⑨ OUTLET PIPE TO STORM DRAIN OR SWALE SYSTEM. LOCATE CROWN OF PIPE BELOW OPEN GRADED BASE (NO. 3) TO PREVENT HEAVING DURING FREEZE/THAW CYCLE
- ⑩ TRENCH DAMS AT ALL UTILITY CROSSINGS
- ⑪ PERFORATED DRAIN PIPE 150mm DIA. MIN
- ⑫ GEOTEXTILE ADHERED TO DRAIN AT OPENING
- ⑬ FLOW RESTRICTOR ASSEMBLY



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PERVIOUS PAVERS
PARTIAL INFILTRATION WITH FLOW
RESTRICTOR

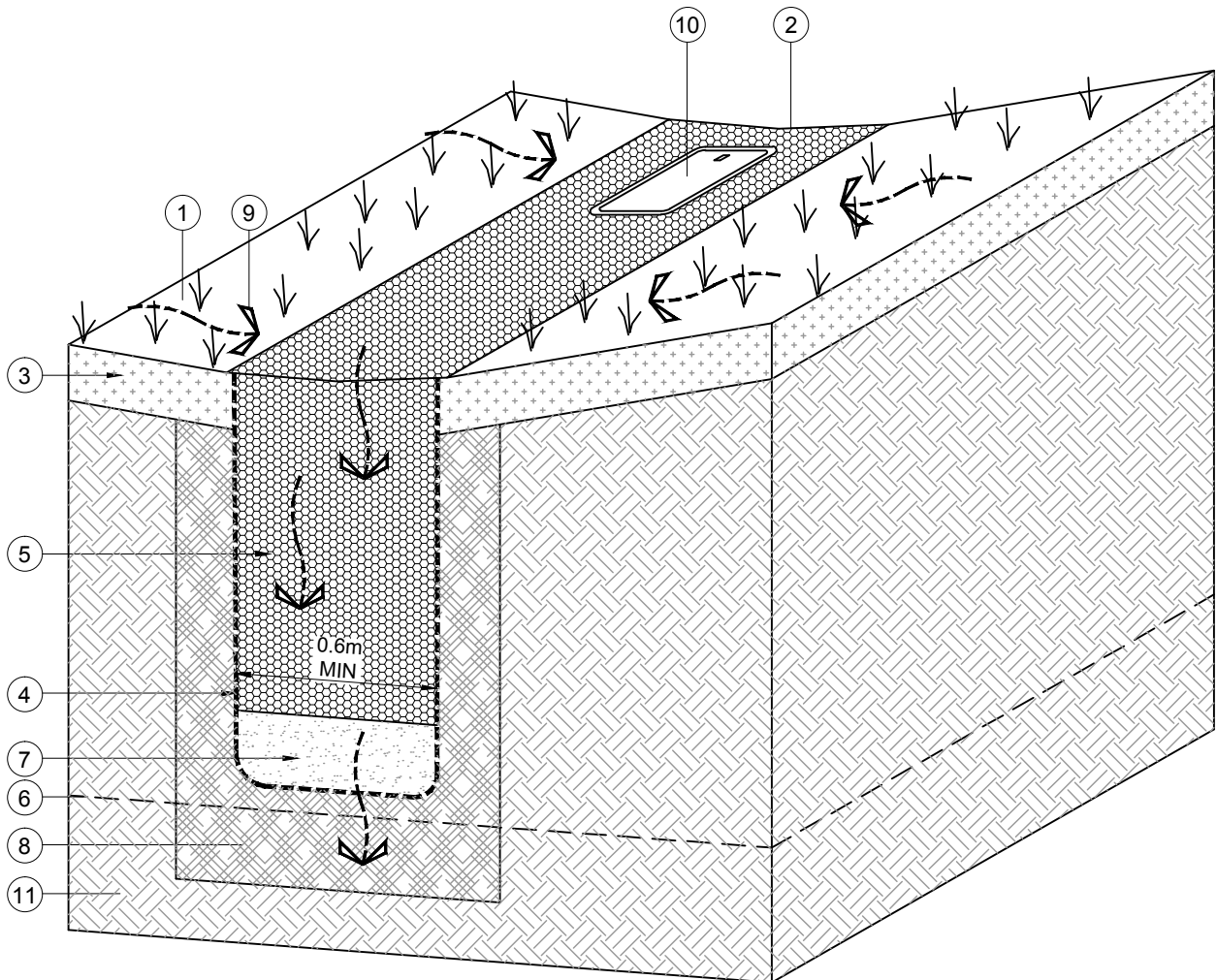
DRAWING NO.
CR-S112

DISK REF.

SHEET OF

REV. 1

- ① RUN OFF FILTER THROUGH GRASS BUFFER
- ② FINISH GRADE
- ③ GROWING MEDIUM BACKFILL
- ④ LIGHT NON-WOVEN GEOTEXTILE
- ⑤ 0.05m DRAIN ROCK OR ROCK OF EQUAL POROSITY
- ⑥ MAXIMUM GROUNDWATER ELEVATION
- ⑦ 0.15m-0.3m DEEP SAND FILTER OR FABRIC EQUIVALENT
- ⑧ EXISTING SCARIFIED SUBSOIL
- ⑨ OVERLAND FLOW
- ⑩ OBSERVATION WELL (METER BOX & LID)
- ⑪ UNDISTURBED SUBSTRATE



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INFILTRATION TRENCH WITH
DISPERSED INPUT FACILITIES

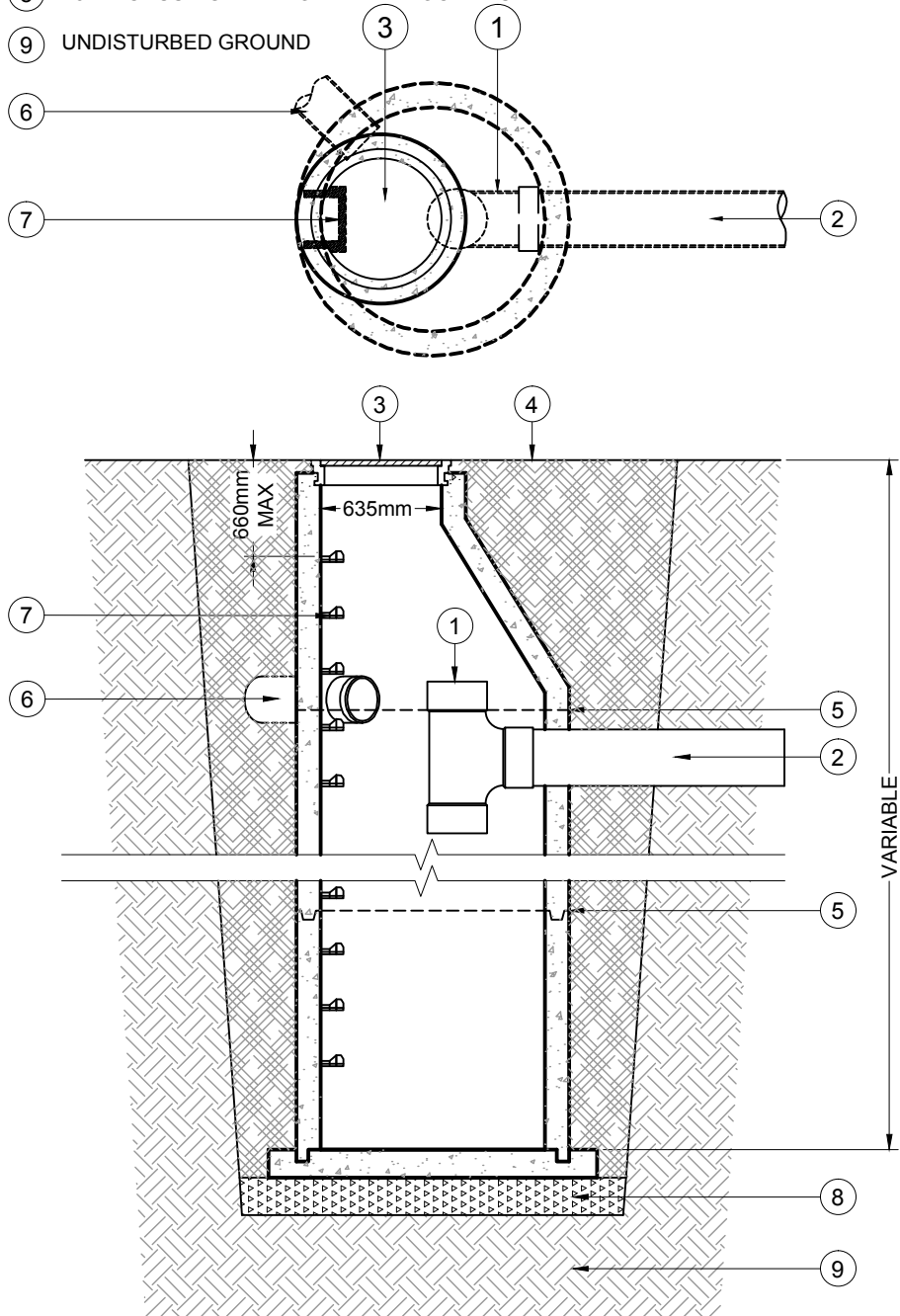
DRAWING NO.
CR-S113

DISK REF.

SHEET OF

REV. 1

- ① 100mm DIA PVC SOLID PIPE C/W OUTLET TEE
- ② INTERCONNECTING PVC SOLID PIPE
- ③ STANDARD MANHOLE FRAME AND COVER
- ④ FINISH GRADE
- ⑤ SEAL JOINTS WITH CEMENT GROUT OR APPROVED MASTIC
- ⑥ STREET INLET CONNECTION
- ⑦ LADDER RUNG
- ⑧ 25mm CRUSH GRAVEL OR DRAIN ROCK BASE
- ⑨ UNDISTURBED GROUND



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SEDIMENTATION MANHOLE
(ALLOWED ONLY WITH CITY APPROVAL)

DRAWING NO.
CR-S115

DISK REF.

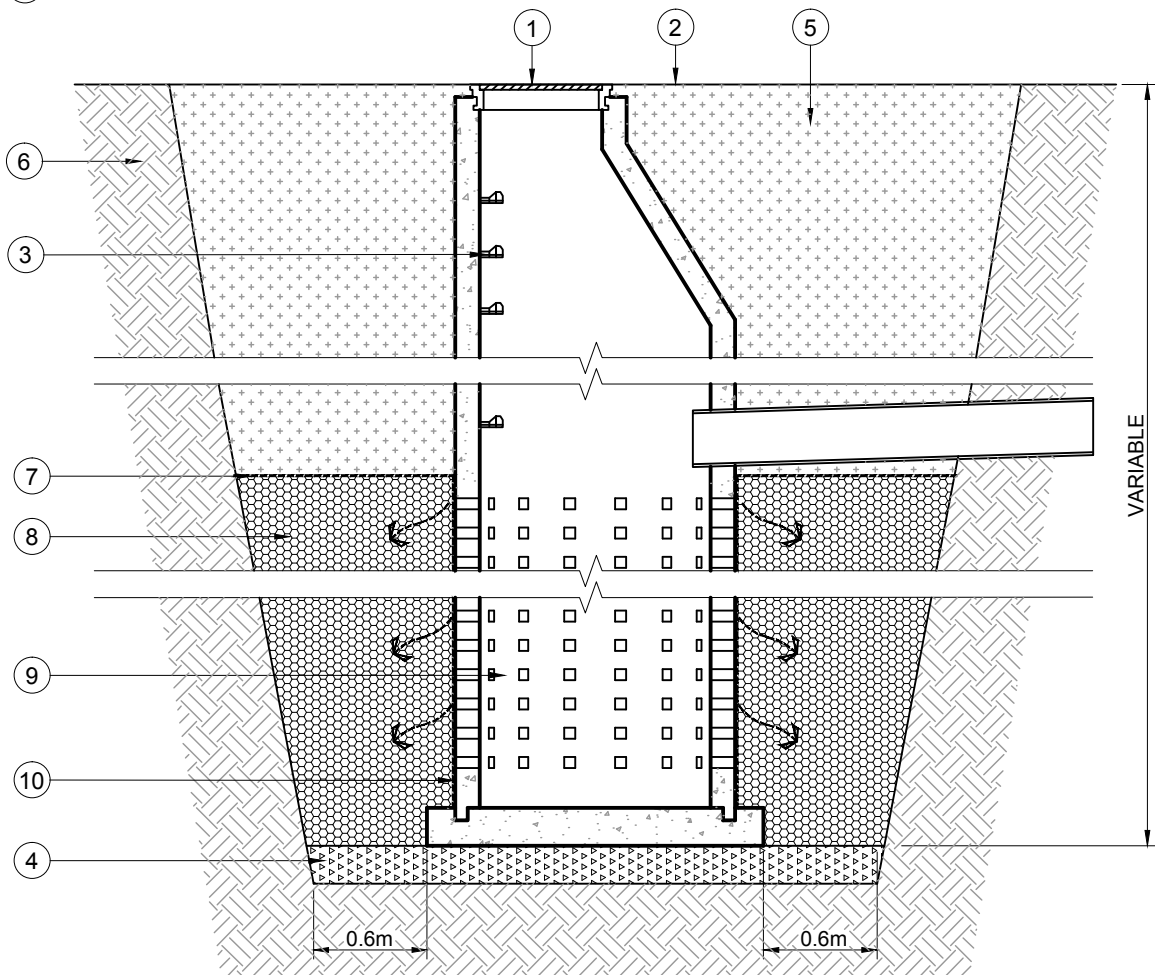
SHEET OF

REV. 1

NOTES:

ALL PRECAST SECTIONS SHALL CONFORM TO THE REQUIREMENTS OF ASTM C 478.
 PROVIDE A MIN. OF 150mm DEEP OF 25mm OR 19mm CLEAN CRUSHED ROCK UNDER ALL PIPES.
 INVERT SHALL BE LEVEL AND SMOOTH.
 SUMP BARREL SHALL NOT BE PERFORATED WITHIN 1200mm OF THE CONE.

- ① STANDARD MANHOLE FRAME AND COVER
- ② FINISH GRADE
- ③ LADDER RUNG
- ④ 25mm DEEP CRUSH GRAVEL OR DRAIN ROCK BASE
- ⑤ NATIVE SOIL BACK FILL
- ⑥ UNDISTURBED GROUND
- ⑦ GEOTEXTILE BETWEEN DRAIN ROCK AND NATIVE SOIL
- ⑧ 600mm MIN. OF 50mm DRAIN ROCK
- ⑨ 1200mm PERFORATED BARREL (LANGLEY CONCRETE OR EQUAL)
- ⑩ GEOTEXTILE AROUND PERFORATED BARREL



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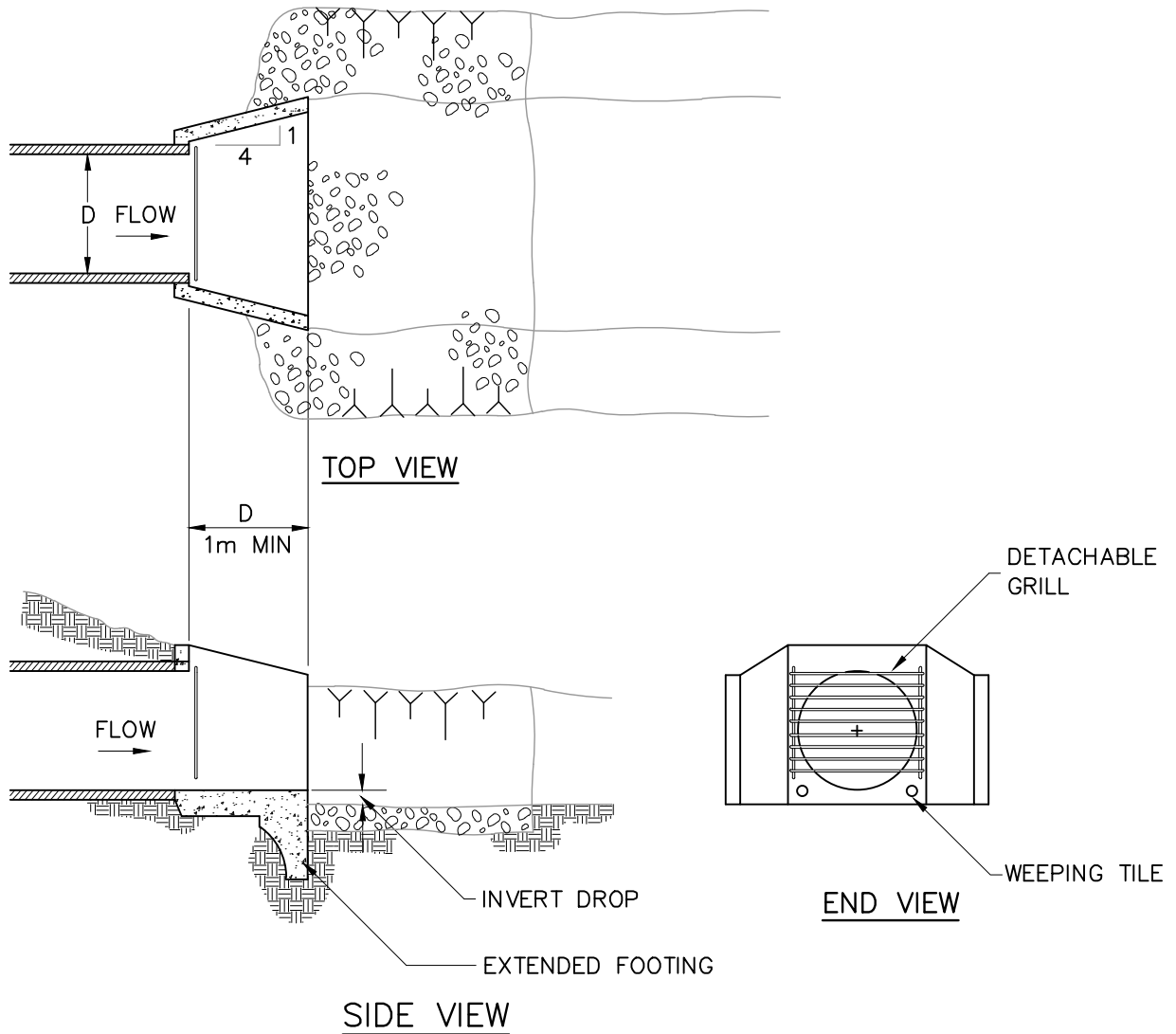
INFILTRATION SHAFT

DRAWING NO.
CR-S116

DISK REF.

SHEET OF

REV. 1



- CONCRETE TO BE 20MPa WITH 5%–7% AIR–ENTRAINMENT.
- ALL EXPOSED CORNERS TO BE CHAMFERED (25mm MIN.).
- WEEPING TILE TO EXTEND FROM SEWER BEDDING THROUGH THE HEADWALL.
- GRILL TO BE PROVIDED ON ALL HEADWALLS.
- INVERT DROP VARIES WITH AVAILABILITY OF DEPTH AND SIZE OF HEADWALL, NORMALLY A MINIMUM OF 150mm TO 225mm.
- RIPRAP TO BE PLACED IN OUTLET CHANNEL:
 - ON BOTTOM AND SIDES UP TO DESIGN WATER LEVEL.
 - DOWNSTREAM UNTIL THE PROJECTION OF THE SIDE WALLS MEET THE CHANNEL SIDE SLOPES AT HALF THE DESIGN WATER DEPTH OF FLOW.
- RIP RAP TO CONFORM TO MMCD SECTION 31 37 10
- FOR HEADWALLS AT CREEKS AND RIVERS, EXTEND RIPRAP OR GABION PROTECTION TO CREEK OR RIVER. PROTECTION IS TO PROVIDE A SMOOTH HYDRAULIC FLOW FOR HEADWALL DISCHARGE AND CREEK OR RIVER FLOWS.
- ALL DIMENSIONS IN METRES UNLESS OTHERWISE SHOWN.

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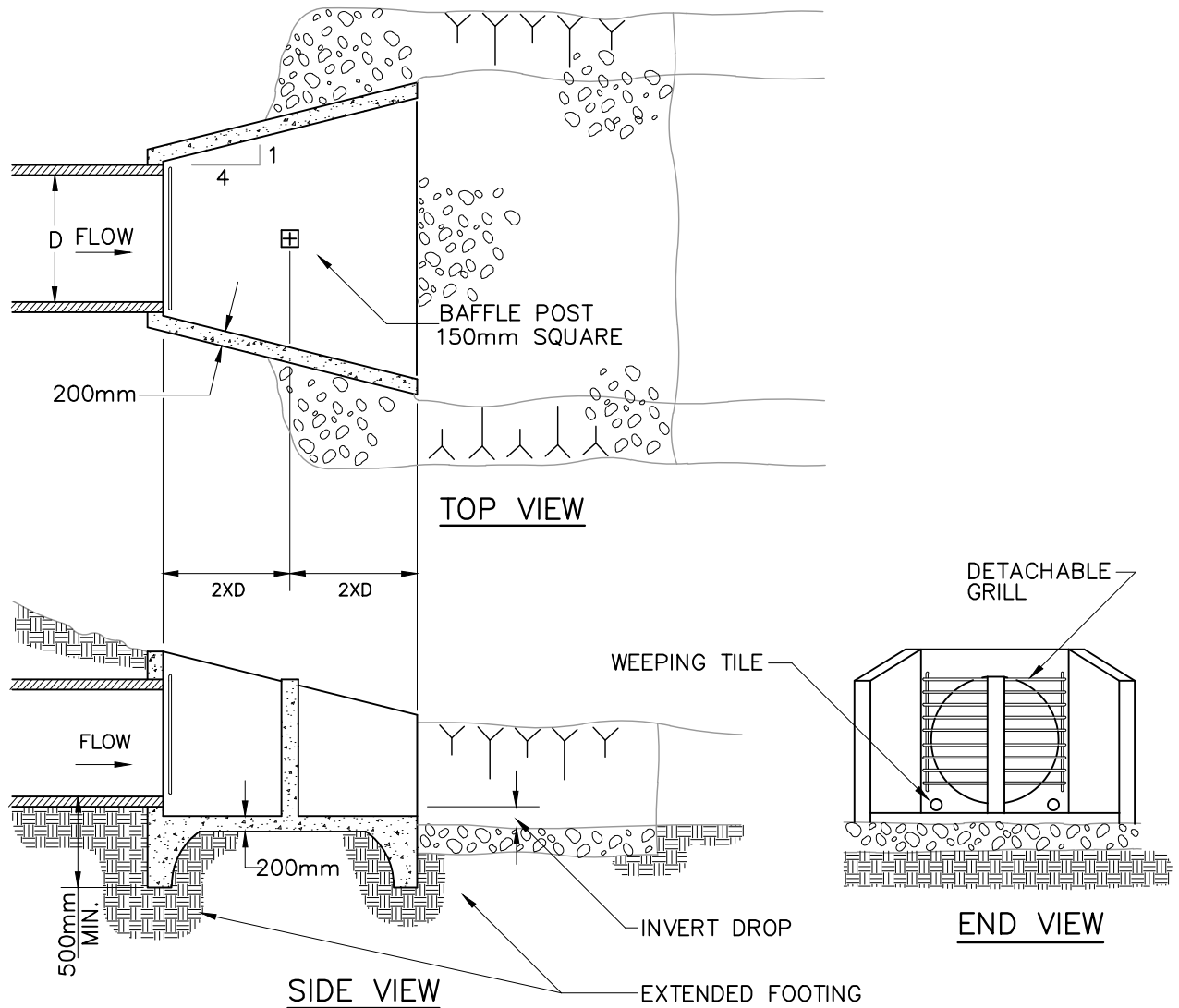
STORM DRAIN OUTFALL
STRUCTURE
HEADWALL TYPE 1
FOR EXIT VELOCITIES
UP TO 2.1m/s

DRAWING NO.
CR-S117

DISK REF.

SHEET OF

REV. 1



- CONCRETE TO BE 20MPa WITH 5%-7% AIR-ENTRAINMENT.
- ALL EXPOSED CORNERS TO BE CHAMFERED (25mm MIN.).
- WEEPING TILE TO EXTEND FROM SEWER BEDDING THROUGH THE HEADWALL.
- GRILL TO BE PROVIDED ON ALL HEADWALLS.
- INVERT DROP VARIES WITH AVAILABILITY OF DEPTH AND SIZE OF HEADWALL, NORMALLY A MINIMUM OF 150mm TO 225mm.
- RIPRAP TO BE PLACED IN OUTLET CHANNEL:
 - ON BOTTOM AND SIDES UP TO DESIGN WATER LEVEL.
 - DOWNSTREAM UNTIL THE PROJECTION OF THE SIDE WALLS MEET THE CHANNEL SIDE SLOPES AT HALF THE DESIGN WATER DEPTH OF FLOW.
- RIP RAP TO CONFORM TO MMCD SECTION 31 37 10
- FOR HEADWALLS AT CREEKS AND RIVERS, EXTEND RIPRAP OR GABION PROTECTION TO CREEK OR RIVER. PROTECTION IS TO PROVIDE A SMOOTH HYDRAULIC FLOW FOR HEADWALL DISCHARGE AND CREEK OR RIVER FLOWS.
- ALL DIMENSIONS IN METRES UNLESS OTHERWISE SHOWN.

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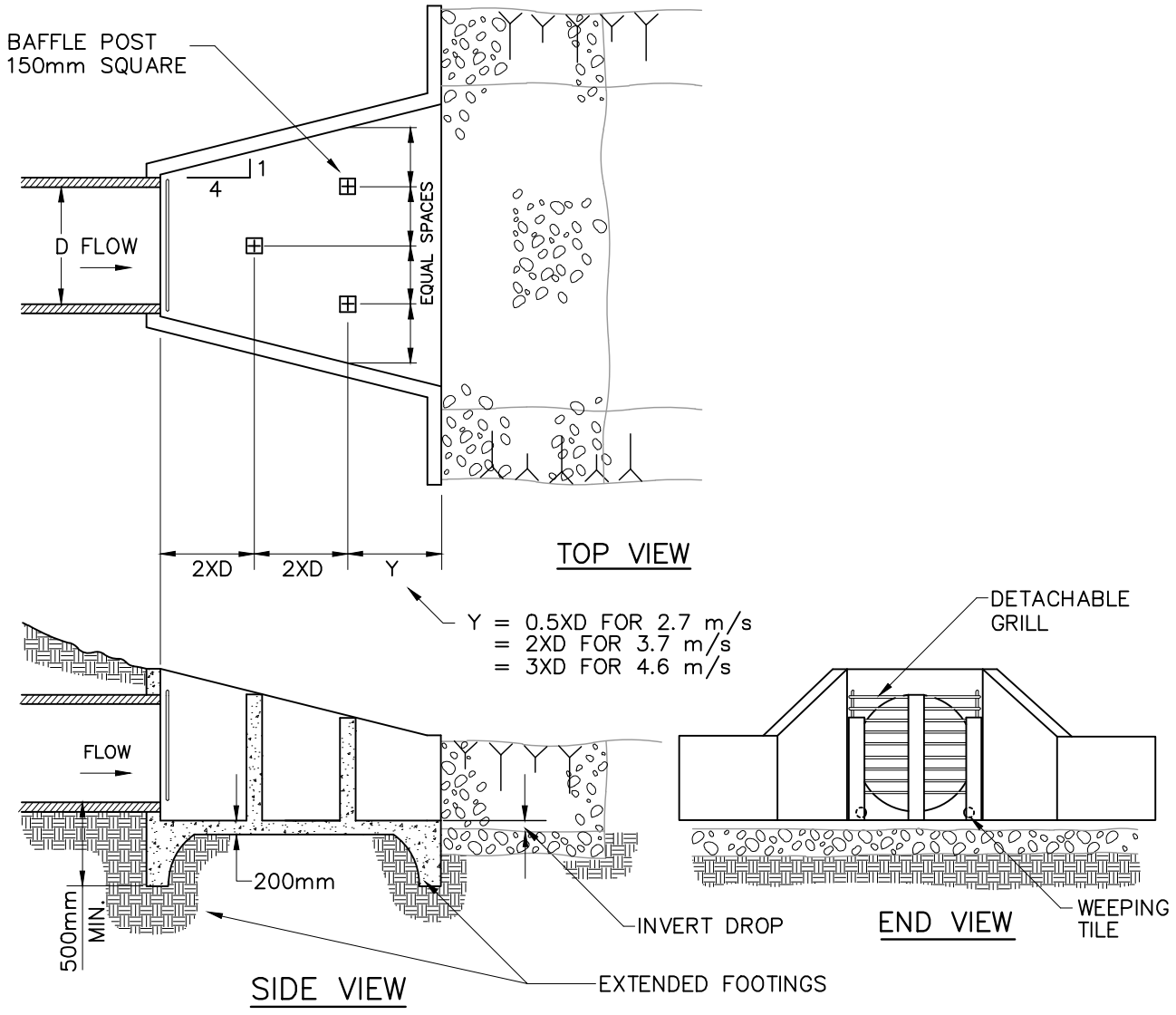
STORM DRAIN OUTFALL
STRUCTURE
HEADWALL TYPE 2
FOR EXIT VELOCITIES
UP TO 2.1 TO 2.7m/s

DRAWING NO.
CR-S118

DISK REF.

SHEET OF

REV. 1



- CONCRETE TO BE 20MPa WITH 5%–7% AIR-ENTRAINMENT.
- ALL EXPOSED CORNERS TO BE CHAMFERED (25mm MIN.).
- WEEPING TILE TO EXTEND FROM SEWER BEDDING THROUGH THE HEADWALL.
- GRILL TO BE PROVIDED ON ALL HEADWALLS.
- INVERT DROP VARIES WITH AVAILABILITY OF DEPTH AND SIZE OF HEADWALL, NORMALLY A MINIMUM OF 150mm TO 225mm.
- RIPRAP TO BE PLACED IN OUTLET CHANNEL:
 - ON BOTTOM AND SIDES UP TO DESIGN WATER LEVEL.
 - DOWNSTREAM UNTIL THE PROJECTION OF THE SIDE WALLS MEET THE CHANNEL SIDE SLOPES AT HALF THE DESIGN WATER DEPTH OF FLOW.
- RIP RAP TO CONFORM TO MMCD SECTION 31 37 10
- FOR HEADWALLS AT CREEKS AND RIVERS, EXTEND RIPRAP OR GABION PROTECTION TO CREEK OR RIVER. PROTECTION IS TO PROVIDE A SMOOTH HYDRAULIC FLOW FOR HEADWALL DISCHARGE AND CREEK OR RIVER FLOWS.
- ALL DIMENSIONS IN METRES UNLESS OTHERWISE SHOWN.

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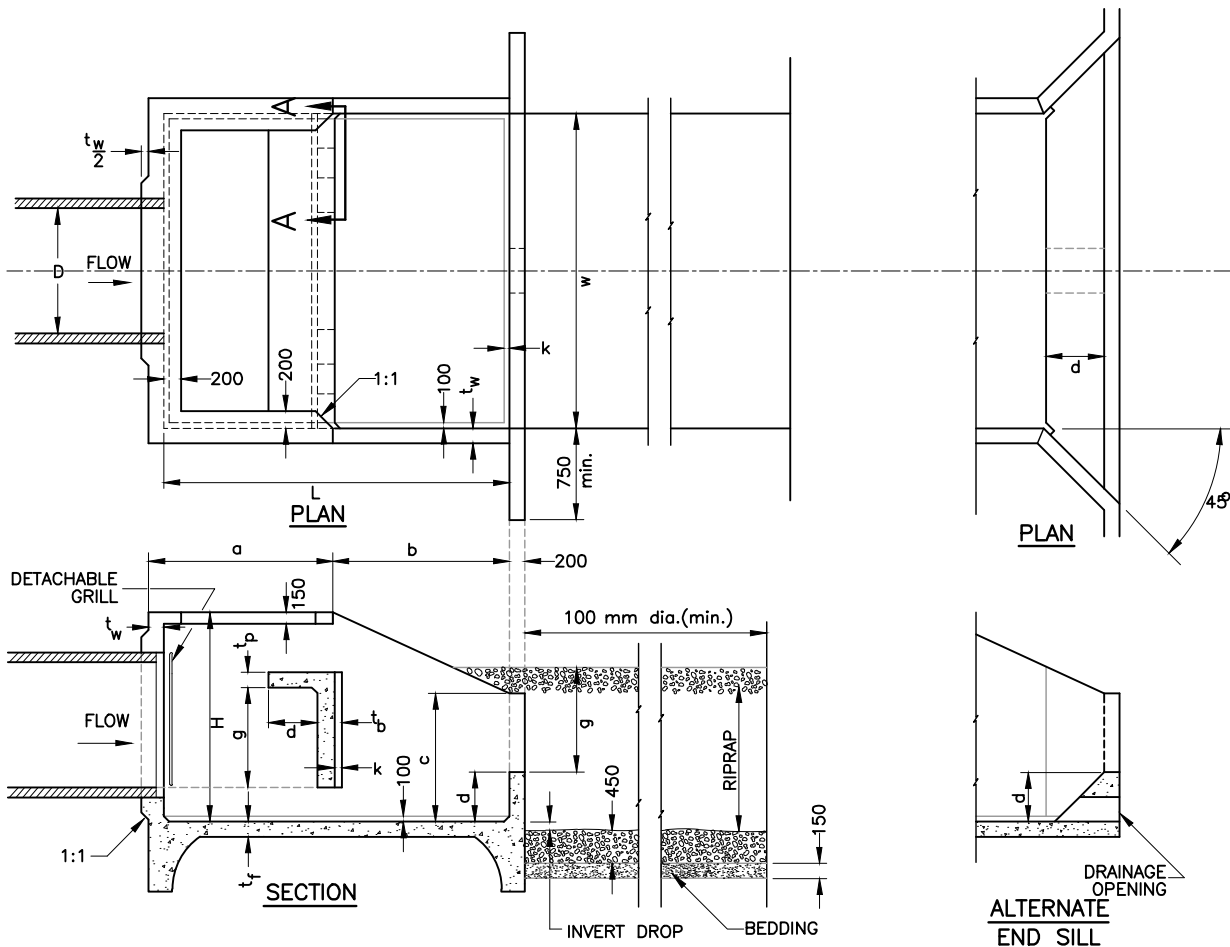
STORM DRAIN OUTFALL
STRUCTURE
HEADWALL TYPE 3
FOR EXIT VELOCITIES
UP TO 2.7 TO 4.6m/s

DRAWING NO.
CR-S119

DISK REF.

SHEET OF

REV. 1



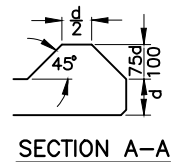
SUGGESTED CONCRETE DIMENSIONS

Q	c	t _w	t _f	t _b	t _p	Recommended Riprap size
100	C=125 300 W	200	200	200	200	240
200	C=200 300 W	200	200	200	200	300
300	C=300 300 W	300	300	300	300	340
400	C=400 400 W	400	400	400	400	375

SUGGESTED MINIMUM THICKNESS OF CONCRETE IS 150mm.

$$W = D + 1500$$

$H = 3/4 W$	$L = 4/3 W$
$a = 7/12 W$	$b = L - a$
$d = 1/6 W$	$g = 3/8 W$



- TYPE 4 HEADWALL CAN BE USED FOR:
 - VELOCITIES UP TO 10 METRES PER SECOND (m/s)
 - DISCHARGES UP TO 11.3 CUBIC METRES PER SECOND (c.m.s.)
 - FOR LARGER DISCHARGES MULTIPLE BASINS CAN BE PLACED SIDE BY SIDE.
- THE DESIGN IS BASED ON THE INCOMING QUANTITY OF WATER, NOT ITS VELOCITY (EXCEPT THAT IT SHOULD NOT EXCEED 10 m/s).
- THE BOTTOM OF THE BAFFLE SHOULD BE PLACED AT THE SAME LEVEL AS THE INVERT OF THE UPSTREAM PIPE.
- THE MAXIMUM INCOMING SEWER GRADE SHOULD BE 28% (15DEG.). FOR GREATER SLOPES USE A HORIZONTAL OR SLOPING PIPE (UP TO 28%) FOR TWO OR MORE DIAMETERS LONG, JUST UPSTREAM FROM HEADWALL.
- THE NOTCHES IN THE BAFFLE FACILITATE THE CLEANING OF SILT FROM THE BASIN. IF SILTING IS NOT CONSIDERED TO BE A PROBLEM THEY CAN BE DELETED.
- FOR BEST POSSIBLE PERFORMANCE THE ALTERNATIVE END SILL AND 45 DEG. END WALLS ARE RECOMMENDED.
- THE RIPRAP USED SHOULD HAVE MOST OF THE STONES EQUAL TO OR LARGER THAN THE SIZE IN THE TABLE.
- THIS TYPE OF HEADWALL IS SUBJECTED TO LARGE DYNAMIC FORCES, VIBRATION AND SCOUR, THEREFORE THE PLACING OF KEYS AND REINFORCING STEEL MUST BE SUFFICIENT TO RESIST THESE CONDITIONS.
- CONCRETE TO BE 20MPa WITH 5%-7% AIR-ENTRAINMENT.
- ALL EXPOSED CORNERS TO BE CHAMFERED. (25mm MIN.)
- WEeping TILE TO EXTEND FROM SEWER BEDDING THROUGH THE HEADWALL.
- GRILL TO BE PROVIDED ON ALL HEADWALLS.
- INVERT DROP VARIES WITH AVAILABILITY OF DEPTH AND SIZE OF HEADWALL, NORMALLY A MINIMUM OF 150mm TO 230mm.
- FOR HEADWALLS AT CREEKS AND RIVERS, EXTEND RIPRAP OR GABION PROTECTION TO CREEK OR RIVER. PROTECTION IS TO PROVIDE A SMOOTH HYDRAULIC FLOW FOR HEADWALL DISCHARGE AND CREEK OR RIVER FLOWS.
- ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE SHOWN.

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City of
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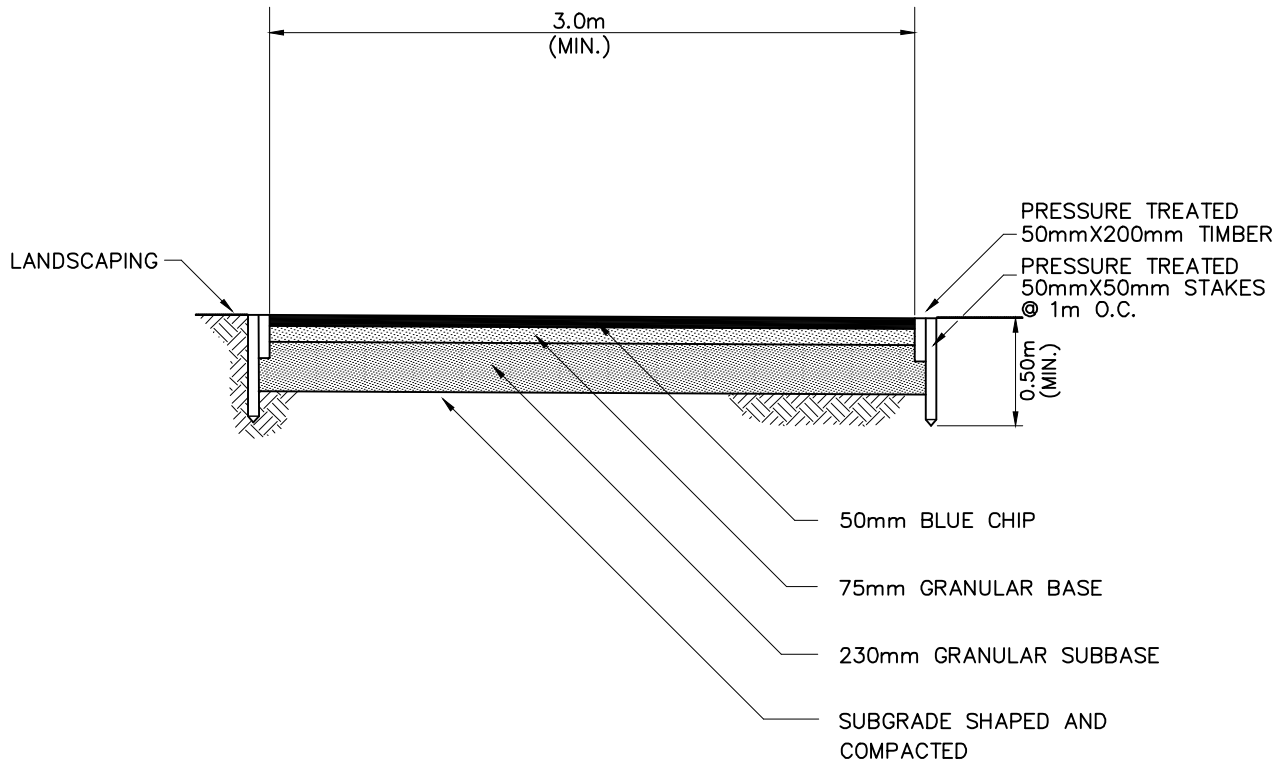
STORM DRAIN OUTFALL
STRUCTURE
HEADWALL TYPE 4
FOR EXIT VELOCITIES
UP TO 10m/s

DRAWING NO.
CR-S120

DISK REF.

SHEET OF
REV. 1

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- ALL DIMENSIONS IN METRES UNLESS OTHERWISE SHOWN.



City of
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STORM WATER MANAGEMENT
WET DETENTION POND
ACCESS ROAD

DRAWING NO.	CR-S121
DISK REF.	
SHEET OF	
REV.	1



City of
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APRIL 2010

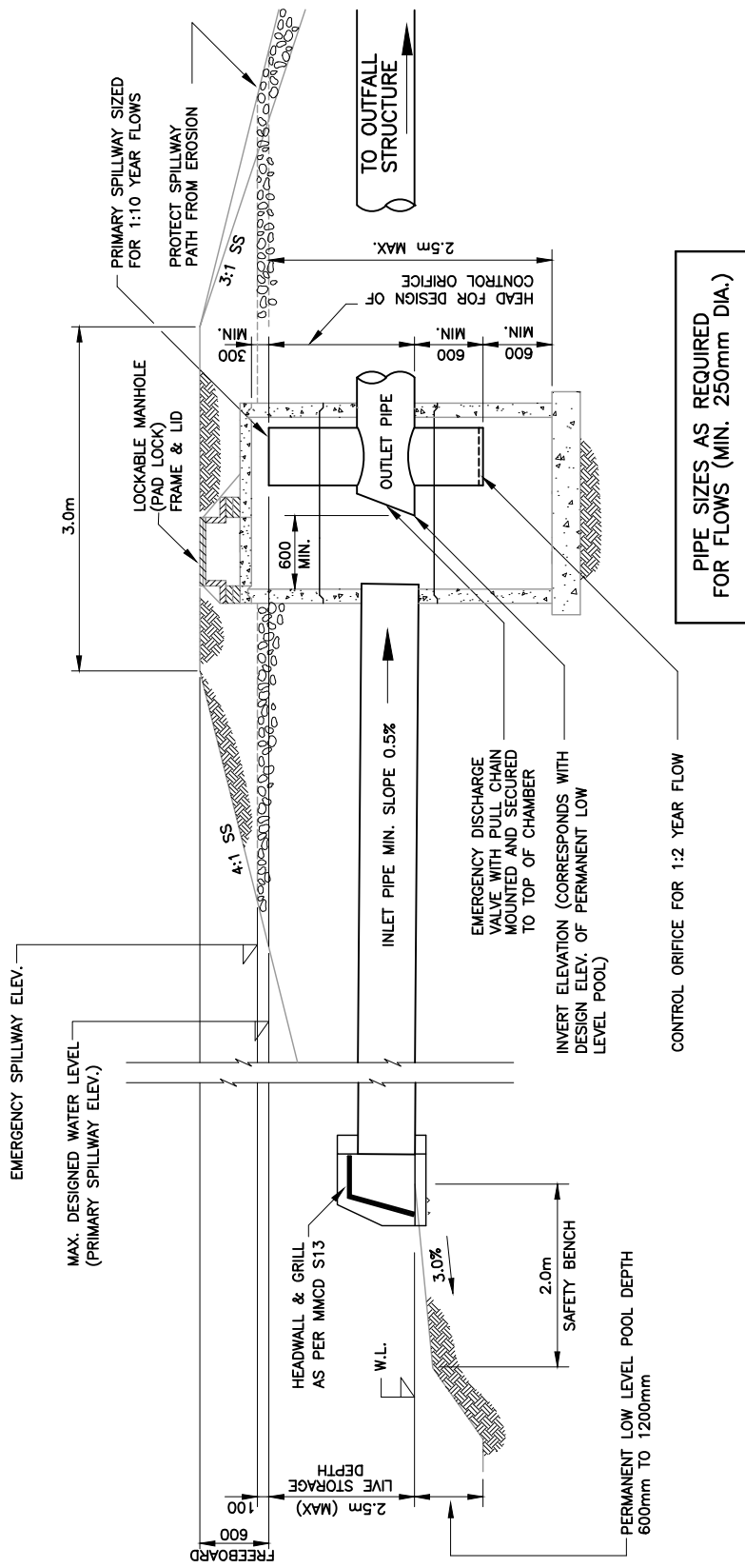
STORM WATER MANAGEMENT
WET DETENTION POND
SECTION

DRAWING NO.
CR-S122

DISK REF.

SHEET OF

REV. 1



- ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE SHOWN.



City of
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DATE:
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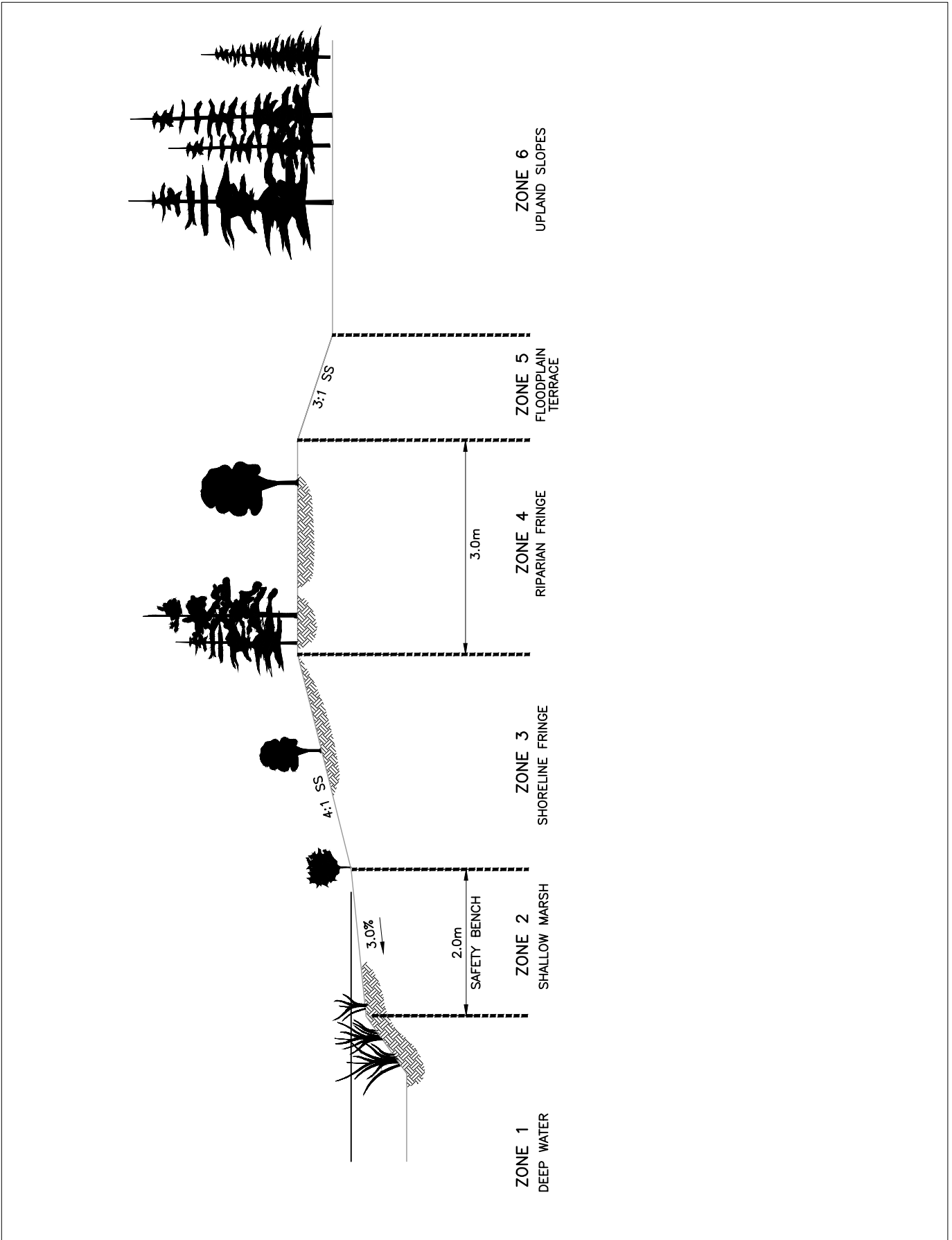
STORM WATER MANAGEMENT
WET DETENTION POND
VEGETATION ZONES

DRAWING NO.
CR-S124

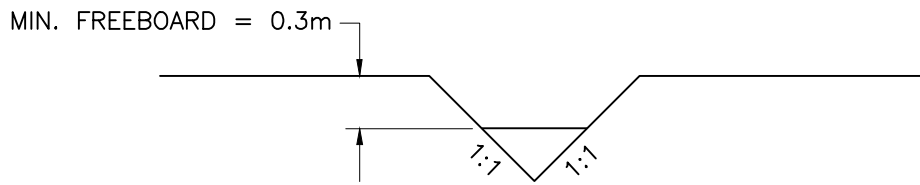
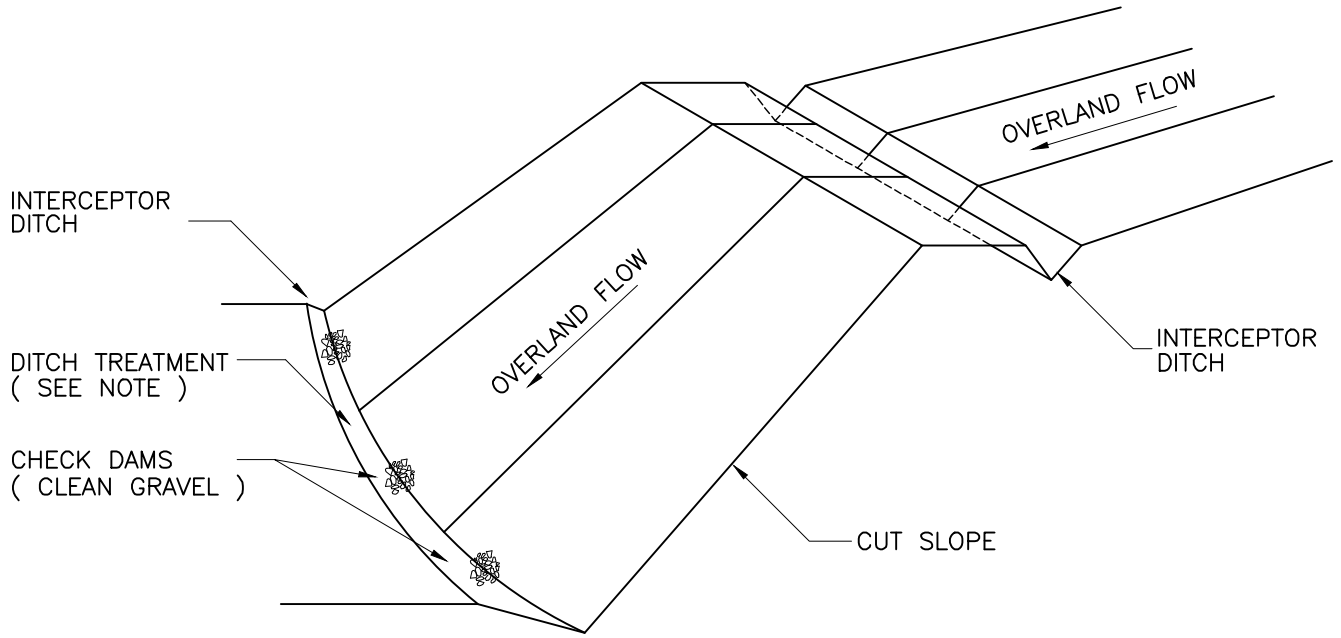
DISK REF.

SHEET OF

REV. 1



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TYP. DITCH X-SECTION

- FOR FLAT NON-ERODABLE SLOPES, (<5%) DITCH MAY GRASS OR SOD SURFACE.
- FOR STEEP SLOPES, (>5%) OR ON ERODABLE SOILS, LINE DITCH WITH POLY OR RIPRAP.
- ALL DIMENSIONS IN METRES UNLESS OTHERWISE SHOWN.



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EROSION AND SEDIMENT
CONTROLS
INTERCEPTOR DITCH

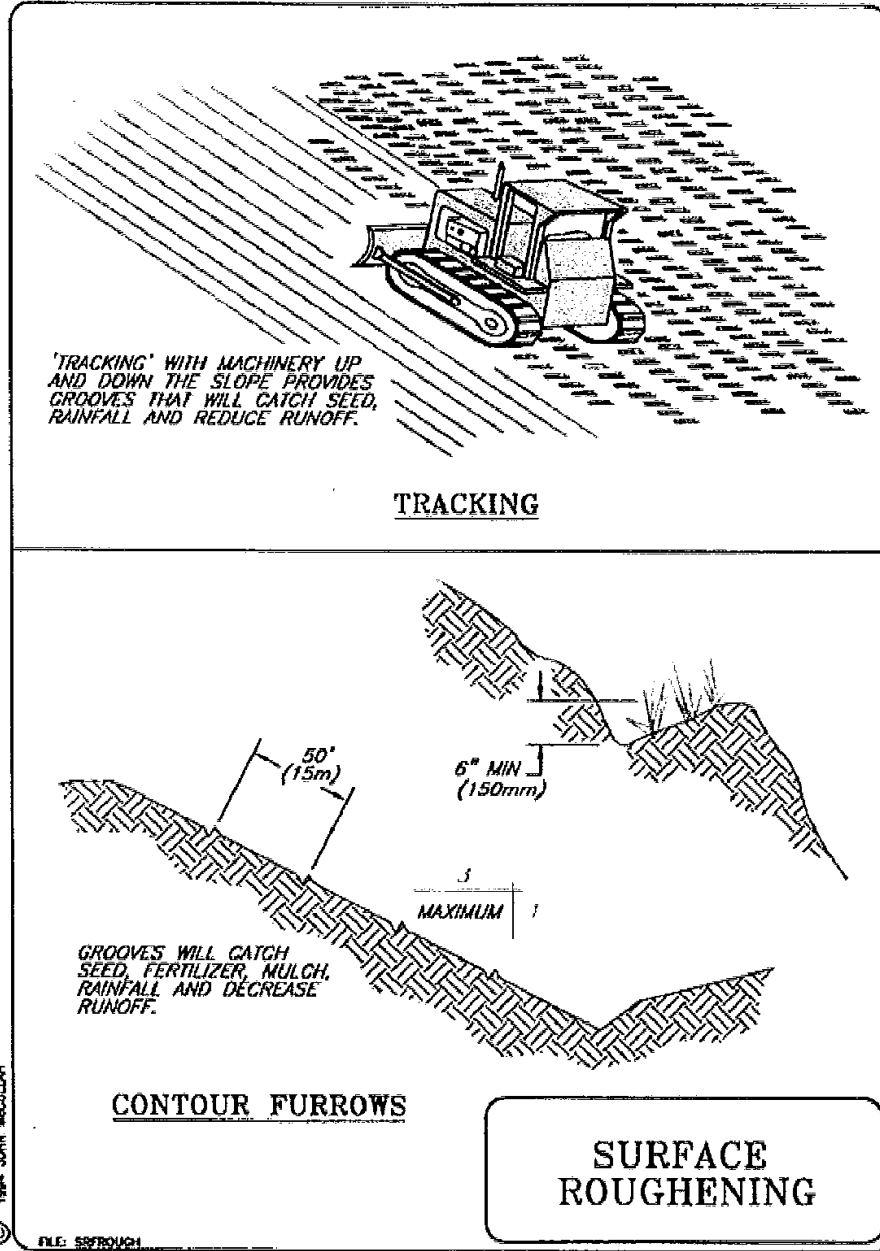
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CR-ES101

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Figure EC BMP #2.3. Slope Texturing: Surface Roughening Typical Drawing



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SURFACE ROUGHENING

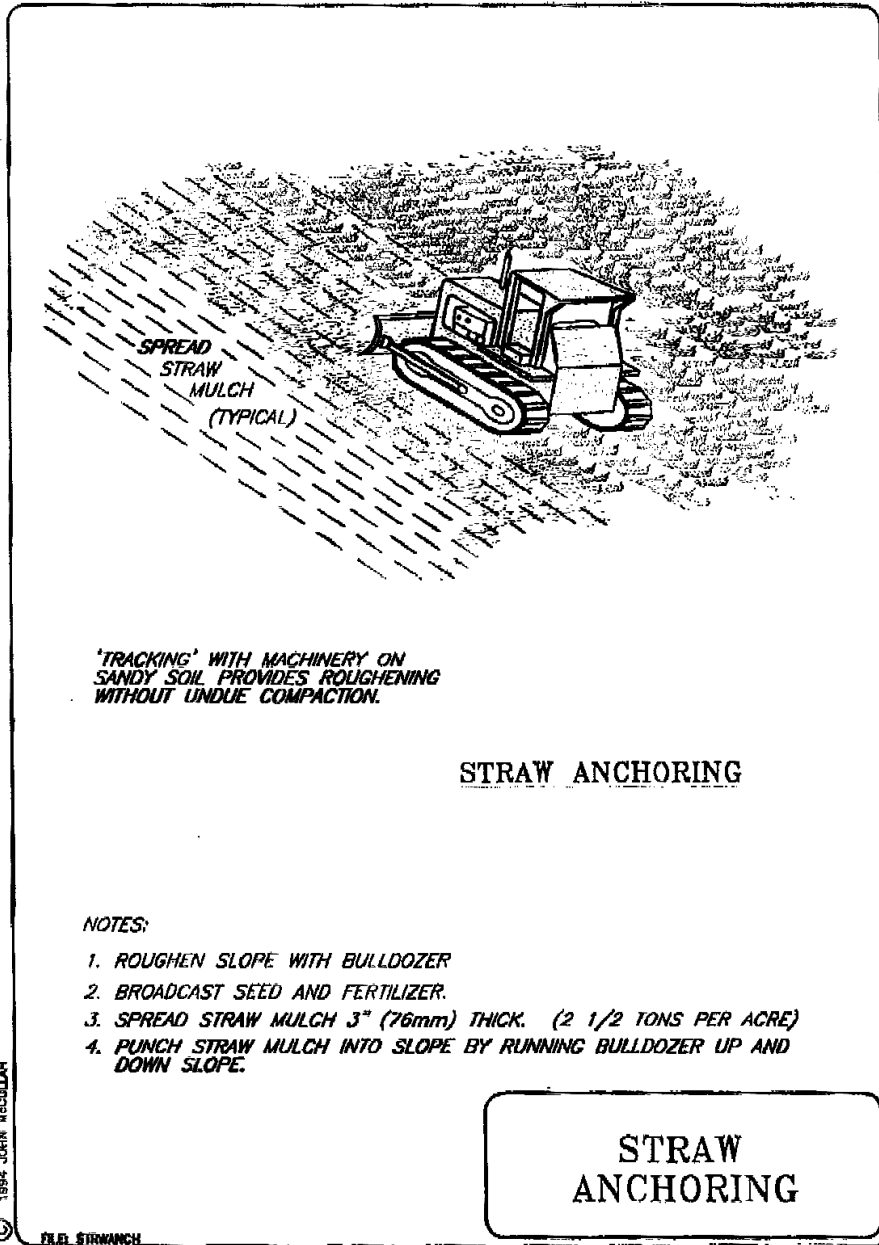
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CR-ES102

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Figure EC BMP #3.3. Mulch: Straw Anchoring Typical Drawing



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STRAW ANCHORING

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Erosion and Sediment Control

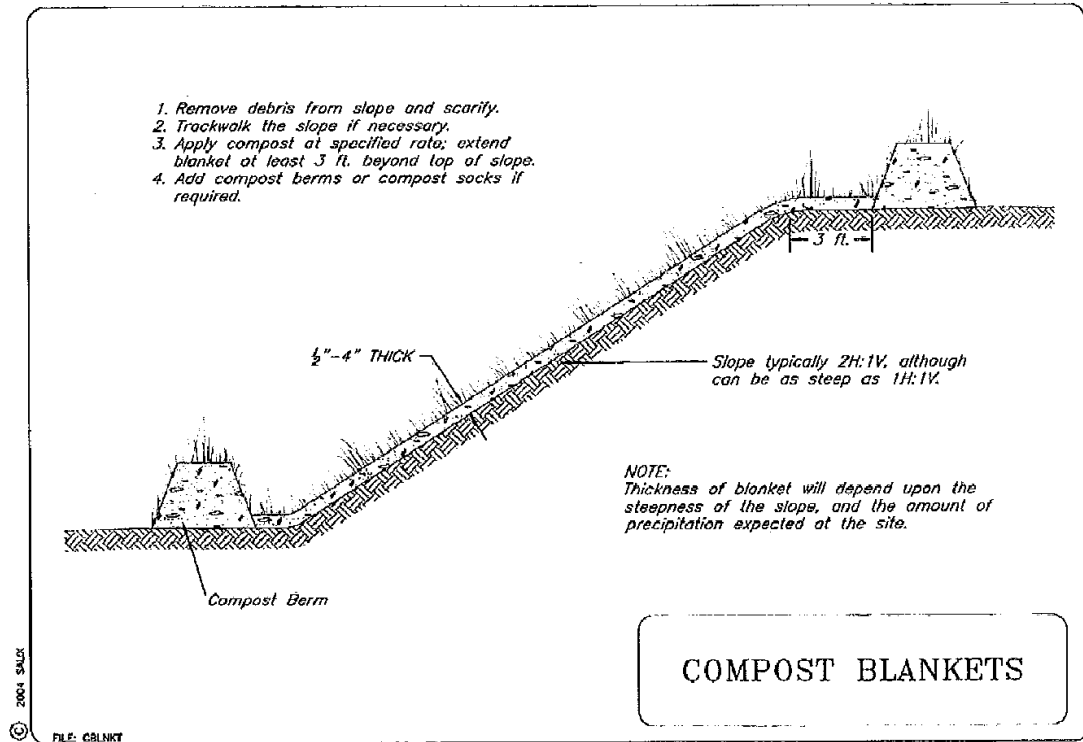


Figure EC BMP #3.6. Mulch: Compost Blankets Typical Drawing

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COMPOST BLANKETS

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Erosion and Sediment Control

Figure EC BMP #4.4. Rolled Erosion Control Products on Slopes: Slope Installation Typical Drawing

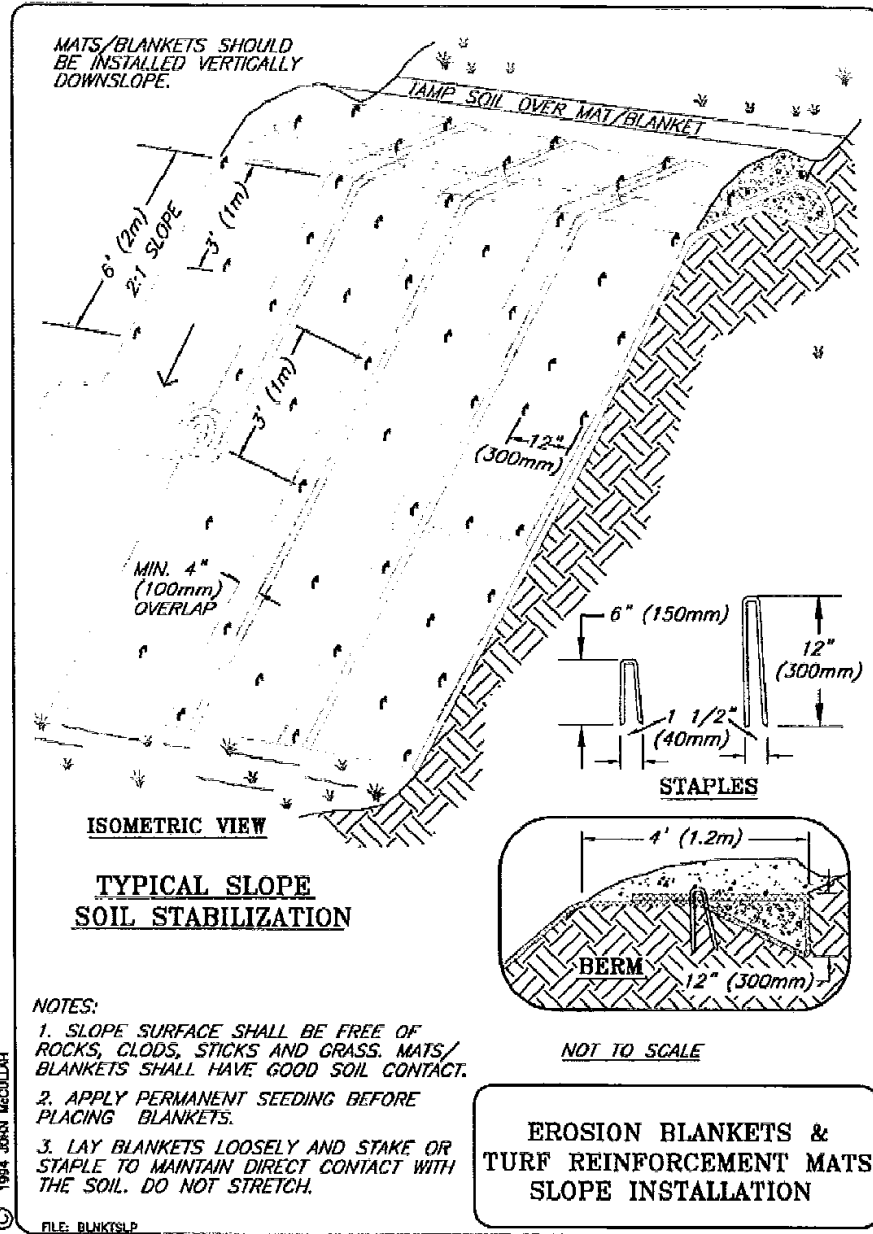
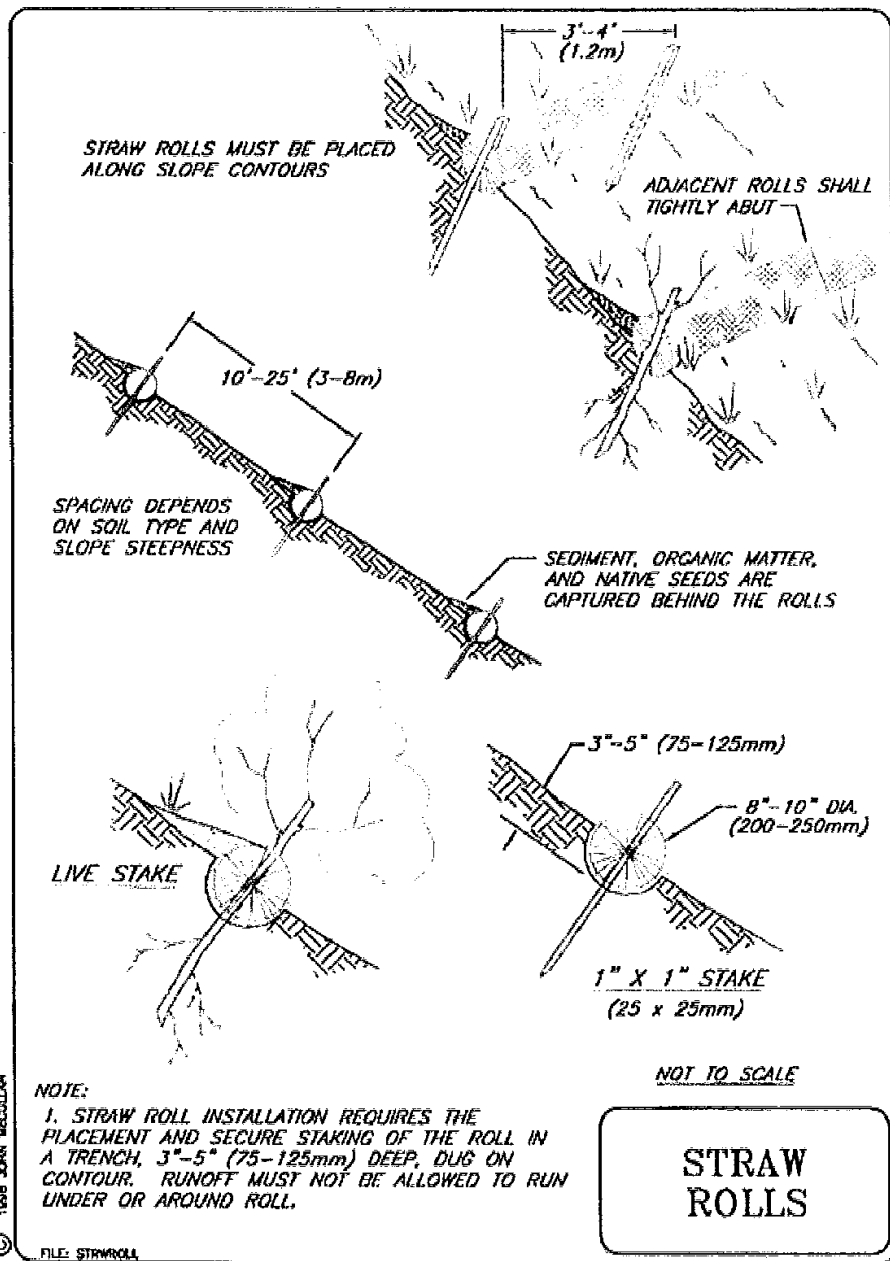


Figure EC BMP #5.3. Straw Wattles Typical Drawing

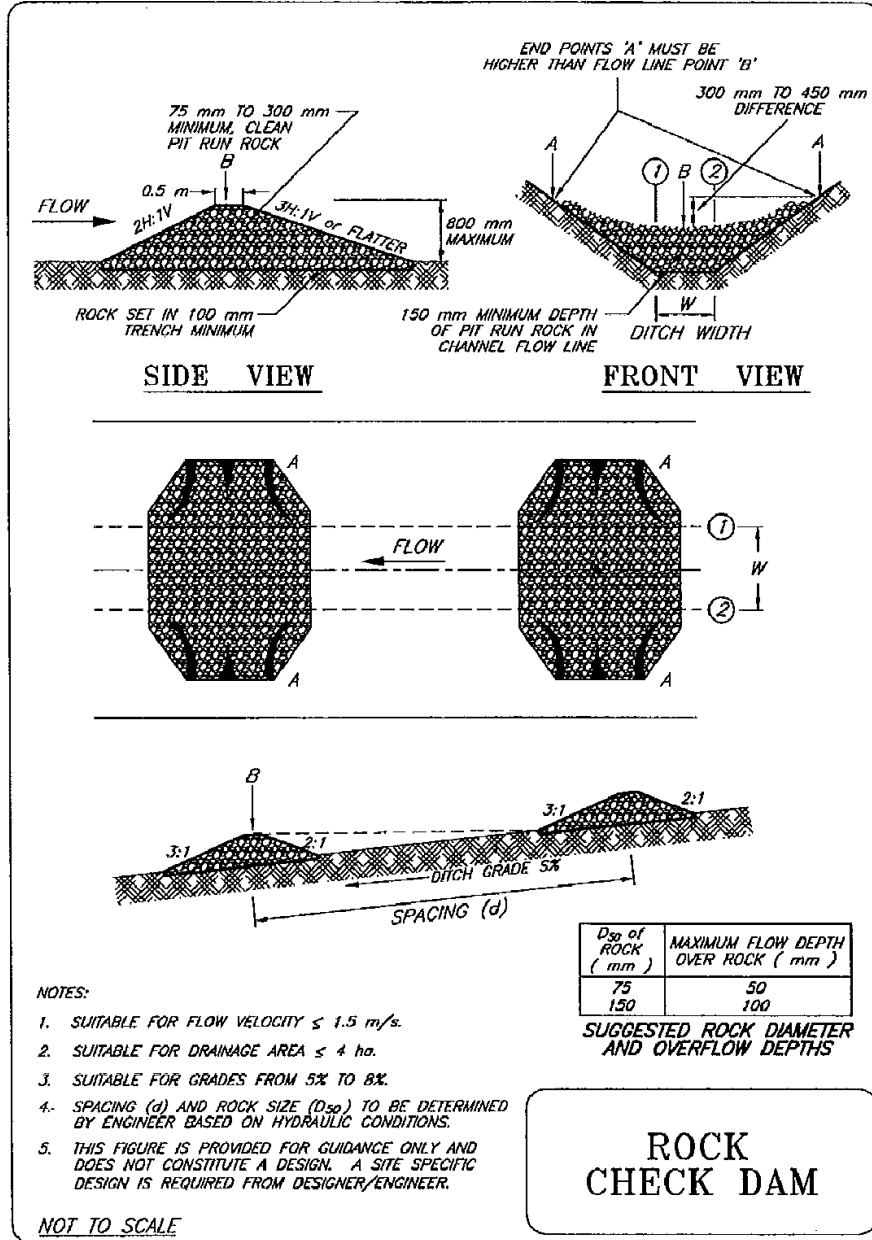


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Erosion and Sediment Control

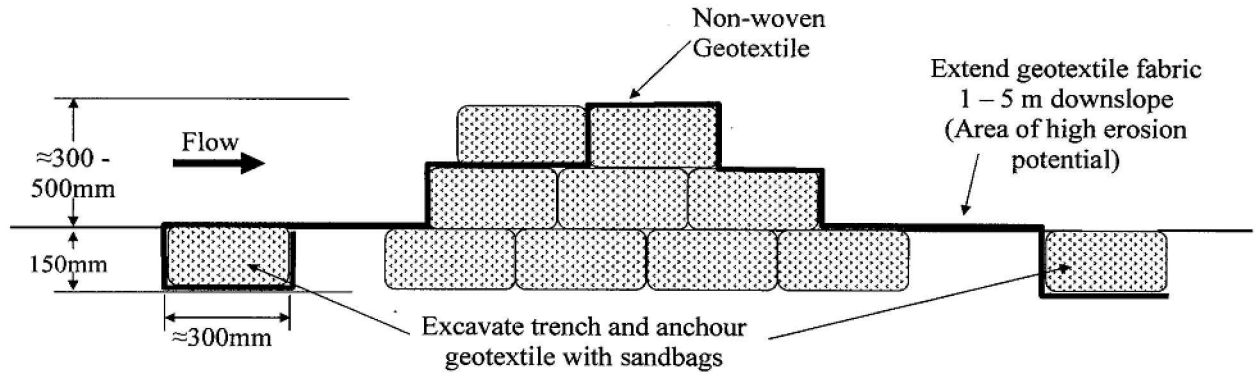
Figure EC BMP #9.3. Rock Check Dams Typical Drawing (Alberta Transport, 2003)



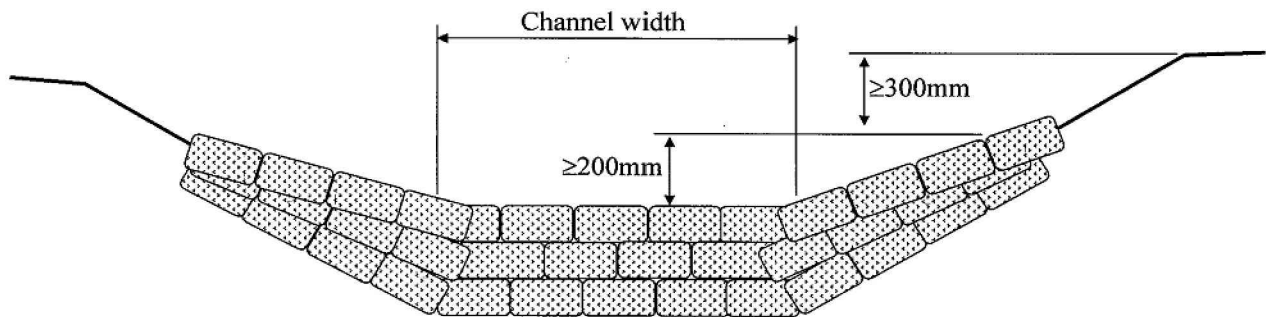
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SECTION VIEW THROUGH DAM

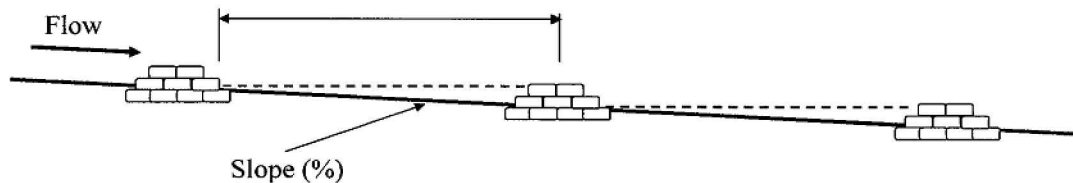


SECTION VIEW THROUGH DAM



TYPICAL SPACING FOR SANDBAG DAMS IN DITCH

$$\text{Spacing (m)} = \text{Dam height (m)} / \text{slope (\%)}$$



NOTES:

- Excavate 150mm deep trench full width of dam base.
- Wrap dam with non-woven geotextile (as shown) to increase dam stability.
- Ditch immediately downstream of dam prone to erosion. If non-woven geotextile is not installed as shown, erosion resistant apron must be placed to prevent erosion at this point.
- Ditch must have sufficient depth and be configured to ensure all flow remains within channel
- Ditch slope ≤5%
- Drainage area ≤ 2 ha
- Remove accumulated sediment

VOI Environmental, 2006. *Erosion and Sediment Control – Participant's Manual*. Prepared for Vancouver Island University Natural Resources Extension Program.

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SANDBAG DITCH DAM

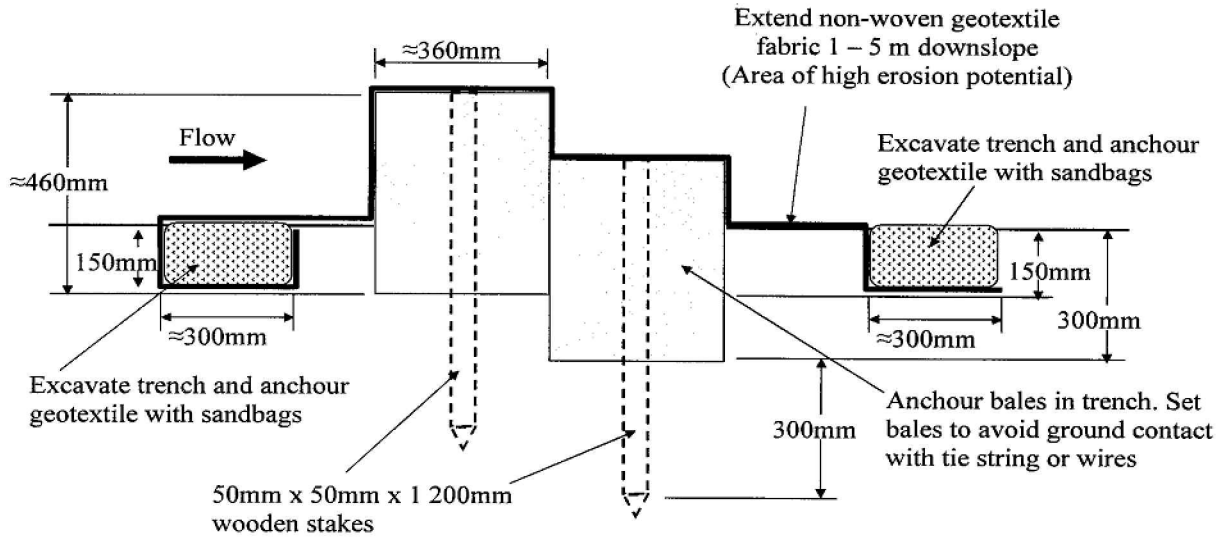
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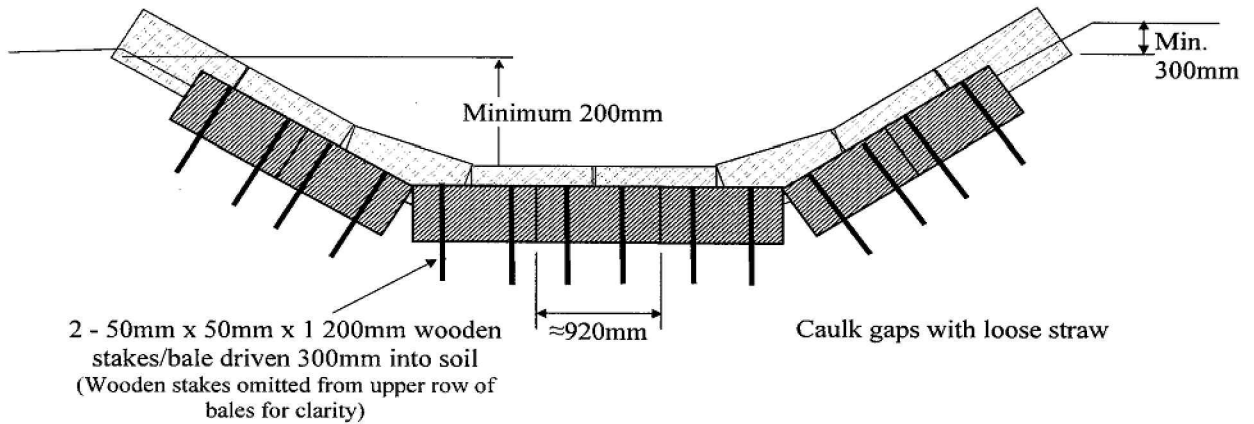
SHEET OF

REV. 1

SECTION VIEW THROUGH DAM

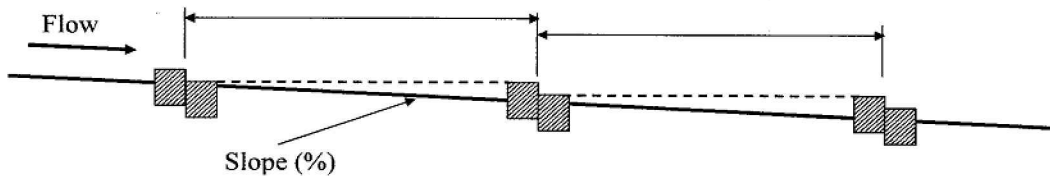


SECTION VIEW THROUGH DAM



TYPICAL SPACING FOR DAMS IN DITCH

$$\text{Spacing} = (\text{Bale height} - 150\text{mm}) / \text{slope} (\%)$$



NOTES:

- One bale high (maximum 500mm)
- Maximum effective dam height is 300 mm.
- Ditch must have sufficient depth and be configured to ensure all flow remains within channel
- Ditch slope ≤5%
- Drainage area ≤2 ha
- Flow velocity ≤0.3 m/s

VOI Environmental, 2006. *Erosion and Sediment Control – Participant's Manual*. Prepared for Vancouver Island University Natural Resources Extension Program.

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STRAW BAIL DITCH DAM

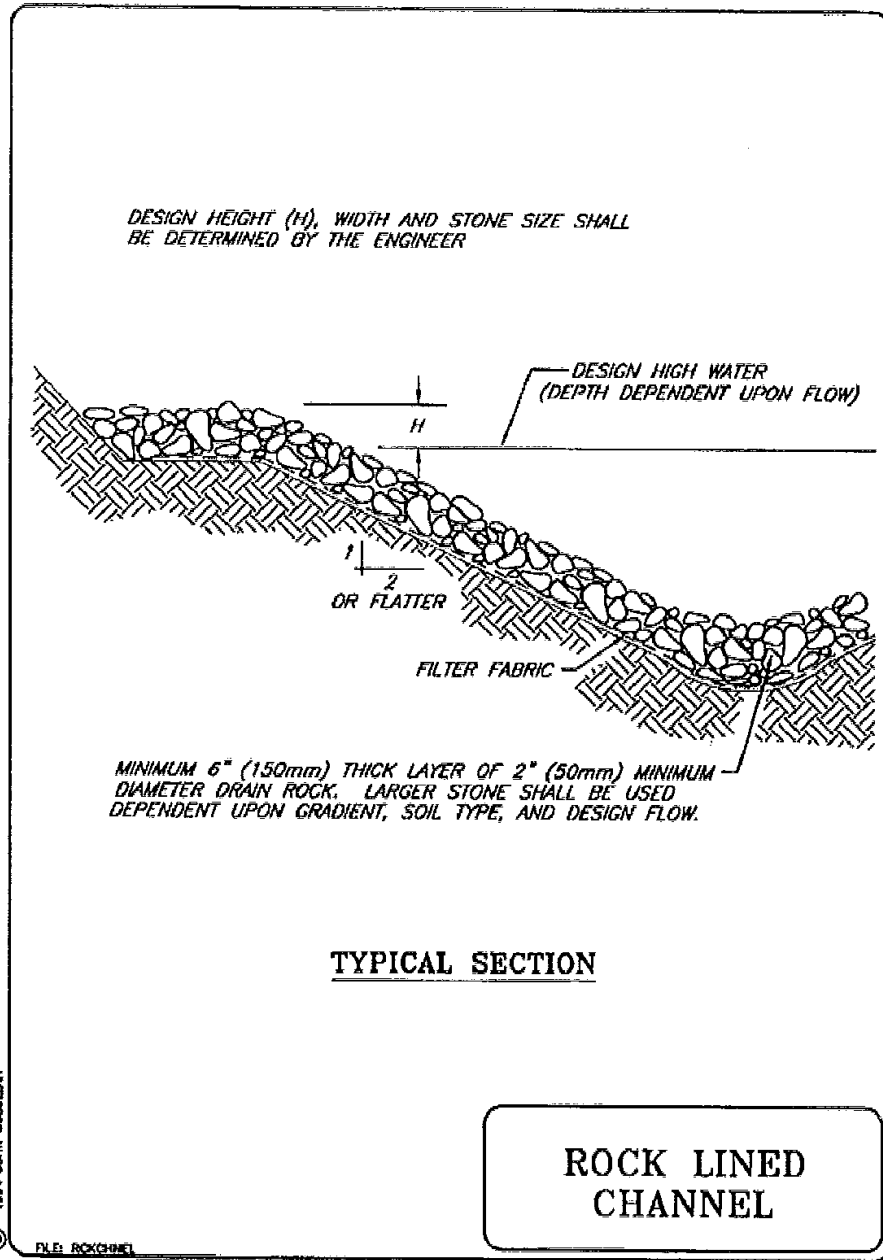
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Figure EC BMP #12.4. Rock-Lined Channel Typical Drawing



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ROCK LINED CHANNEL

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CR-ES110

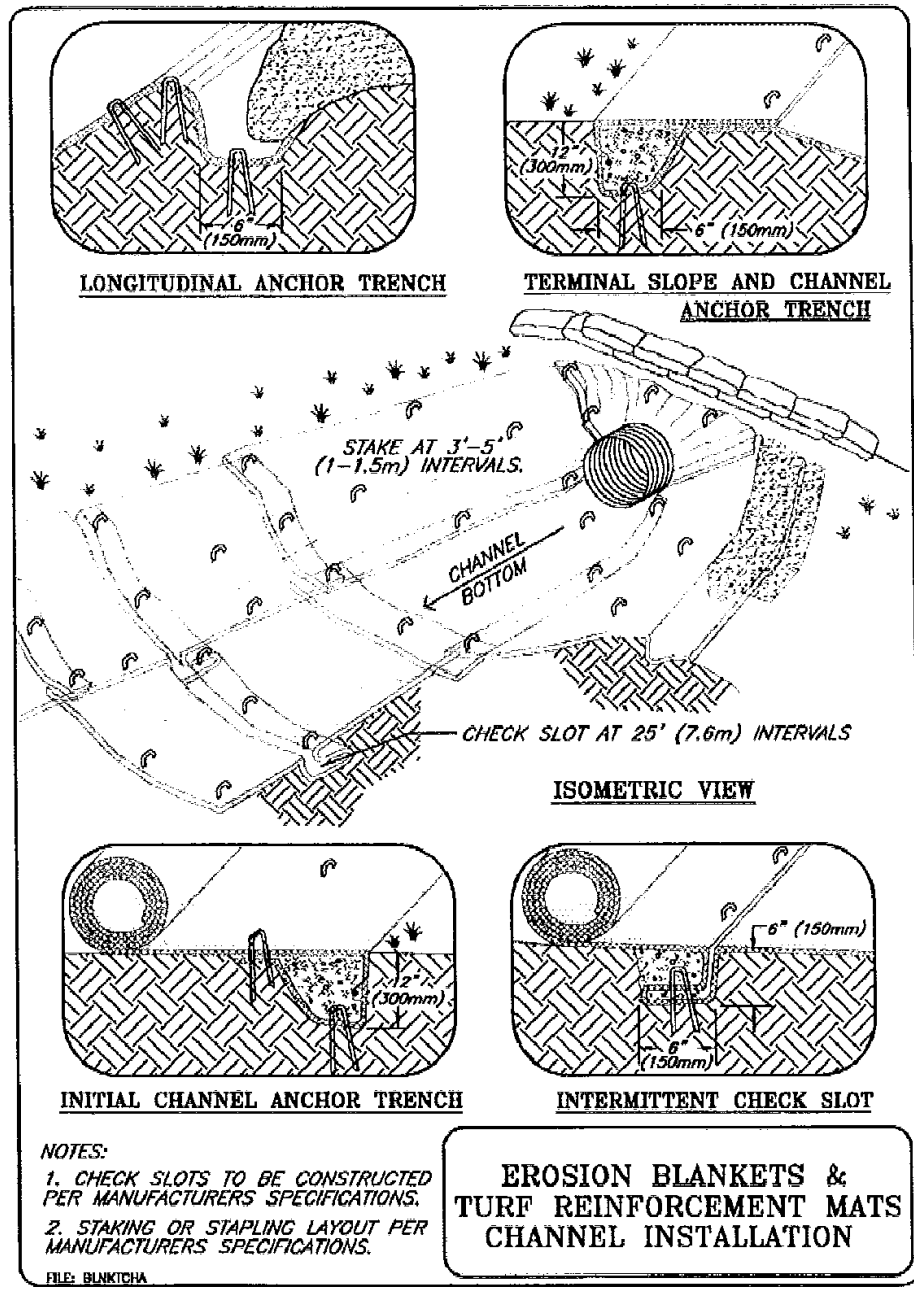
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Erosion and Sediment Control

Figure EC BMP #13.4. Rolled Erosion Control Products: Channel Installation Typical Drawing



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EROSION BLANKETS &
TURF REINFORCEMENT MATS
CHANNEL INSTALLATION

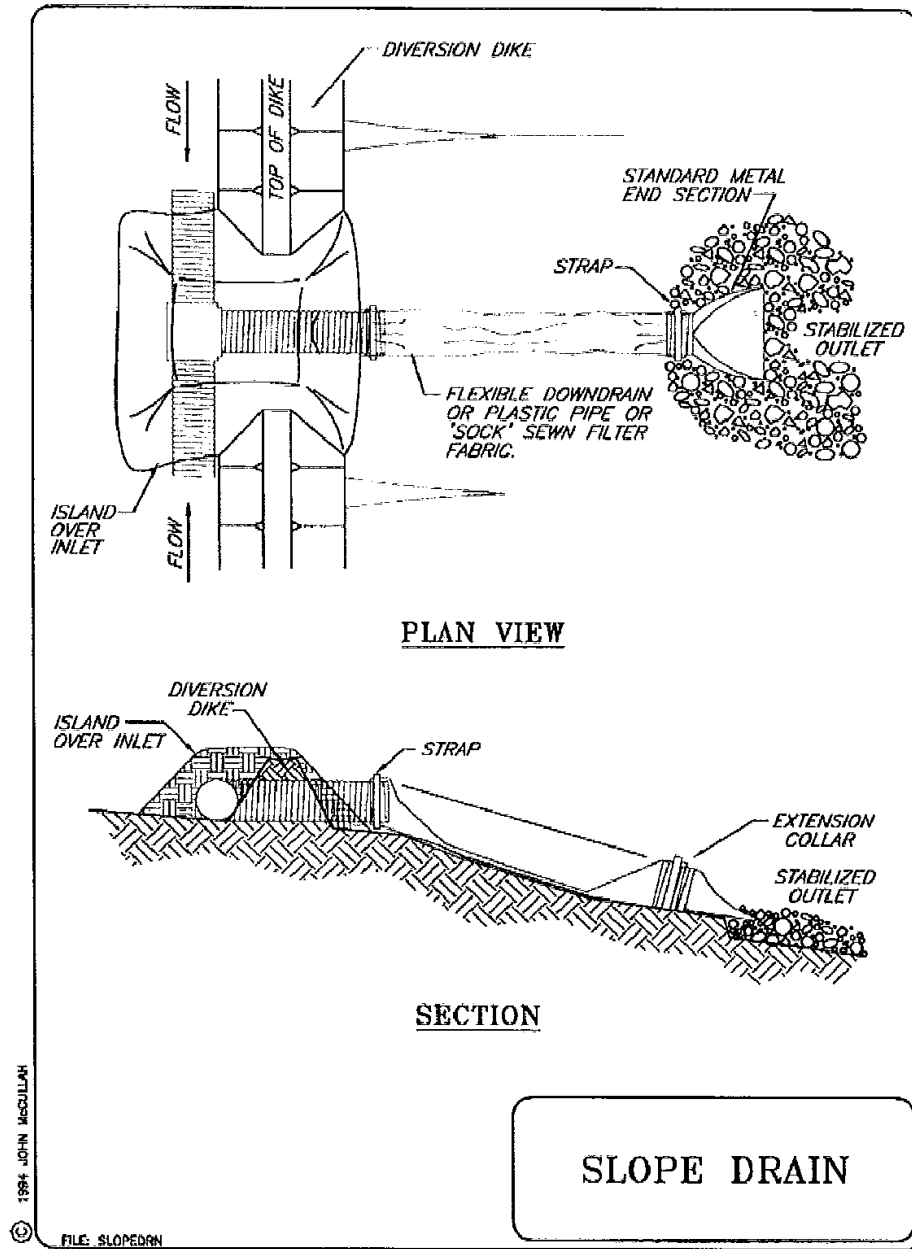
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Figure EC BMP #15.3. Slope Drain Typical Drawing



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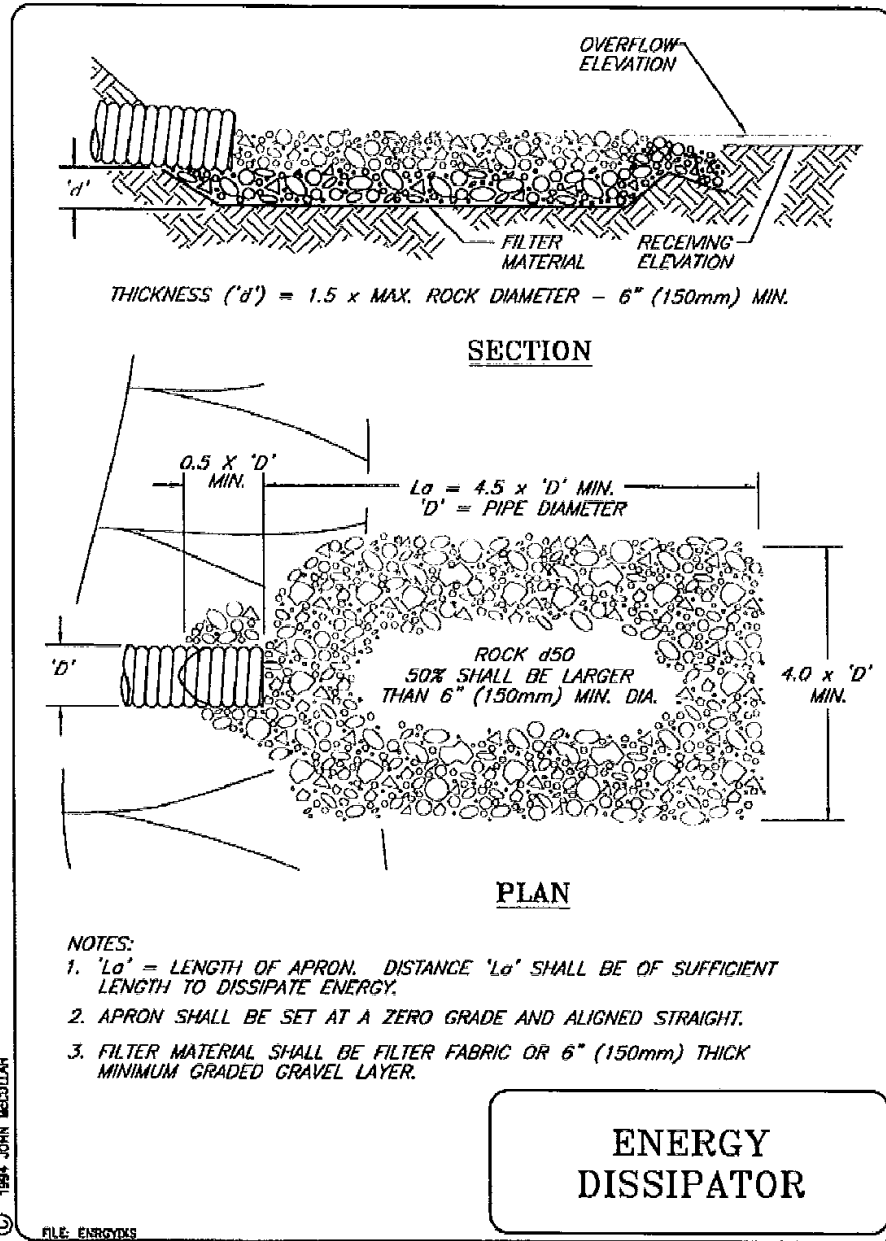
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SLOPE DRAIN

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Figure EC BMP #16.2. Energy Dissipater Typical Drawing



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ENERGY DISSIPATOR

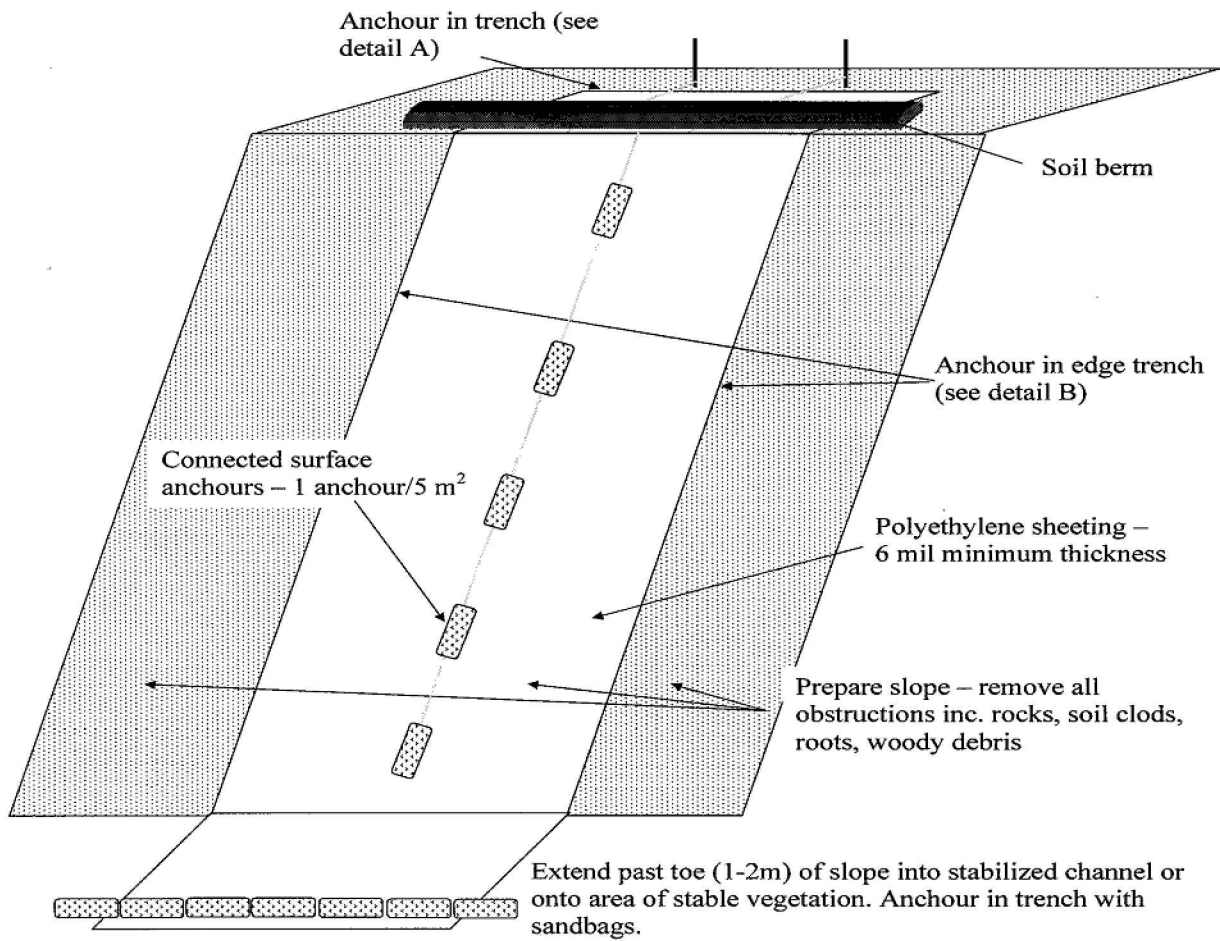
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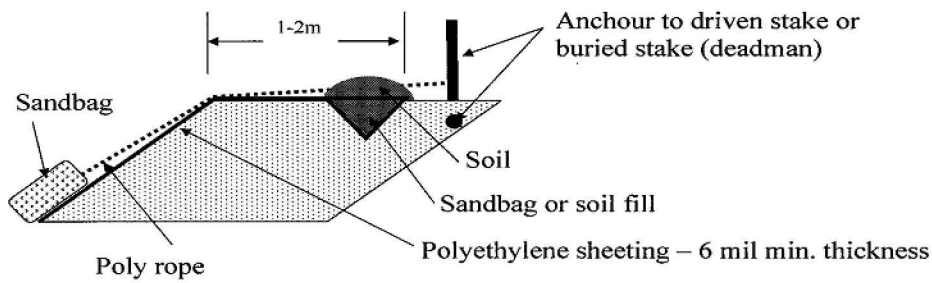
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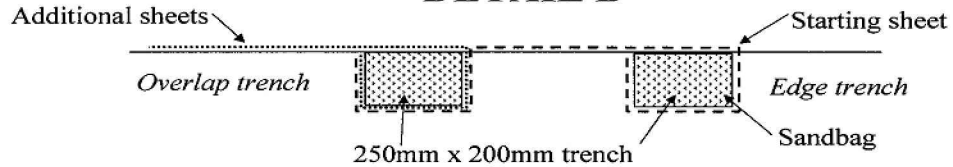
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DETAIL A



DETAIL B



VOI Environmental, 2006. *Erosion and Sediment Control - Participant's Manual*. Prepared for Vancouver Island University Natural Resources Extension Program.



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POLYETHYLENE SHEETING ON SLOPES

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Erosion and Sediment Control

Figure SC BMP #1.4. Sediment Fence: Typical Placement for Two Slopes

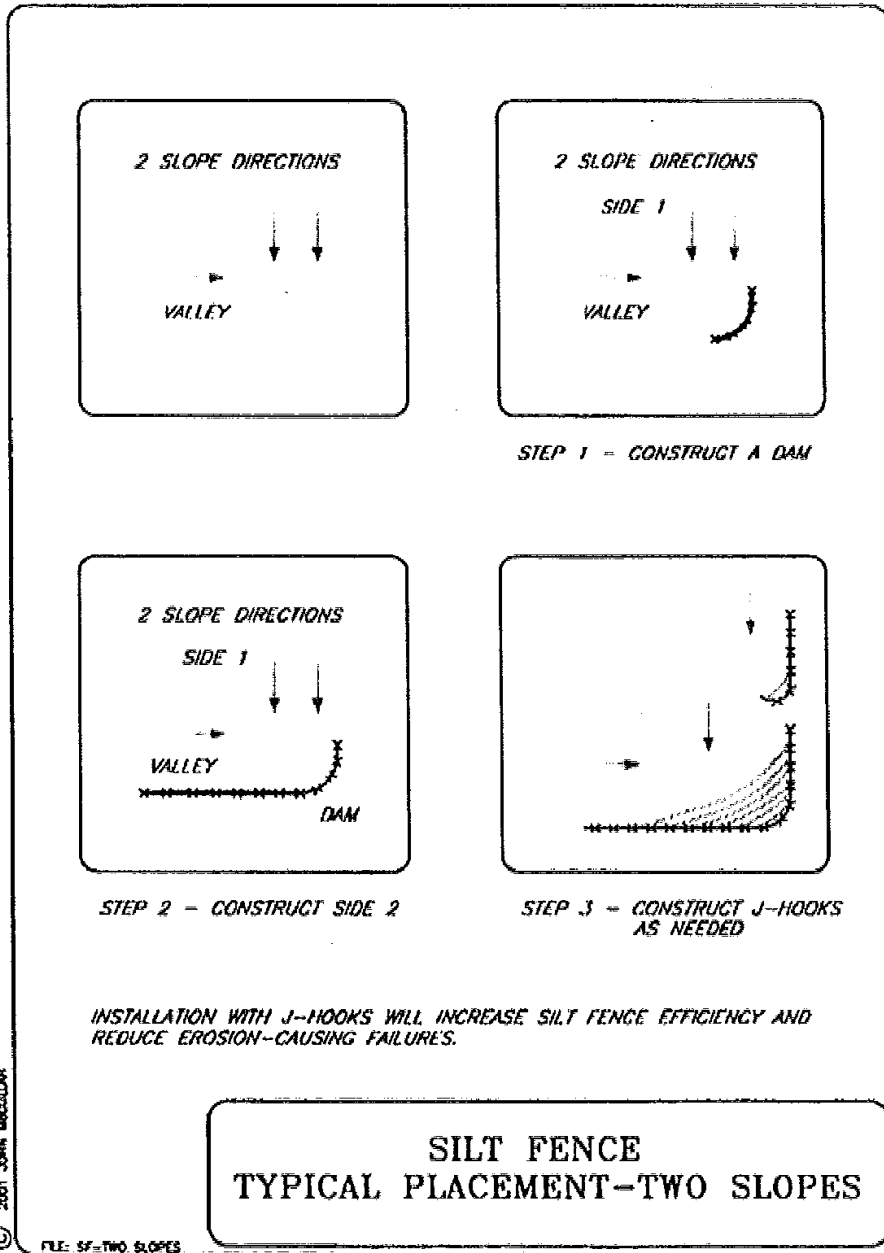
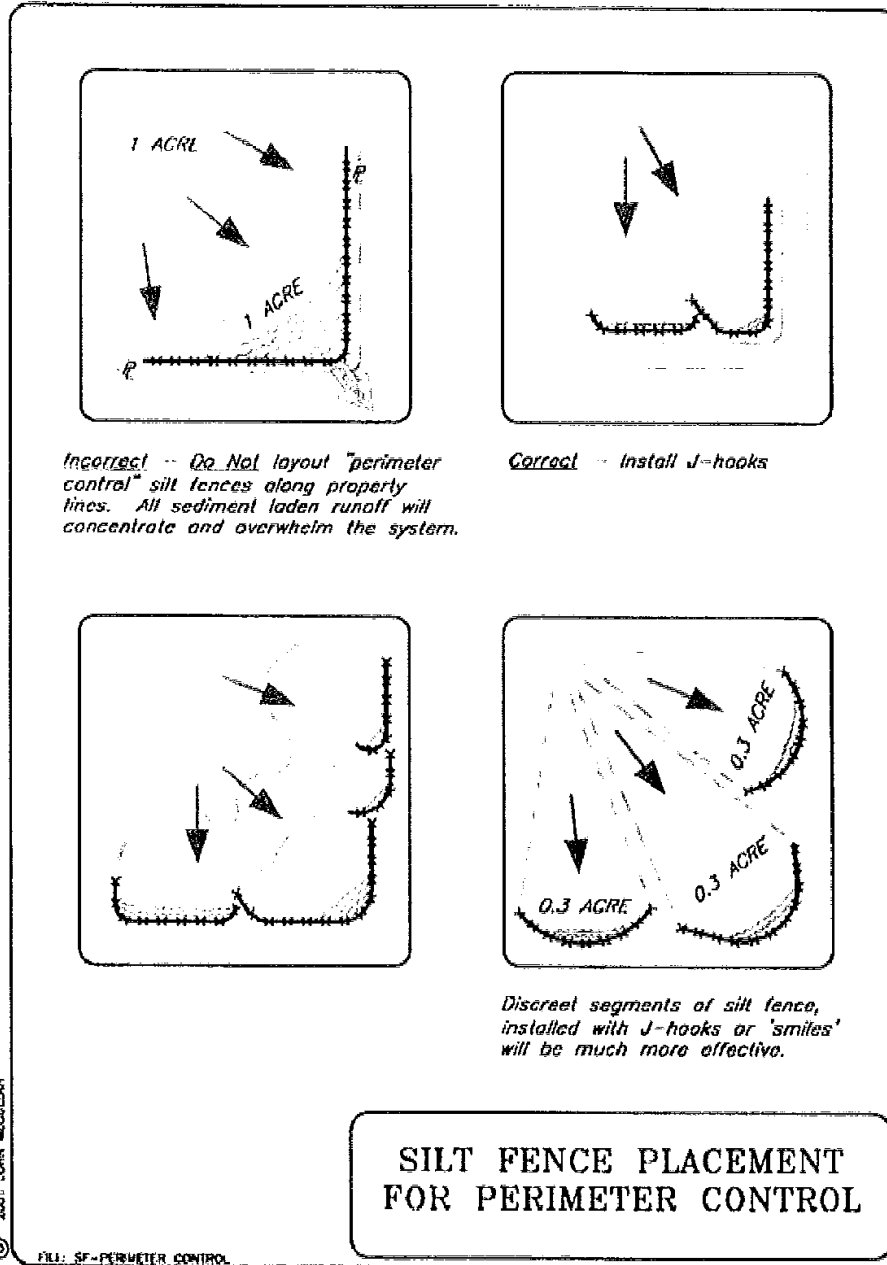


Figure SC BMP #1.5. Sediment Fence: Typical Placement for Perimeter Control



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SEDIMENT FENCE PLACEMENT
 FOR PERIMETER CONTROL

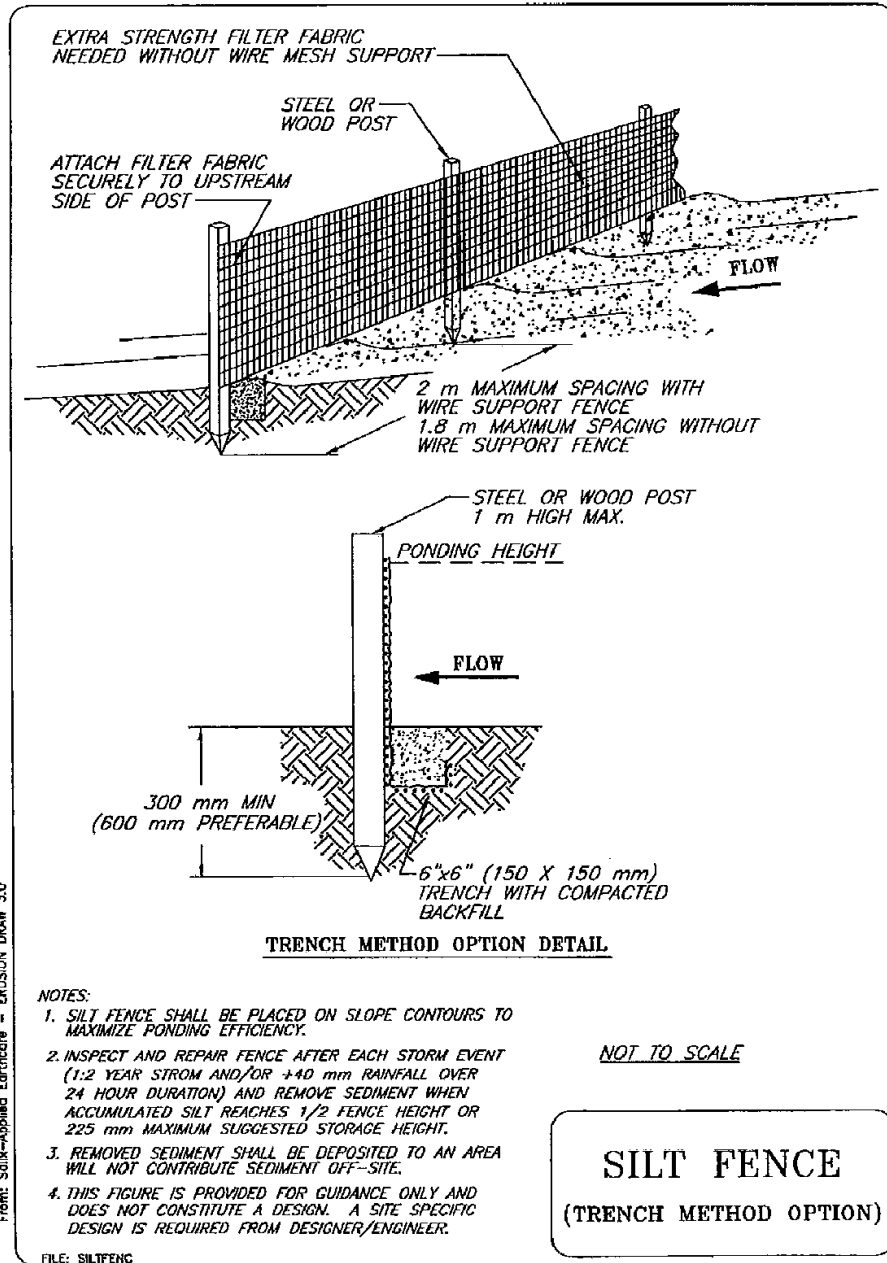
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Figure SC BMP #1.6. Sediment Fence Installation – Trench Method Typical Drawing (Alberta Transport, 2003)



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From: Soils-Applied Earthcare - EROSION DRAW 3.0

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SEDIMENT FENCE
TRENCH METHOD OPTION

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CR-ES117

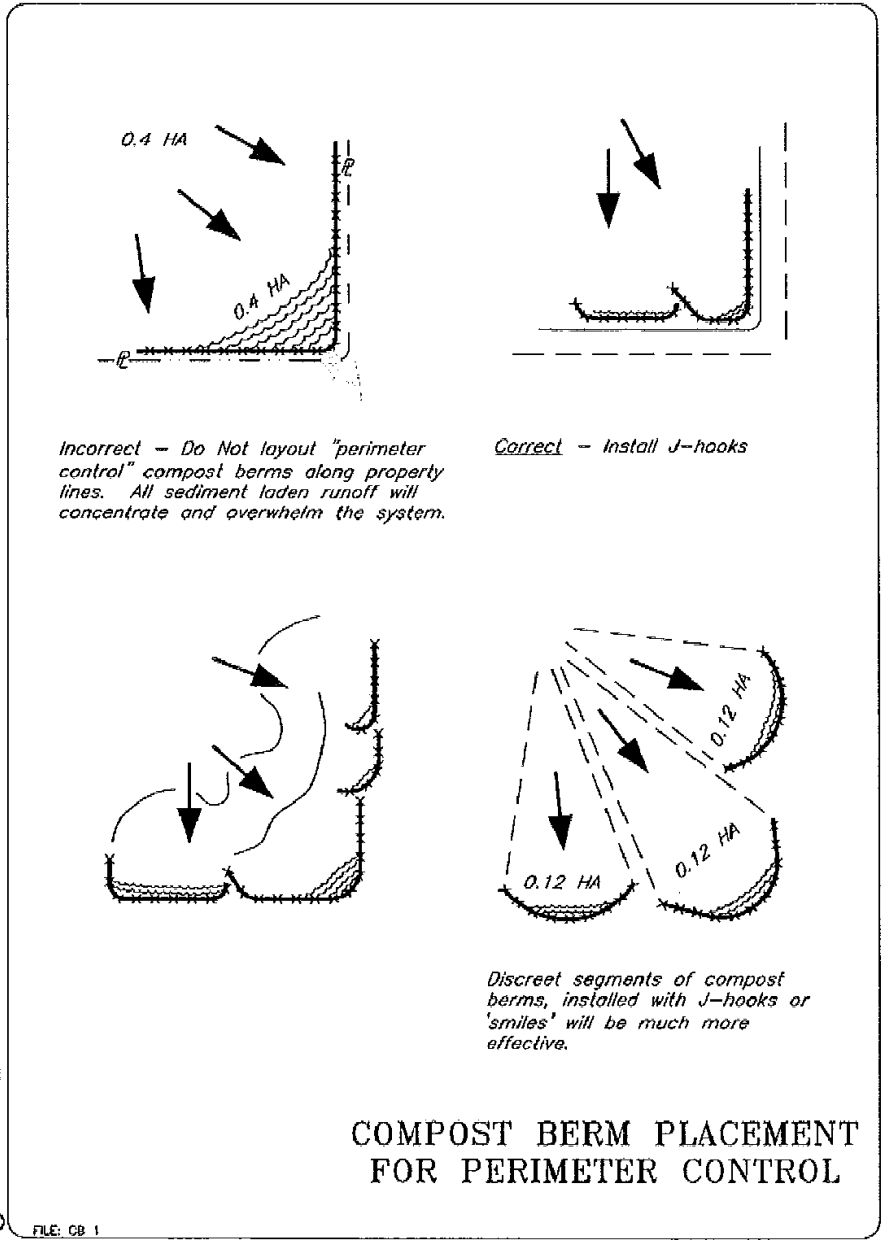
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Erosion and Sediment Control

Figure SC BMP #2.5. Compost Berm: Placement for Perimeter Control



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COMPOST BERM PLACEMENT
FOR PERIMETER CONTROL

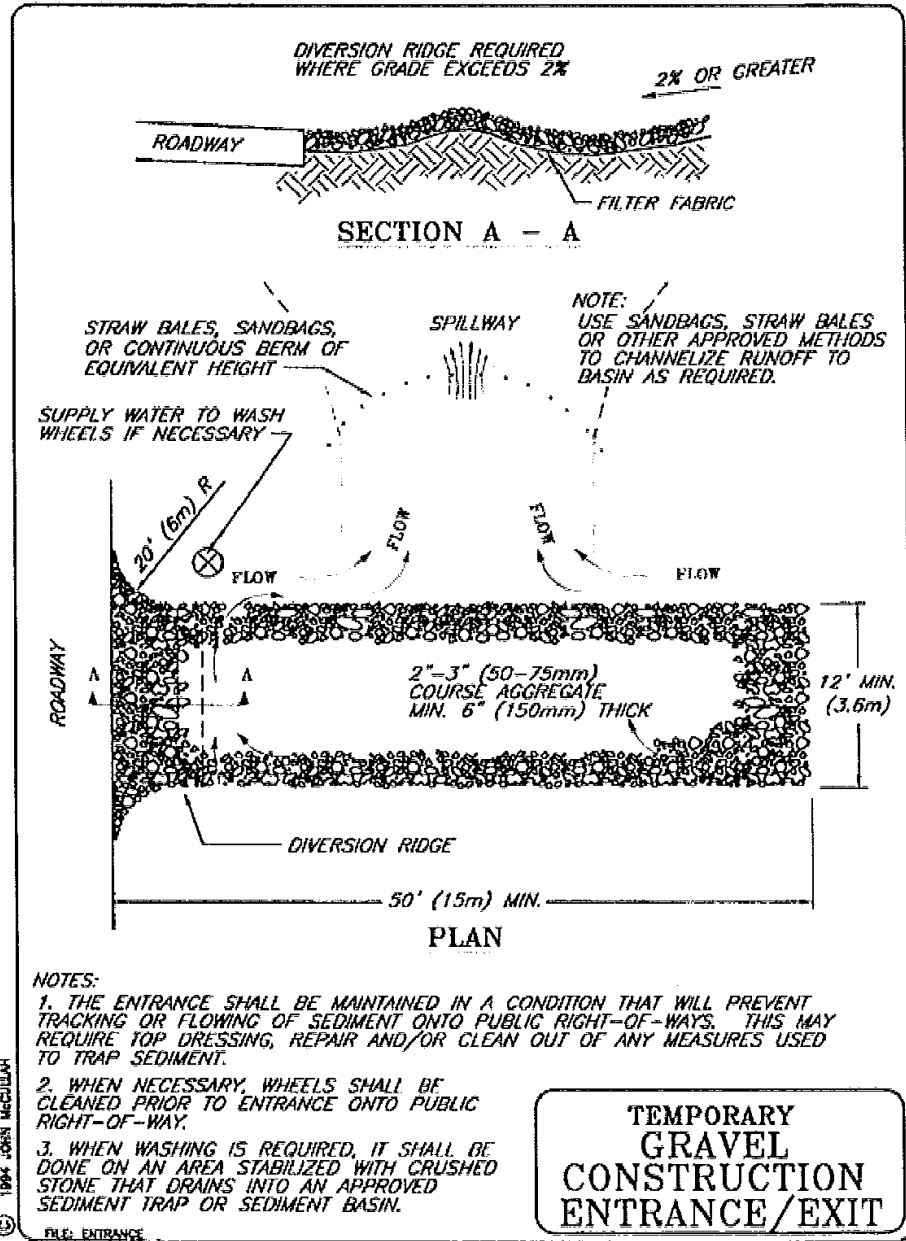
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Figure SC BMP #5.2. Stabilized Worksite Entrance Typical Drawing



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TEMPORARY GRAVEL CONSTRUCTION
ENTRANCE/EXIT

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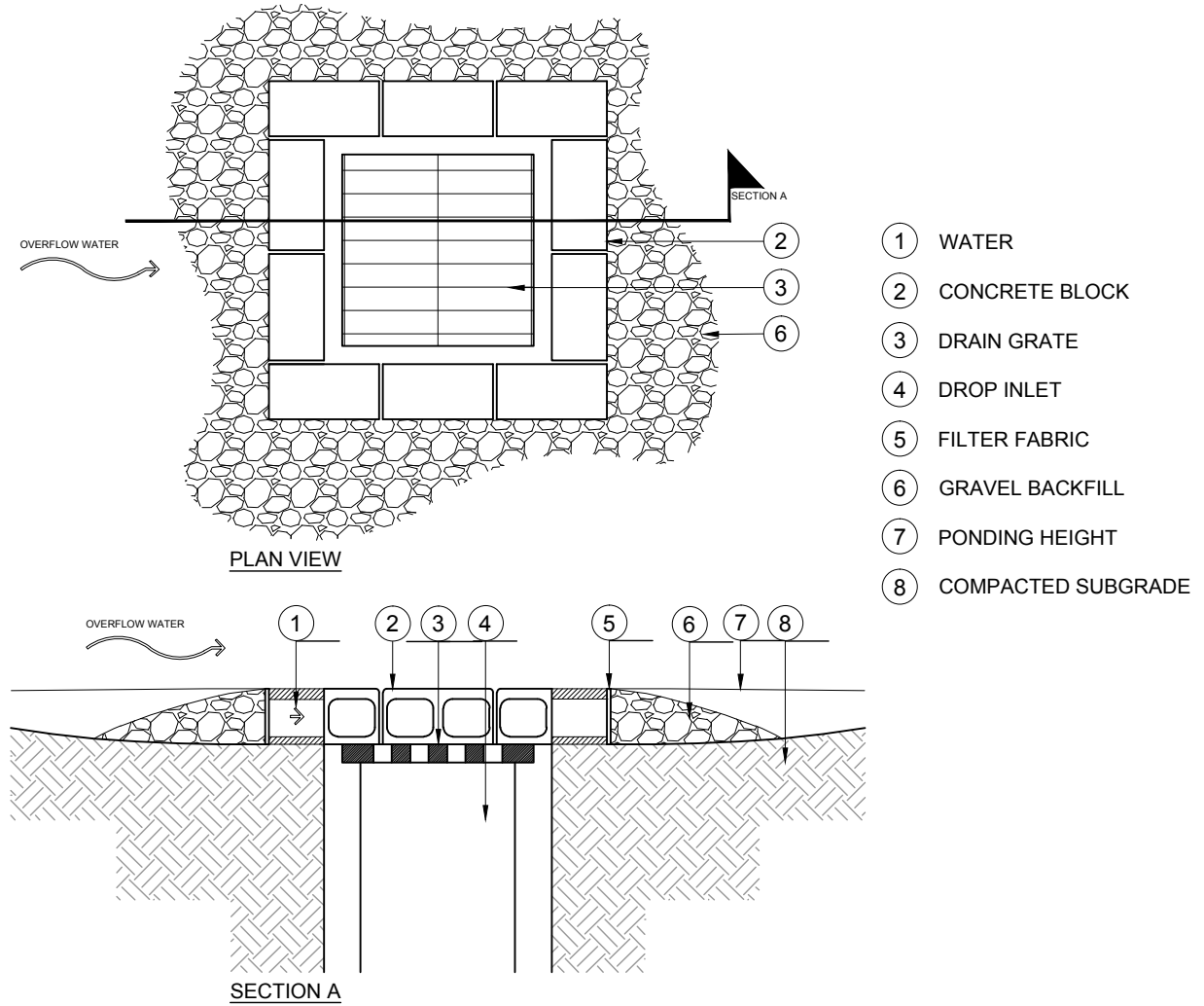
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NOTES:

1. DROP INLET SEDIMENT BARRIERS ARE TO BE USED FOR SMALL, NEARLY LEVEL DRAINAGE AREA (LESS THAN 5%).

2. EXCAVATE A BASIN OF SUFFICIENT SIZE ADJACENT TO THE DROP INLET.

3. THE TOP OF THE STRUCTURE (PONDING HEIGHT) MUST BE WELL BELOW THE GROUND ELEVATION DOWNSLOPE TO PREVENT RUNOFF FROM BYPASSING INLET. A TEMPORARY DIKE MAY BE NECESSARY ON THE DOWNSLOPE SIDE OF THE STRUCTURE.



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**BLOCK AND GRAVEL
DROP INLET SEDIMENT
BARRIER**

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CR-ES120

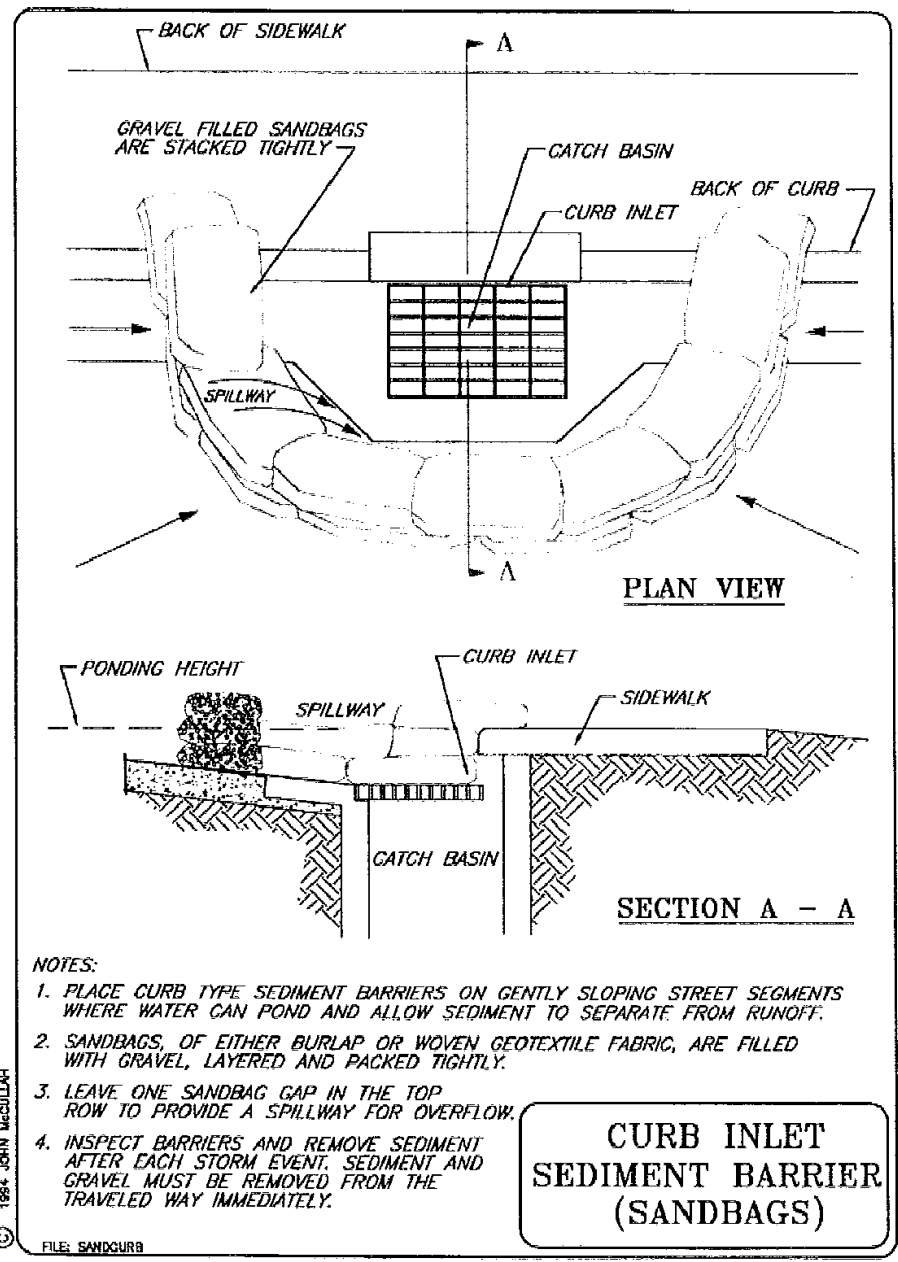
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Erosion and Sediment Control

Figure SC BMP #7.3. Curb Inlet Sediment Barrier: Sandbags Typical Drawing



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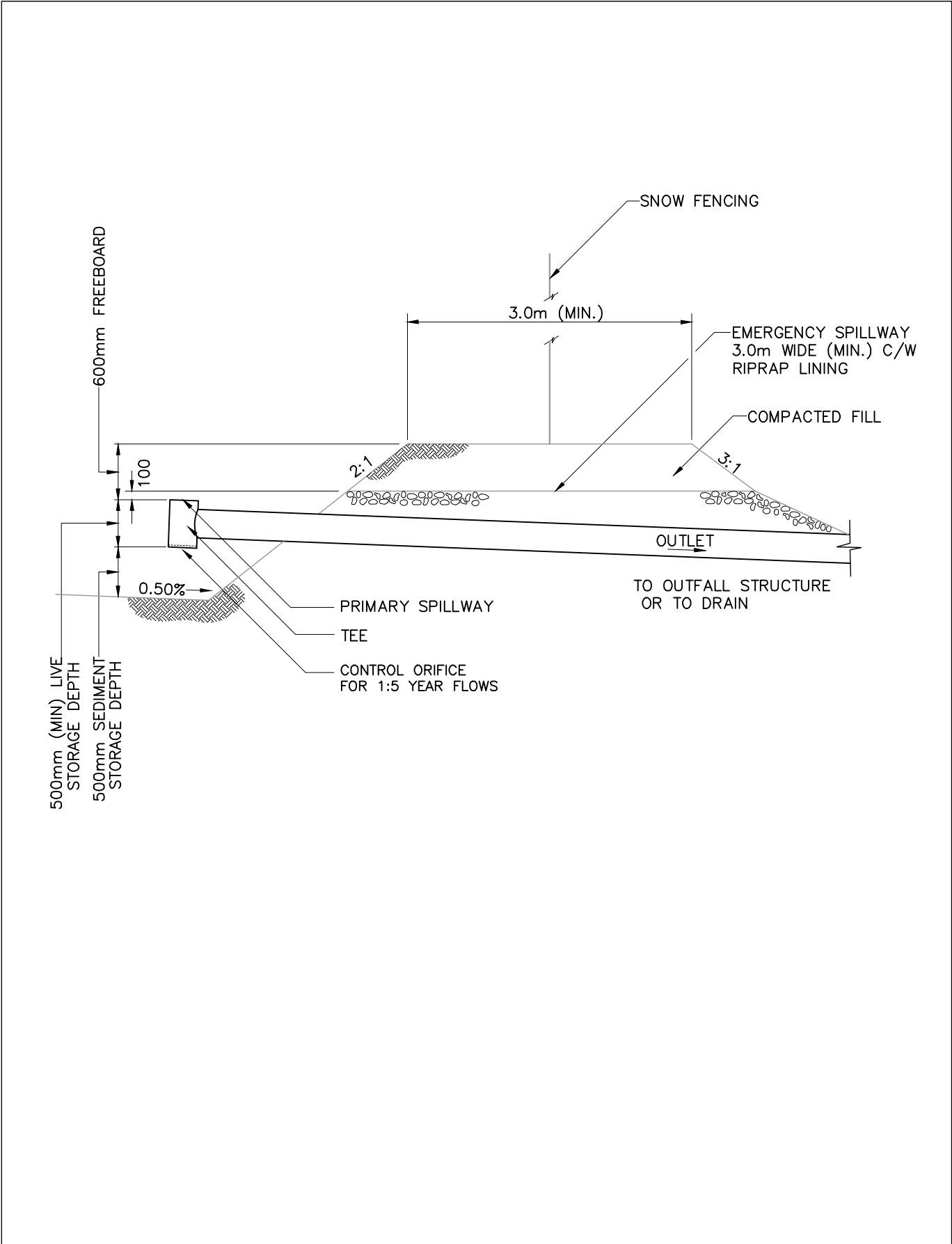
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**CURB INLET
 SEDIMENT BARRIER
 (SANDBAGS)**

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REV.	1

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EROSION & SEDIMENT CONTROLS
SEDIMENT CONTROL BASIN
SECTION

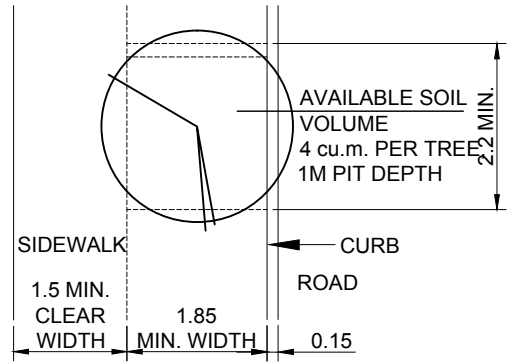
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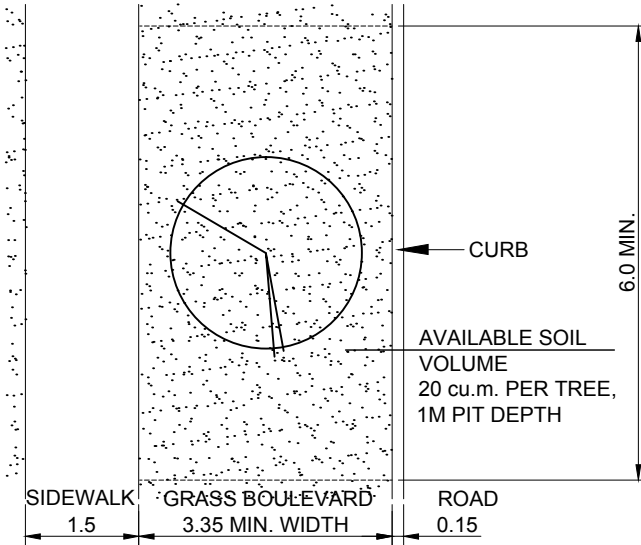
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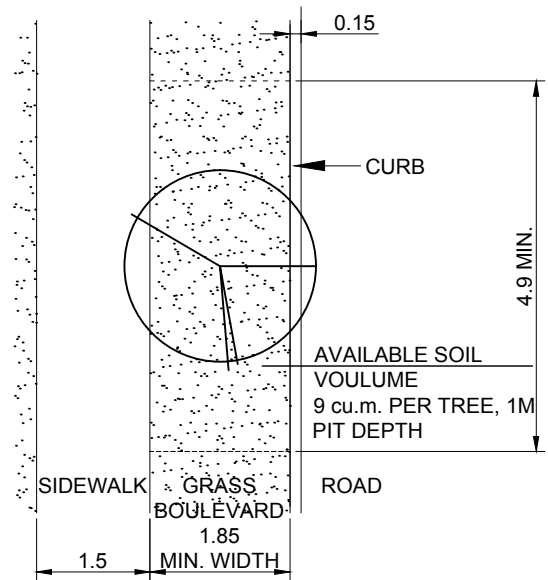


TREE PLANTING WITH 4 cu.m ROOT ZONE PLAN VIEW

NOTE: REFER TO DESIGN STANDARDS FOR STREET TREE SPACING, LOCATION AND SIZE IN RELATION TO AVAILABLE ROOT ZONE VOLUME.



TREE PLANTING WITH 20cu.m ROOT ZONE PLAN VIEW



TREE PLANTING WITH 9 cu.M ROOT ZONE PLAN VIEW



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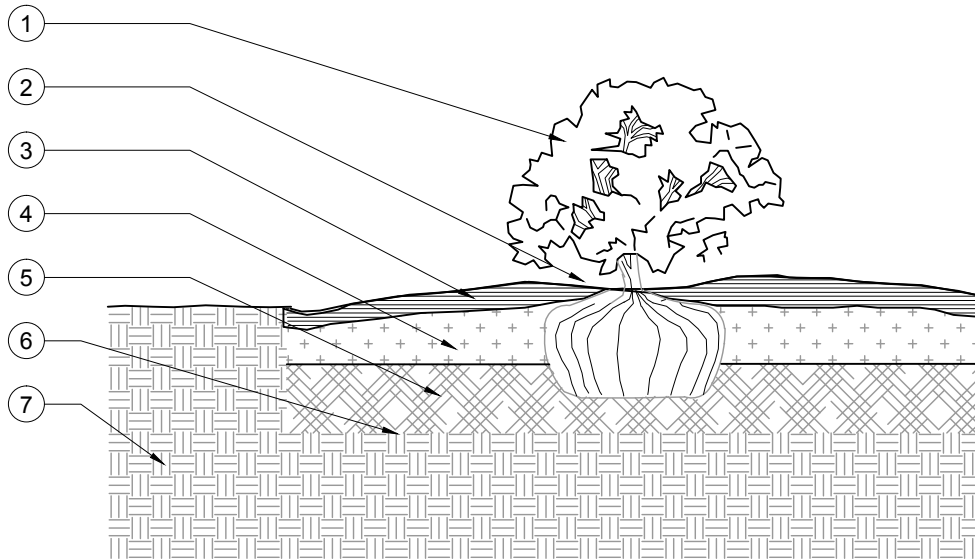
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TREE PLANTING ROOT ZONE VOLUME

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DISK REF.

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- ① REMOVE DEAD, DAMAGED OR WEAK GROWTH
- ② NOTE: ENSURE THE SOIL LEVEL DOES NOT EXCEED THE ORIGINAL NURSERY SOIL LINE AND THAT ROOTS ARE COMPLETELY COVERED IN SOIL.
- ③ 50mm DEPTH BARK MULCH.
- ④ 150mm LAYER OF 'A HORIZON' SOIL MIX.
- ⑤ 300mm LAYER OF UN-AMENDED TOPSOIL IN SHRUB BEDS. 150mm LAYER DEPTH IN GROUND COVERS BEDS.
- ⑥ SCARIFY BOTTOM OF PLANTING BED TO REMOVE GLAZING
- ⑦ COMPACTED FILL OR NATIVE MATERIAL



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SHRUB IN PLANTING BED

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NOTES:

THIS TREE PLANTING DETAIL IS USED WHEN PLANTING A TREE IN A TYPICAL UNCOMPACTED OPEN SPACE AREA.

ALL PLANTS & PLANTING ARE TO CONFORM TO THE B.C. LANDSCAPE STANDARD.

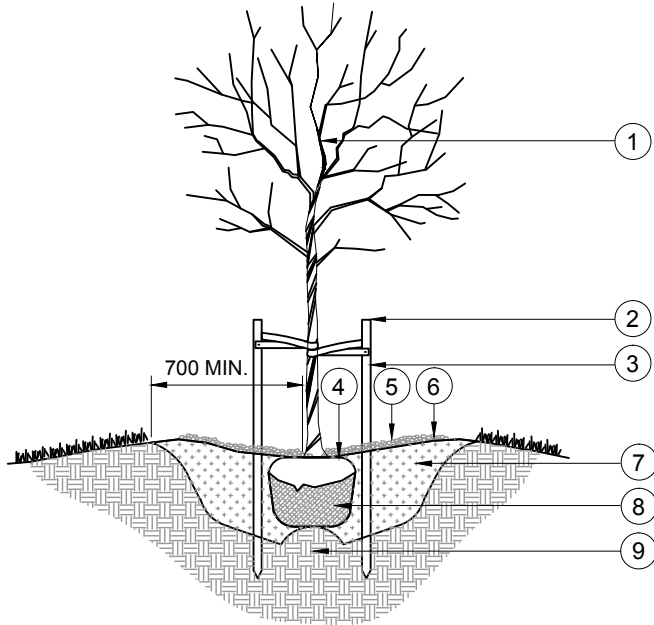
PROTECT TREE FROM DAMAGE DURING TRANSPORT AND PLANTING. TREE ROOTS NOT TO BE EXPOSED TO SUN OR FROST.

CONFIRM TREE LOCATION AGAINST ALL REQUIRED OFFSETS.

CONFIRM LOCATION OF UTILITIES; IT IS RECOMMENDED THAT STREET TREE PLANTING PITS BE DUG BY HAND AS UNDERGROUND SERVICES MAY EXIST.

CONFIRM FREE DRAINING SUBSOIL. CONTACT THE CITY IF DRAINAGE PROBLEMS ARE PRESENT.

PROVIDE IRRIGATION TO CITY REQUIREMENTS.



- ① DO NOT CUT LEADER
- ② SET TREE PLUM. STAKE TREE WITH TWO VERTICAL 50mmX50mm PRESSURE TREATED STAKES 1500mm LONG; PLACE 1/3rd OF THE STAKE BELOW GRADE. STAKES TO BE POSITIONED PARALLEL TO STREET FOR STREET TREES OR TO PREVAILING WIND. STAKES NOT TO PENETRATE OR DAMAGE ROOT BALL.
- ③ SECURE TREE WITH SOFT POLYPROPYLENE TAPE/TIE. TIE IN FIGURE EIGHT PATTERN AND ATTACH TO STAKES WITH SHINGLE NAILS.
- ④ TOP OF THE ROOTBALL TO BE FLUSH WITH SURROUNDING GRADE. FINISHED GRADE OF PLANTING TO BE EQUIVALENT TO NURSERY GROWN GRADE OF TREE.
- ⑤ CREATE A 50mm DEEP WELL IN GROWING MEDIUM FOR THE FIRST YEAR OF WATERING. ENSURE WELL IS A CLEAN-EDGED CIRCLE WITH A DIAMETER OF 1400mm.
- ⑥ PLACE 50mm DEPTH OF MULCH OVER THE PLANTING WELL. KEEP MULCH BACK FROM TRUNK A MINIMUM DISTANCE OF 100mm.
- ⑦ GROWING MEDIUM IN PLANTING HOLE DEPTH EQUAL TO HEIGHT OF THE ROOTBALL. PLANTING HOLE EDGE TO BE A SHALLOW ANGLE. SCARIFY SIDES AND BOTTOM OF TREE PIT PRIOR TO PLANTING.
- ⑧ REMOVE STRAPPING, BASKETS OR ROOT BAGS CUT ALL BINDING MATERIAL AND FOLD BURLAP INTO HOLE PRIOR TO BACKFILLING.
- ⑨ ENSURE A MINIMUM OF 300mm DEPTH OF COMPACTED SUBGRADE UNDERNEATH ROOTBALL TO PREVENT SETTLING OF TREE.

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TREE PLANTING - GRASS BOULEVARD
APPLICATION

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CR-L103

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NOTES:

ALL TREES SHALL BE INSTALLED AS PER APPROVED PLAN.

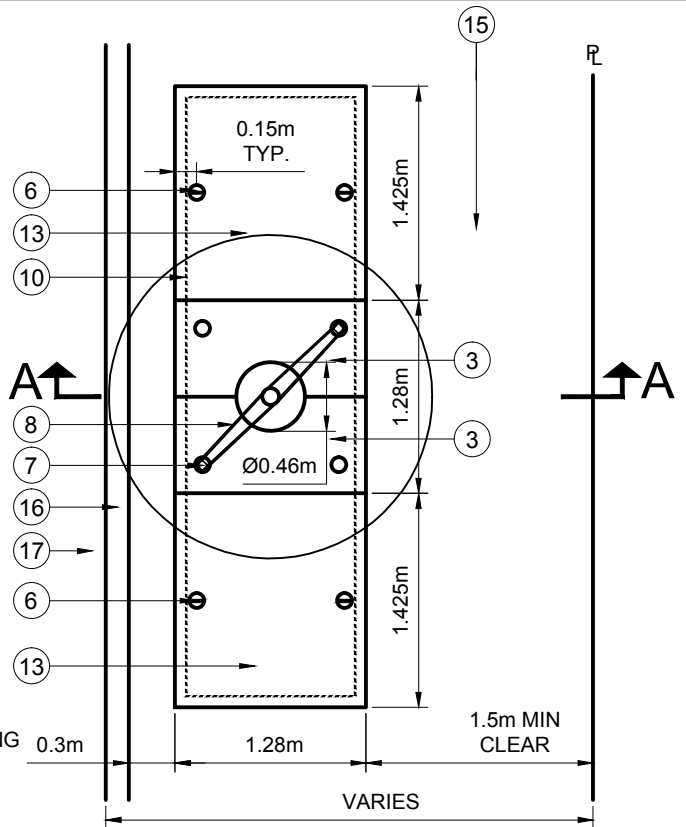
THIS TREE PLANTING DETAIL IS USED WHEN PLANTING A TREE IN A HARDSCAPE SITUATION.

ALL PLANTS AND PLANTING ARE TO CONFORM TO THE B.C. LANDSCAPE STANDARD. ALSO SEE MMCD SECTION 32 93 01: PLANTING OF TREES, SHRUBS AND GROUND COVERS.

PROTECT TREE FROM DAMAGE DURING TRANSPORT AND PLANTING. TREE ROOTS NOT TO BE EXPOSED TO SUN OR FROST.

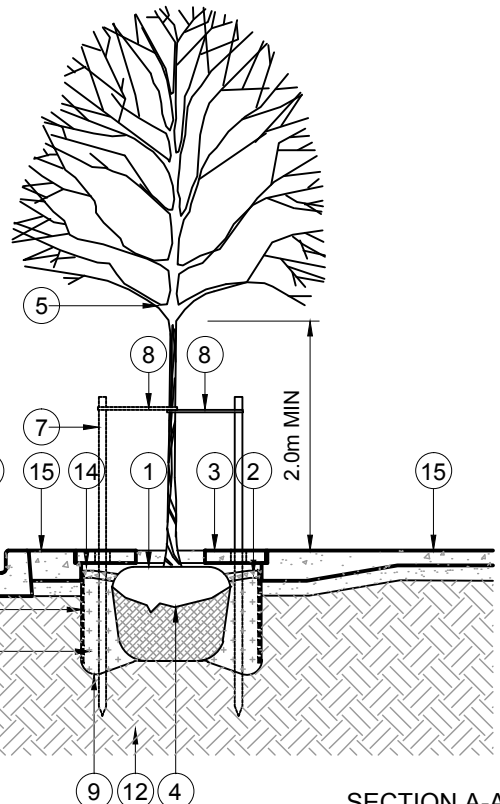
CONFIRM LOCATION OF UTILITIES; IT IS RECOMMENDED THAT STREET TREE PLANTING PITS BE DUG BY HAND AS UNDERGROUND SERVICES MAY EXIST.

CONFIRM FREE DRAINING SUBSOIL. CONTACT THE CITY IF DRAINAGE PROBLEMS ARE PRESENT.



PLAN

- ① TOP OF ROOT BALL TO BE SET 50mm ABOVE SURROUNDING GRADE
- ② 50mm DEPTH OF MULCH
- ③ CONCRETE TREE GRATE CAST IN TWO HALVES
- ④ SET ROOT BALL ON UNDISTURBED SOIL TO PREVENT SETTING. REMOVE STRAPPING, BASKETS OR ROOT BAGS. CUT ALL BINDING MATERIAL AND FOLD BURLAP INTO HOLE PRIOR TO BACKFILLING
- ⑤ PRUNE FOR CLEARANCE: 2m ALONG SIDEWALK, 5m ALONG ROADWAY. DO NOT CUT LEADER.
- ⑥ Ø100mm HOLE WITH RECESSED Ø10mm DOWEL FOR LIFTING
- ⑦ TWO 50mmX50mm PRESSURE TREATED STAKES DRIVEN INTO UNDISTURBED SOIL OUTSIDE ROOT BALL. REMOVE STAKES AFTER ONE YEAR.



SECTION A-A

- ⑧ TWO OPPOSING, FLEXIBLE TIES
- ⑨ SCARIFY BOTTOM AND SIDES OF PIT TO REMOVE GLAZING
- ⑩ ROOT BARRIER, 600mm DEPTH
- ⑪ GROWING MEDIUM
- ⑫ UNDISTURBED NATIVE SOIL
- ⑬ CONCRETE SIDE PANEL
- ⑭ 50mm DEEP AIR SPACE
- ⑮ SIDEWALK
- ⑯ CURB
- ⑰ ROAD

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City of
**Campbell
River**

SCALE:
N.T.S.

APPROVED:
CCR

DATE:
APRIL 2010

**STREET TREE IN PAVEMENT
TYPE 1**

DRAWING NO.
CR-L104

DISK REF.

SHEET OF

REV. 1

NOTES:

THIS TREE PLANTING DETAIL IS USED WHEN PLANTING A TREE IN A HARDSCAPE SITUATION.

ALL PLANTS AND PLANTING ARE TO CONFORM TO THE B.C. LANDSCAPE STANDARD.

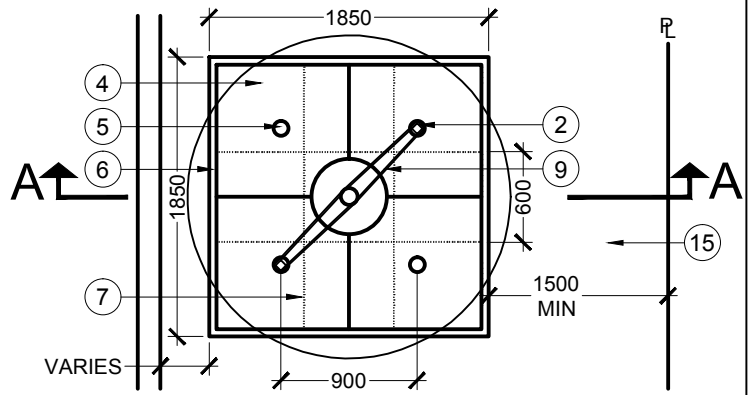
PROTECT TREE FROM DAMAGE DURING TRANSPORT AND PLANTING. TREE ROOTS NOT TO BE EXPOSED TO SUN OR FROST.

CONFIRM LOCATION OF UTILITIES; IT IS RECOMMENDED THAT STREET TREE PLANTING PITS BE DUG BY HAND AS UNDERGROUND SERVICES MAY EXIST.

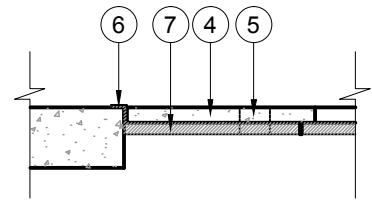
CONFIRM FREE DRAINING SUBSOIL. CONTACT THE CITY IF PROBLEMS ARISE.

PROVIDE IRRIGATION TO CITY OF CAMPBELL RIVER REQUIREMENTS.

LOCATE TREES TO MINIMIZE CONFLICTS WITH UTILITES, BUILDINGS, STRUCTURES, PEDESTRIAN AND VEHICULAR TRAFFIC.



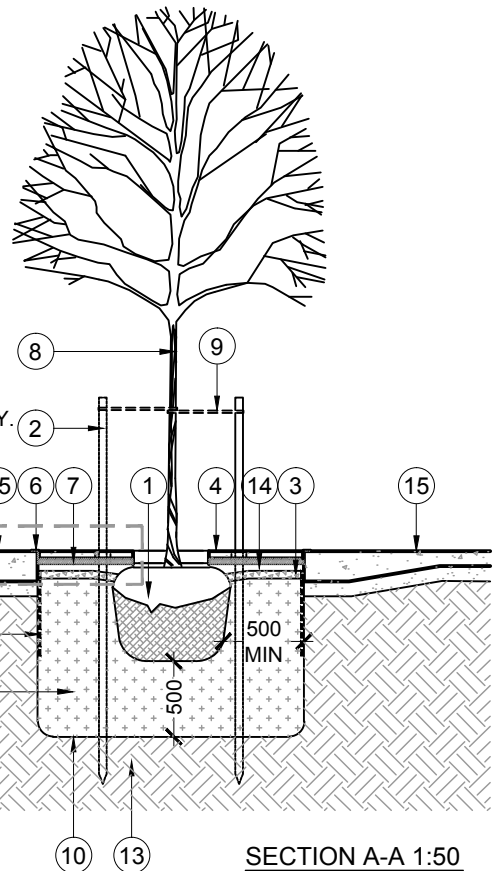
PLAN1:50



TREE GRATE DETAIL 1:25

- 1 REMOVE STRAPPING, CUT ALL BINDING MATERIAL AND FOLD BURLAP INTO HOLE PRIOR TO BACKFILLING. ENSURE A MINIMUM OF 500mm DEPTH OF COMPACTED SUBGRADE UNDERNEATH TO PREVENT SETTLING OF TREE. TOP OF ROOT BALL TO BE SET 50mm ABOVE SURROUNDING GRADE
- 2 TWO 50mmX50mm PRESSURE TREATED STAKES DRIVEN INTO UNDISTURBED SOIL OUTSIDE ROOT BALL. REMOVE STAKES AFTER ONE YEAR.
- 3 50mm DEPTH OF MULCH
- 4 50mm THICK, 1850mm X 1850mm PRECAST CONCRETE TREE GRATE WITH Ø500mm TREE OPENING CAST IN FOUR QUARTERS.
- 5 Ø100mm OPENING FOR STAKE
- 6 8mm THICK ALUMINUM ANGLE HANGER
- 7 6mm THICK ALUMINUM FRAME WELDED TO HANGER
- 8 PRUNE FOR CLEARANCE: 2m ALONG SIDEWALK, 5m ALONG ROADWAY.
- 9 TWO OPPOSING, FLEXIBLE TIES
- 10 SCARIFY BOTTOM AND SIDES OF PIT TO REMOVE GLAZING
- 11 ROOT BARRIER, 600mm DEPTH
- 12 GROWING MEDIUM
- 13 UNDISTURBED NATIVE SOIL
- 14 50mm DEEP AIR SPACE
- 15 SIDEWALK
- 16 CURB
- 17 ROAD

SEE TREE GRATE DETAIL ABOVE



SECTION A-A 1:50

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City of
**Campbell
River**

SCALE:
N.T.S.

APPROVED:
CCR

DATE:
APRIL 2010

STREET TREE IN PAVEMENT
TYPE 2

DRAWING NO.
CR-L105

DISK REF.

SHEET OF

REV. 1

NOTES:

THIS TREE PLANTING DETAIL IS FOR LINEAR BOULEVARD PLANTING BETWEEN THE CURB AND SIDEWALK WHERE ADJACENT LANDSCAPE AREAS OCCUR ON FAR SIDE OF SIDEWALK.

ALL PLANTS & PLANTING ARE TO CONFORM TO THE B.C. LANDSCAPE STANDARD.

STRUCTURAL SOIL MATERIALS AND INSTALLATION MUST CONFORM TO MUNICIPAL STANDARDS AND PROJECT SPECIFICATIONS.

PROTECT TREE FROM DAMAGE DURING TRANSPORT AND PLANTING. TREE ROOTS NOT TO BE EXPOSED TO SUN OR FROST.

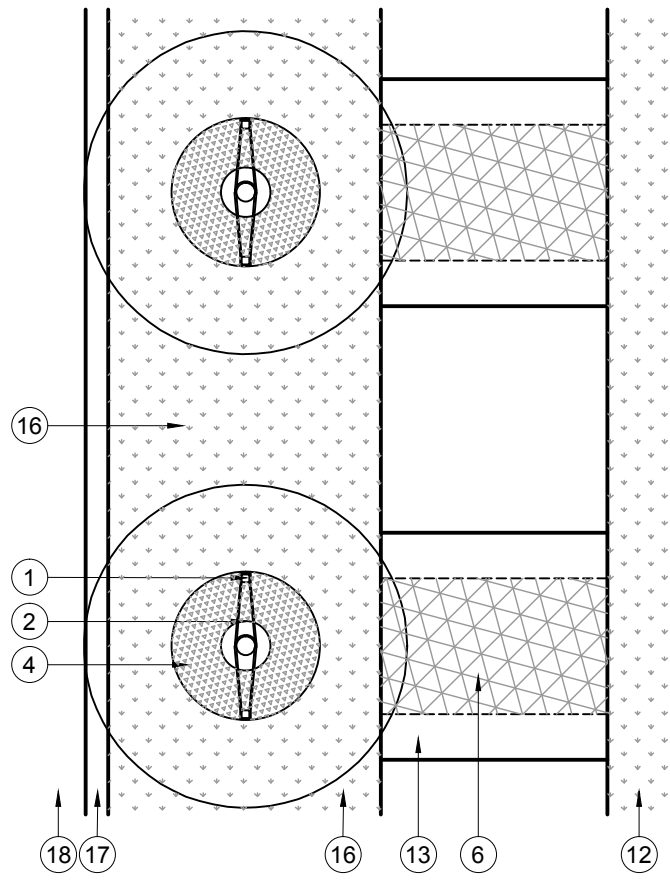
CONFIRM TREE LOCATION AGAINST ALL REQUIRED OFFSETS.

CONFIRM LOCATION OF UTILITIES; IT IS RECOMMENDED THAT STREET TREE PLANTING PITS BE DUG BY HAND AS UNDERGROUND SERVICES MAY EXIST.

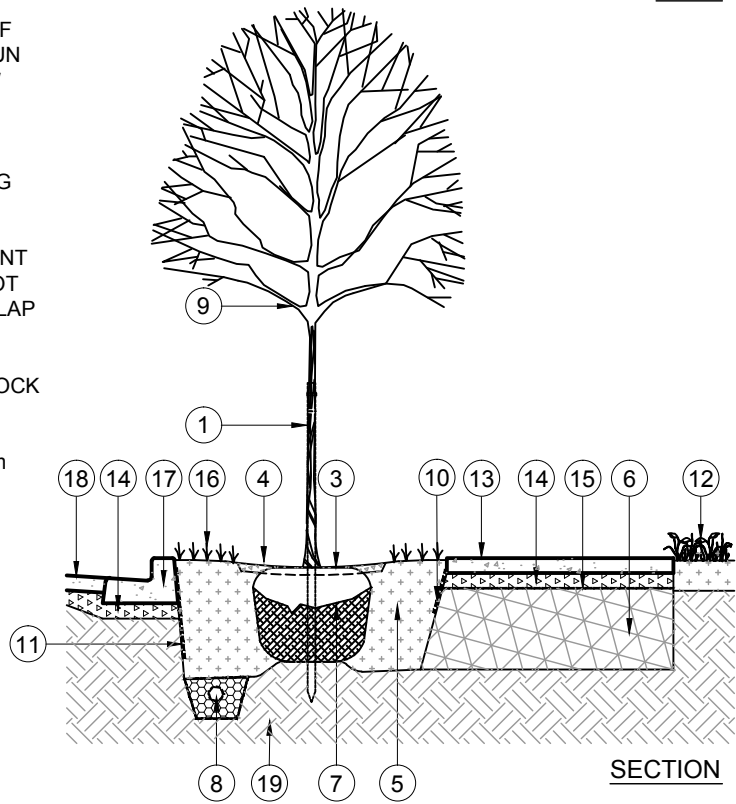
CONFIRM FREE DRAINING SUBSOIL. CONTACT THE CITY IF DRAINAGE PROBLEMS ARE PRESENT.

PROVIDE IRRIGATION TO CITY OF CAMPBELL RIVER REQUIREMENTS.

- ① 50mmX50mm PRESSURE TREATED STAKES DRIVEN INTO UNDISTURBED SOIL OUTSIDE ROOT BALL. REMOVE STAKES AFTER ONE YEAR.
- ② TWO OPPOSING, FLEXIBLE TIES
- ③ TOP OF THE ROOT BALL TO BE FLUSH WITH SURROUNDING GRADE. CREATE A Ø1.2m FLUSH-EDGED WELL FOR FIRST YEAR WATERING
- ④ 50mm DEPTH OF MULCH OVER PLANTING WELL. KEEP MULCH BACK 0.1m MIN FROM TRUNK
- ⑤ PLANTING CHANNEL TO BE CONTINUOUS DEPTH OF STRUCTURAL SOIL GROWING MEDIUM. DO NOT RUN CHANNEL UNDER DRIVEWAYS. PROVIDE SHALLOW ANGLED 600mm SETBACK FROM ENCUMBRANCES.
- ⑥ 600mm MIN DEEP STRUCTURAL SOIL BREAKOUT UNDER SIDEWALK TO CONNECT TO NEIGHBOURING LANDSCAPE AREA
- ⑦ SET ROOT BALL ON UNDISTURBED SOIL TO PREVENT SETTLING. REMOVE STRAPPING, BASKETS OR ROOT BAGS, CUT ALL BINDING MATERIAL AND FOLD BURLAP INTO HOLE PRIOR TO BACKFILLING
- ⑧ OPTIONAL Ø100mm PERFORATED PIPE IN DRAIN ROCK TRENCH WITH GEOTEXTILE ALONG ALL SIDES
- ⑨ PRUNE FOR CLEARANCE: 2m ALONG SIDEWALK, 5m ALONG ROADWAY. DO NOT CUT LEADER.
- ⑩ ROOT BARRIER, 300mm DEPTH
- ⑪ ROOT BARRIER, 600mm DEPTH
- ⑫ NEIGHBOURING LANDSCAPE AREA
- ⑬ SIDEWALK
- ⑭ GRANULAR BASE
- ⑮ GEOTEXTILE
- ⑯ TURF
- ⑰ CURB
- ⑱ ROAD
- ⑲ UNDISTURBED NATIVE SOIL



PLAN



SECTION

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City of
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River**

SCALE:
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DATE:
APRIL 2010

**STREET TREE BY STRUCTURAL
SOIL BREAKOUT**

DRAWING NO.
CR-L106

DISK REF.

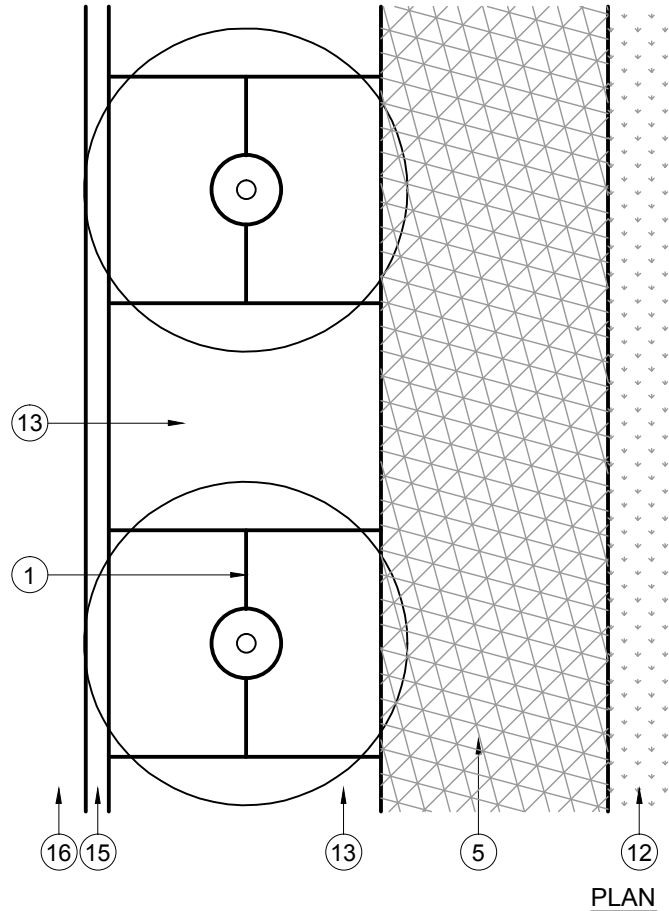
SHEET OF

REV. 1

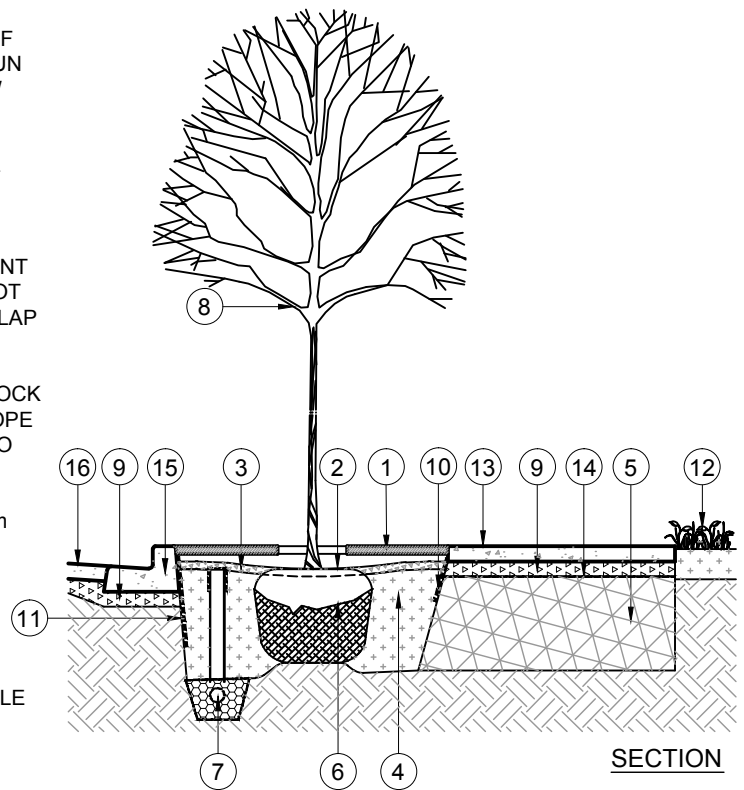
NOTES:

THIS TREE PLANTING DETAIL IS FOR A LINEAR PLANTING CHANNEL OF STRUCTURAL SOIL PARALLEL TO STREET FOR USE IN HARD SURFACE BOULEVARD AREAS. ALL PLANTS & PLANTING ARE TO CONFORM TO THE B.C. LANDSCAPE STANDARD. STRUCTURAL SOIL MATERIALS AND INSTALLATION MUST CONFORM TO MUNICIPAL STANDARDS AND PROJECT SPECIFICATIONS. PROTECT TREE FROM DAMAGE DURING TRANSPORT AND PLANTING. TREE ROOTS NOT TO BE EXPOSED TO SUN OR FROST. CONFIRM TREE LOCATION AGAINST ALL REQUIRED OFFSETS. CONFIRM LOCATION OF UTILITIES; IT IS RECOMMENDED THAT STREET TREE PLANTING PITS BE DUG BY HAND AS UNDERGROUND SERVICES MAY EXIST. CONFIRM FREE DRAINING SUBSOIL. CONTACT THE CITY IF DRAINAGE PROBLEMS ARE PRESENT. PROVIDE IRRIGATION TO CITY OF CAMPBELL RIVER REQUIREMENTS.

- ① TREE GRATE (OR OTHER TREE PIT TREATMENT) AT THE DISCRETION OF THE CITY. VERIFY REQUIRED MODEL AND DETAILS.
- ② TOP OF ROOT BALL TO BE 100mm BELOW BOTTOM OF THE GRATE. FINISHED GRADE OF PLANTING, INCLUDING MULCH, TO BE EQUIVALENT TO NURSERY GROWN GRADE OF TREE. CREATE A Ø900mm MIN, 80mm DEEP WELL FOR FIRST YEAR WATERING
- ③ 50mm DEPTH OF MULCH OVER PLANTING WELL. KEEP MULCH BACK 100mm MIN FROM TRUNK
- ④ PLANTING CHANNEL TO BE CONTINUOUS DEPTH OF STRUCTURAL SOIL GROWING MEDIUM. DO NOT RUN CHANNEL UNDER DRIVEWAYS. PROVIDE SHALLOW ANGLED 600mm SETBACK FROM ENCUMBRANCES.
- ⑤ 600mm MIN DEEP CONTINUOUS STRUCTURAL SOIL CHANNEL UNDER SIDEWALK TO CONNECT TO NEIGHBOURING LANDSCAPE AREA
- ⑥ SET ROOT BALL ON UNDISTURBED SOIL TO PREVENT SETTING. REMOVE STRAPPING, BASKETS AND ROOT BAGS, CUT ALL BINDING MATERIAL AND FOLD BURLAP INTO HOLE PRIOR TO BACKFILLING
- ⑦ OPTIONAL Ø100mm PERFORATED PIPE IN DRAIN ROCK TRENCH WITH GEOTEXTILE ALONG ALL SIDES. SLOPE 2% MIN TO DRAIN. PROVIDE VERTICAL UPSTAND TO MEET FINISH GRADE.
- ⑧ PRUNE FOR CLEARANCE: 2m ALONG SIDEWALK, 5m ALONG ROADWAY. DO NOT CUT LEADER
- ⑨ COMPACTED GRAVEL BASE, 100mm MIN DEEP
- ⑩ ROOT BARRIER, 300mm DEPTH
- ⑪ ROOT BARRIER, 600mm DEPTH
- ⑫ NEIGHBOURING LANDSCAPE AREA
- ⑬ SIDEWALK/PAVING
- ⑭ GEOTEXTILE
- ⑮ CURB
- ⑯ ROAD



PLAN



SECTION

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City of
**Campbell
River**

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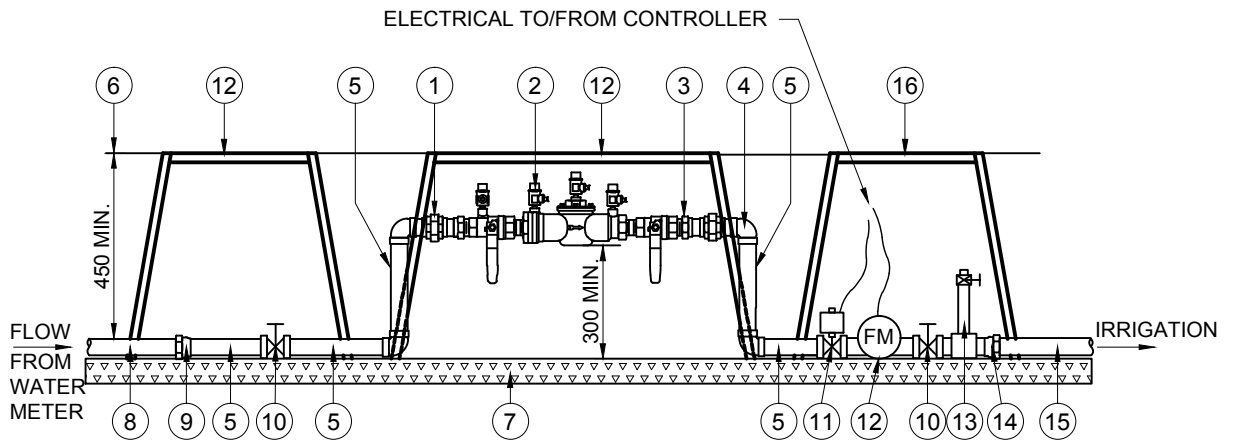
DATE:
APRIL 2010

**STREET TREE BY STRUCTURAL
SOIL CHANNEL**

DRAWING NO.
CR-L107
DISK REF.

SHEET OF
REV. 1

#	QUANT	DESCRIPTION
①	2	COPPER UNION
②	1	DOUBLE CHECK BACKFLOW PREVENTER ASSEMBLY c/w BALL VALVE SHUT OFF AT EACH END
③	2	COPPER MALE ADAPTER
④	4	COPPER 90° ELBOW
⑤	AS REQ'D	COPPER SPOOL PIECES (TYPICAL)
⑥	-	FINISH GRADE
⑦	-	50mm DEPTH 19mm MINUS GRAVEL
⑧	1	COPPER OR PVC PIPE FROM CITY WATER METER
⑨	1	COPPER FEMALE ADAPTER - REQUIRED IF SUPPLY PIPE IS PVC
⑩	2	BRONZE GATE VALVE - CLOSE FOR WINTERIZATION
⑪	1	MASTER VALVE
⑫	1	FLOW SENSOR
⑬	1	19mm BRONZE HOSE BIB ON RISER - FOR WINTERIZING SYSTEM
⑭	1	COPPER FEMALE ADAPTER
⑮	1	PVC PIPE TO IRRIGATION
⑯	3	VALVE BOX



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City of
**Campbell
River**

SCALE:
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DATE:
APRIL 2010

IRRIGATION BACKFLOW PREVENTER
AND POINT OF CONNECTION
TYPE 1 - 25mmØ OR SMALLER

DRAWING NO.
CR-I101

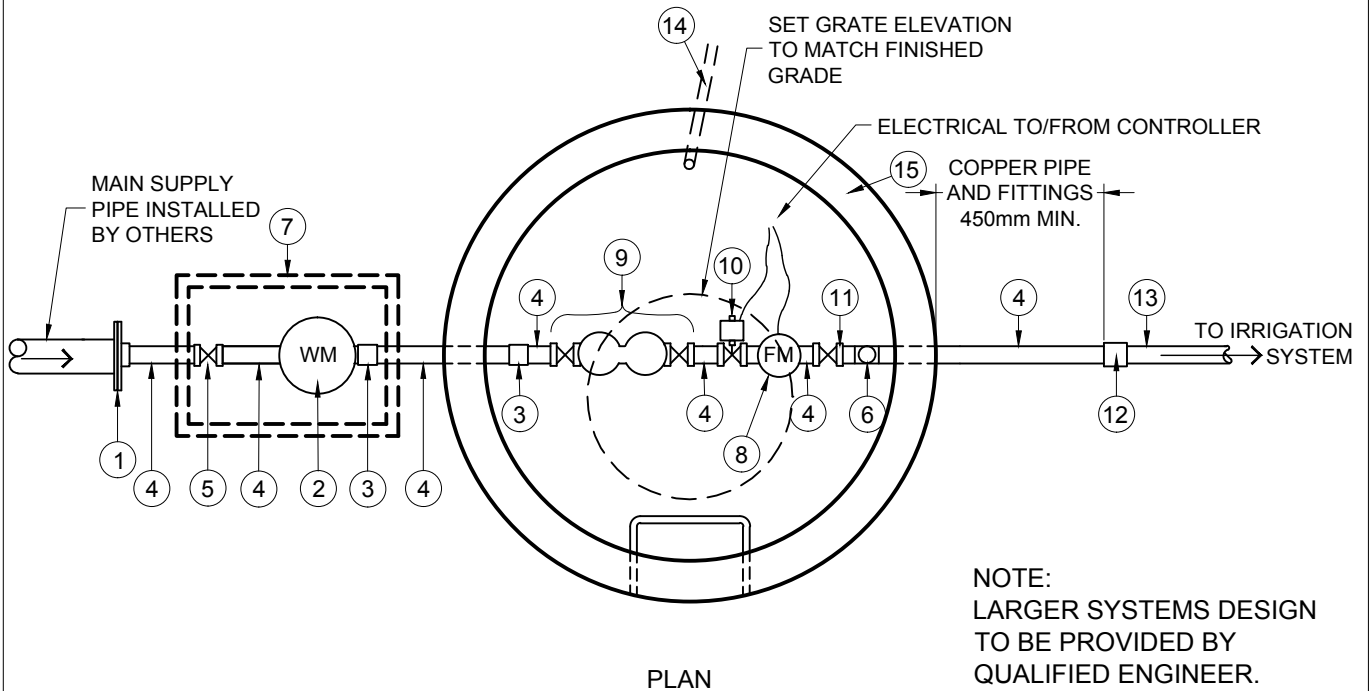
DISK REF.

SHEET OF

REV. 1

#	QUANT	DESCRIPTION	CONNECTION
①	1	COMPANION FLANGE	FIPT
②	1	WATER METER (MIN. 4 Ø FROM INLET VALVE AND 6 Ø TO NEXT VALVE)	
③	2	DISMANTLING JOINT	FIPXSLIP
④	7	COPPER SPOOL PIECE SIZED TO SUIT (TYPICAL)	VARIOUS
⑤	2	BRONZE GATE VALVE CW HANDWHEEL - CLOSE FOR WINTERIZATION	FIPT
⑥	1	19mm BRONZE HOSE BIB ON RISER - FOR WINTERIZING SYSTEM.	FIPT
⑦	1	METER BOX	
⑧	1	FLOW METER	
⑨	1	TESTABLE DOUBLE CHECK DETECTOR VALVE BACKFLOW PREVENTER ASSEMBLY c/w GATE VALVES	
⑩	1	MASTER VALVE	
⑪	1	BRONZE GATE VALVE CW HANDWHEEL	MIPT
⑫	1	SCHED 80 ADAPTER	FIPXSLIP
⑬	1	PVC IRRIGATION MAIN	PE
⑭	1	100mm SDR28 PVC DRAIN PIPE - CONNECT TO STORM DRAIN OR OUTLET	
⑮	1	CONCRETE MANHOLE CHAMBER C/W STEP IRONS, LID, CAST-IN-PLACE (OR PREMANUFACTURED) BASE H20 MANHOLE FRAME AND COVER AND GRADE RINGS AS REQUIRED	

NOTES:
 INSTALL ADJUSTABLE SUPPORTS UNDER METER & BACKFLOW PREVENTER TO PROVIDE 300mm MIN. CLEARANCE ABOVE FINISH GRADE OF BOTTOM OF CHAMBER.
 INSTALL THRUST RINGS AT CHAMBER OPENINGS OR PROVIDE RESTRAINING DEVICES INSIDE CHAMBER.
 ALL FITTINGS, PIPES AND VALVES WITHIN, AND 450 EITHER SIDE OF, CHAMBER TO BE COPPER.



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City of
**Campbell
 River**

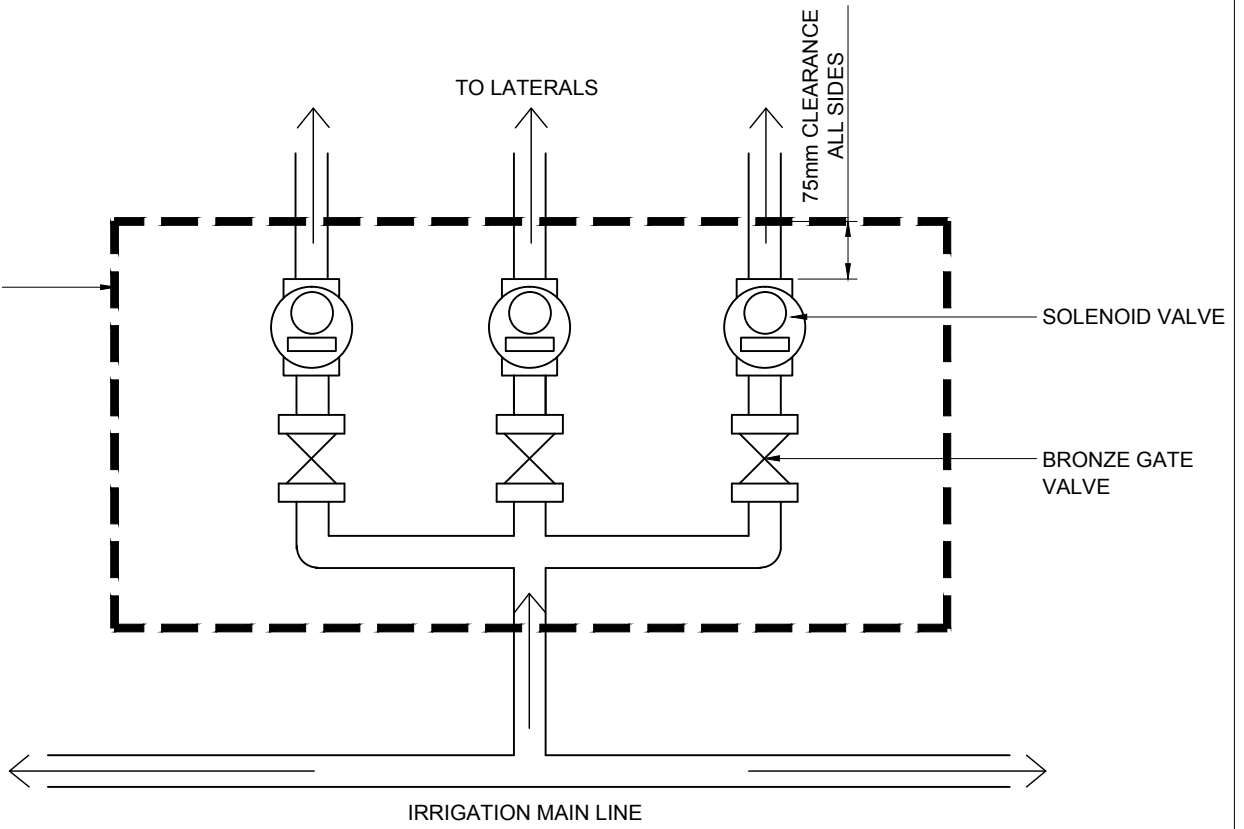
SCALE:
 N.T.S.
 APPROVED:
 CCR
 DATE:
 APRIL 2010

**IRRIGATION BACKFLOW PREVENTER
 AND POINT OF CONNECTION
 FOR 38mm TO 75mm (1 1/2" TO 3")
 TYPE 2 WATER SERVICE**

DRAWING NO.
CR-I102
 DISK REF.
 SHEET OF
 REV. 1

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VALVE BOX

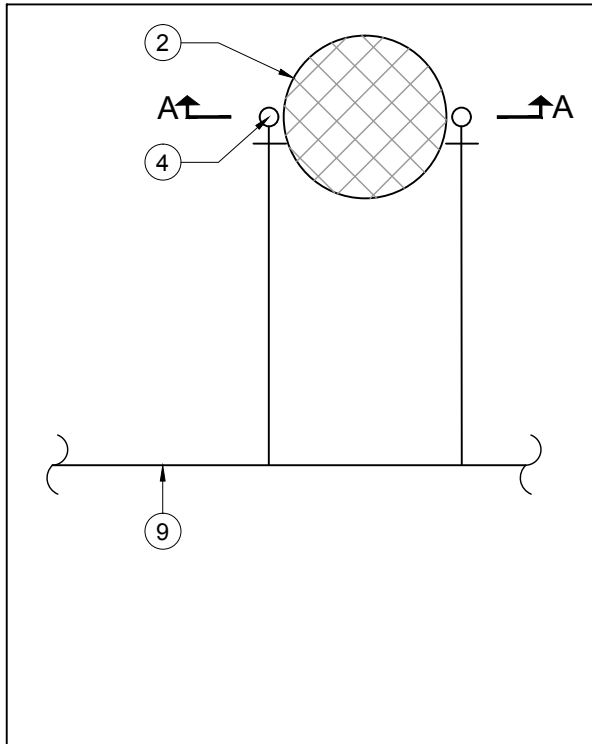


City of
Campbell
River

SCALE:	N.T.S.
APPROVED:	CCR
DATE:	APRIL 2010

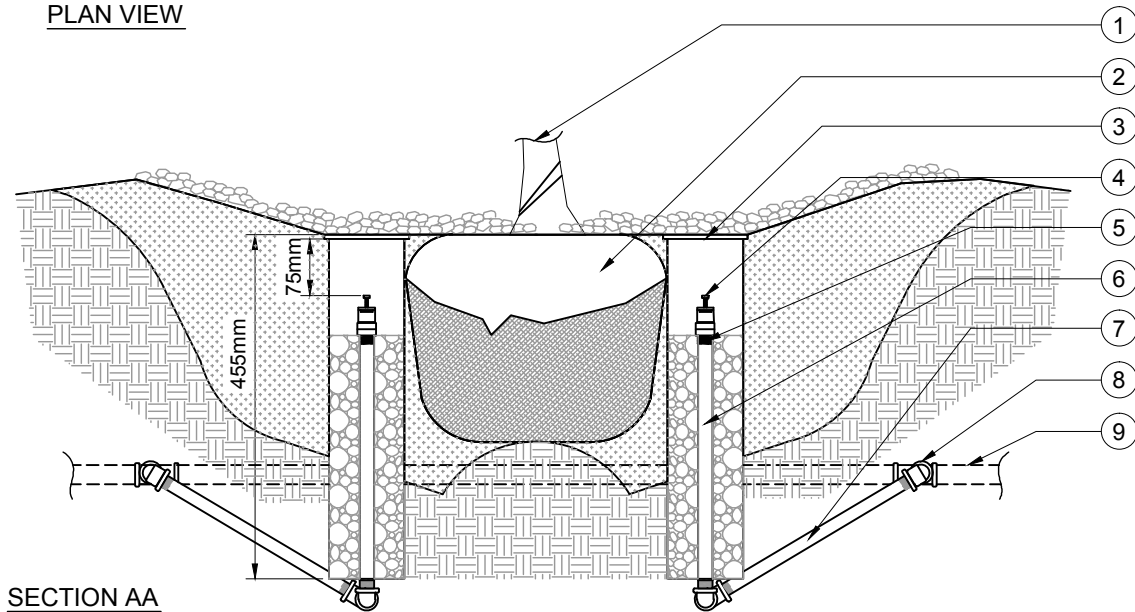
VALVE BOX SCHEMATIC PIPING
CONFIGURATION AT VALVE CLUSTER

DRAWING NO.	CR-I103
DISK REF.	
SHEET OF	
REV.	1



PLAN VIEW

- ① REFER TO TREE PLANTING DETAIL FOR OTHER REQUIREMENTS
- ② ROOT BALL IN APPROVED PLANTING MEDIUM. PLACE BUBBLER AGAINST ROOT BALL AT TIME OF INSTALLATION
- ③ 100mm PVC FABRIC WRAPPED RIGID PERFORATED PIPE WITH ROUND BLACK GRATE (450mm LENGTH) FLUSH WITH FINISHED GRADE. FILL WITH PEA GRAVEL TO BOTTOM OF BUBBLER
- ④ BUBBLER (2 PER TREE). POSITION NOZZLE 75mm BELOW GRATE
- ⑤ MALE ADAPTER, TYP.
- ⑥ SCH. 80 PVC THREADED NIPPLE. LENGTH AS REQUIRED, TYP.
- ⑦ SWING ASSEMBLY
- ⑧ PVC SCH. 40 TEE OR ELL
- ⑨ PVC LATERAL PIPE



SECTION AA

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City of
**Campbell
River**

SCALE:
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CCR

DATE:
APRIL 2010

DEEP ROOT WATERING SYSTEM
AT TREE

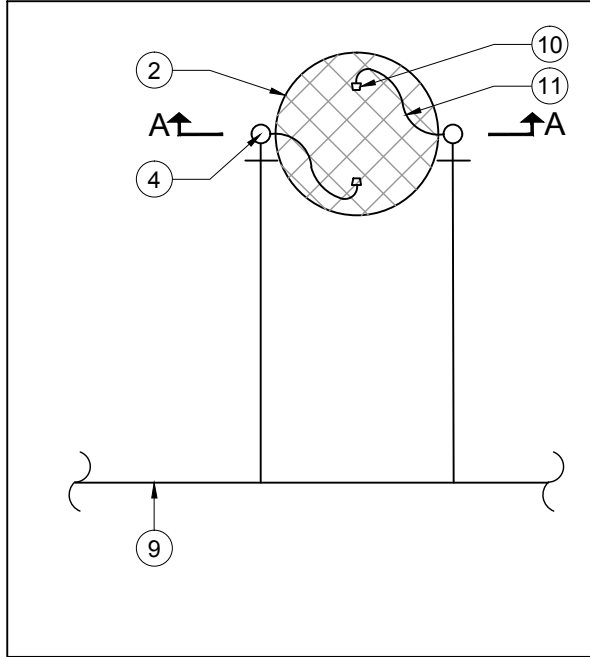
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CR-1104a

DISK REF.

SHEET OF
REV. 1

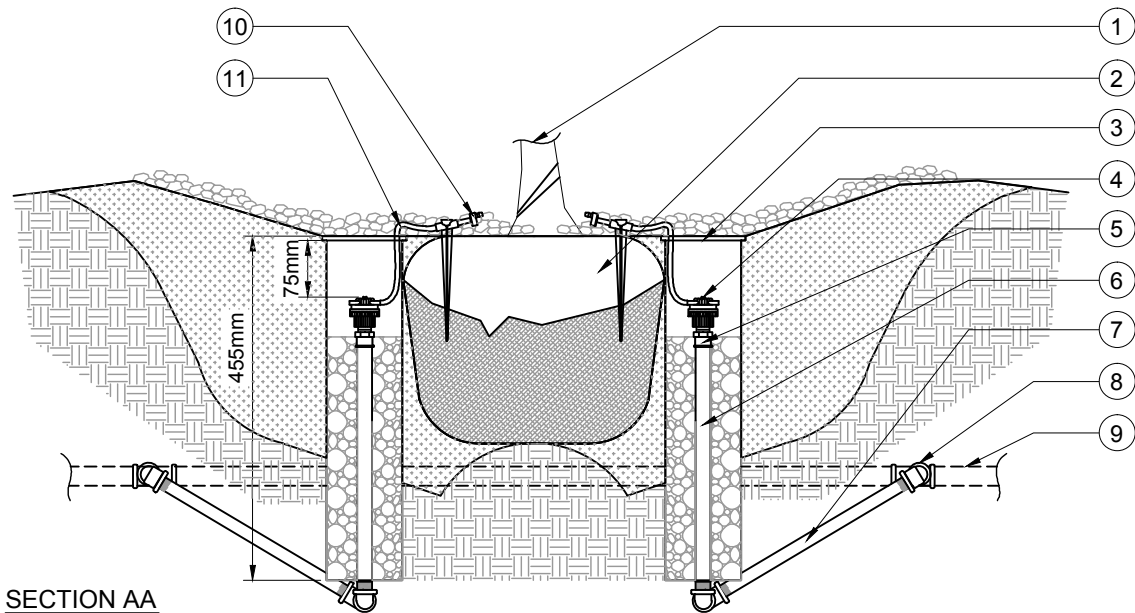
NOTES:
 TREE PLANTING BETWEEN JUNE AND OCTOBER IS NOT RECOMMENDED

REPLACE MULTI-PORT EMITTER WITH CITY STANDARD BUBBLER



PLAN VIEW

- ① REFER TO TREE PLANTING DETAIL FOR OTHER REQUIREMENTS
- ② ROOT BALL IN APPROVED PLANTING MEDIUM. PLACE PERFORATED PIPE AGAINST ROOT BALL AT TIME OF INSTALLATION
- ③ 100mm PVC FABRIC WRAPPED RIGID PERFORATED PIPE WITH ROUND GRATE (450mm LENGTH) FLUSH WITH FINISHED GRADE. FILL WITH PEA GRAVEL TO BOTTOM OF EMITTER.
- ④ MULTI-PORT EMITTER (2 PER TREE). POSITION NOZZLE 75mm BELOW GRATE. LEAVE PORTS OPEN AS REQUIRED TO PROVIDE ADEQUATE WATER TO TREE ROOTS
- ⑤ MALE ADAPTER, TYP.
- ⑥ SCH. 80 PVC THREADED NIPPLE. LENGTH AS REQUIRED, TYP.
- ⑦ SWING ASSEMBLY
- ⑧ PVC SCH. 40 TEE OR ELL
- ⑨ PVC LATERAL PIPE
- ⑩ VARIABLE FLOW DRIP EMITTER ON STAKE. PROVIDE (2) ABOVE GRADE OVER ROOTBALL
- ⑪ 6mm (1/4") PE TUBING



SECTION AA

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City of
**Campbell
 River**

SCALE:
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DATE:
 APRIL 2010

**DEEP ROOT WATERING
 SYSTEM AT TREE
 (JUNE TO OCTOBER)**

DRAWING NO.
CR-1104b

DISK REF.

SHEET OF

REV. 1

NOTES:

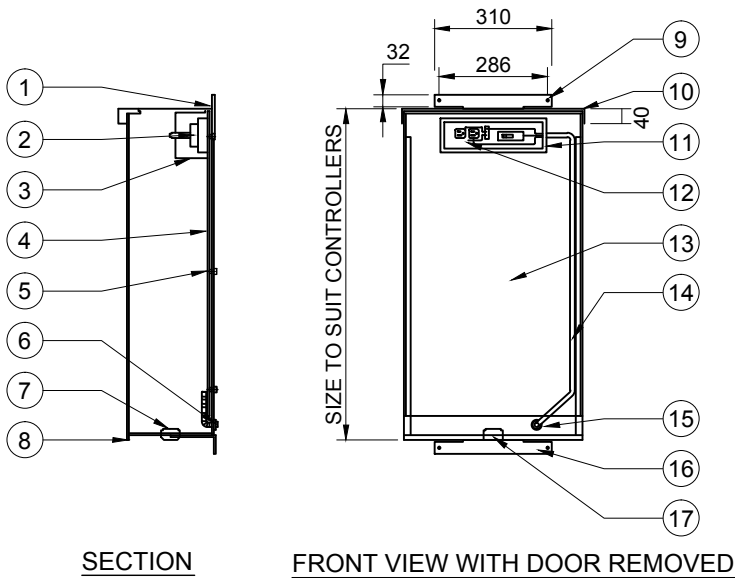
ENTIRE ENCLOSURE TO BE 16 GAUGE MILD STEEL OR ALUMINUM WITH THE EXCEPTION OF THE RECEPTACLE ENCLOSURE & MOUNTING PAN WHICH SHALL BE 14 GAUGE. STEEL FINISHED WITH GREY ENAMEL, ALUMINUM CLEAR ANODIZED. ALL SEAMS SHALL BE CONTINUOUSLY WELDED

THE ENCLOSURE SHALL BE MANUFACTURED TO CONFORM TO C.S.A. ENCLOSURE 3 SPECIFICATIONS & SHALL BEAR APPROVAL FROM THE PROVINCIAL SAFETY BRANCH INSPECTOR

ALL HARDWARE (SCREWS, NUTS, ETC.) SHALL BE STAINLESS STEEL

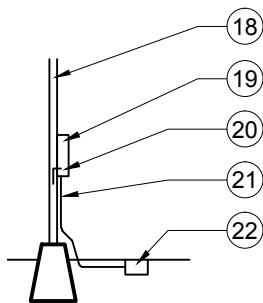
DOOR TO BE FULLY GASKETTED & WITH PADLOCKING FACILITY

THE PANEL SHALL BEAR THE MANUFACTURER & THE PROVINCIAL APPROVAL LABELS INSIDE THE PANEL

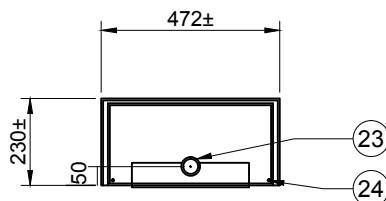


SECTION

FRONT VIEW WITH DOOR REMOVED



MOUNTING DETAIL



BOTTOM VIEW

DIMENSIONS IN MILLIMETRES UNLESS NOTED OTHERWISE

- ① CONTINUOUS WELD
- ② CIRCUIT BREAKER & MOUNTING BASE
- ③ PROTECTIVE COVER
- ④ MOUNTING PAN
- ⑤ MOUNTING PAN HARDWARE
- ⑥ WASHER & CHASE NIPPLE
- ⑦ 'BULLET' HUB
- ⑧ 3 X 20 CLOSED CELL NEOPRENE GASKET ALONG SIDES & BOTTOM OF DOOR
- ⑨ POLE MOUNTING BRACKET (12 Ga) BEND TO SUIT POLE OR WALL MOUNT
- ⑩ REMOVABLE HOOD
- ⑪ RECEPTACLE/CIRCUIT BREAKER ENCLOSURE W/COVER REMOVED (SIZE TO SUIT)
- ⑫ DUPLEX RECEPTACLE G 120 VAC CONNECTION
- ⑬ MOUNTING PAN FOR IRRIGATION TIMECLOCK/CONTROLLER
- ⑭ 12mm (1/2") FLEX CONDUIT STRAP TO PAN
- ⑮ 12mm (1/2") INSULATED CHASE NIPPLE C/W SEALING LOCKNUT 38mm (1 1/2") NEOPRENE WASHER
- ⑯ POLE MOUNTING BRACKET (12 Ga) BEND TO SUIT POLE OR WALL MOUNT
- ⑰ HOLE FOR LOW VOLTAGE IRRIGATION WIRES
- ⑱ LUMINAIRE
- ⑲ CONTROLLER CABINET
- ⑳ 120 V. CONNECTION
- ㉑ LOW VOLTAGE WIRES IN R.C. TO GRADE
- ㉒ TO VALVES
- ㉓ 50mm (2") RC WEATHERPROOF 'BULLET' HUB (GALVANIZED) FOR LOW VOLTAGE WIRES
- ㉔ 2-5mm DIA. DRAIN HOLES

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City of
**Campbell
River**

SCALE:
N.T.S.

APPROVED:
CCR

DATE:
APRIL 2010

IRRIGATION CONTROLLER
CABINET DETAILS

DRAWING NO.
CR-1105

DISK REF.

SHEET OF

REV. 1

NOTES:

STREET SIGN PLATE GRAPHICS IN ACCORDANCE WITH EITHER THIS PLAN OR CR-G102 AS SUITABLE FOR THE APPLICATION.

STOP SIGN BLANK SHALL BE 12 ga. (O.081) 505H32 ALLOY ALUMINUM OR EQUAL.

STOP SIGN TO BE 600 X 600 ON LOCAL ROADS AND 750 X 750 ON ARTERIAL AND COLLECTOR ROADS. STOP SIGN FACE SHALL BE DIAMOND GRADE REFLECTORIZED WHITE ON REFLECTORIZED RED.

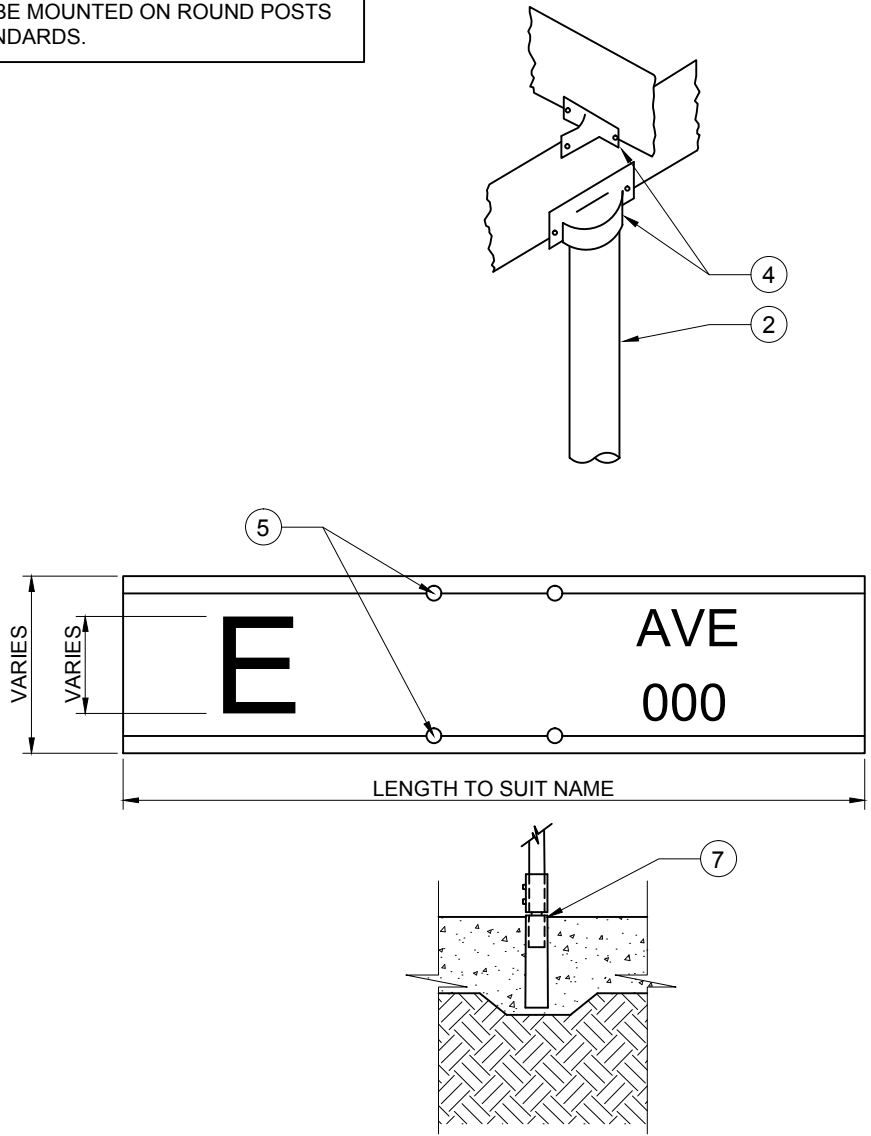
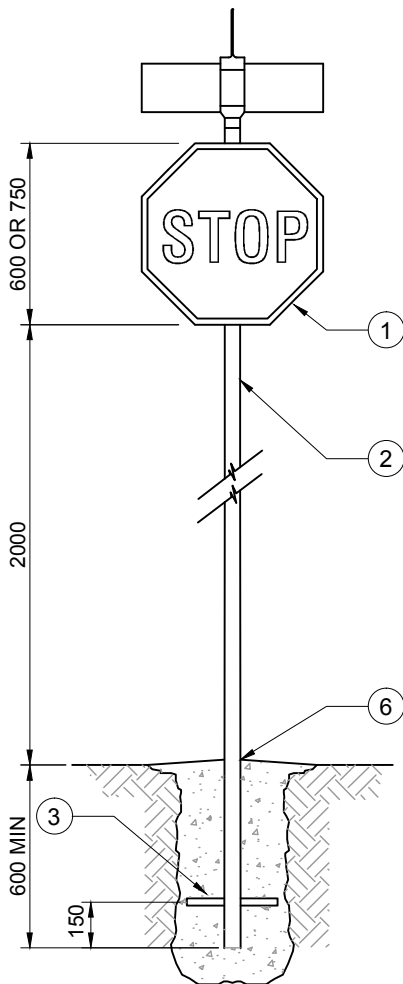
STREET SIGN BLANK SHALL BE ALCAN 6063-T6C ALUMINUM SIGN BLADE, SHAPE V15116, OR EQUAL.

STREET SIGN FACE TO BE NON-REFLECTIVE BLACK CHARACTERS ON ENGINEERING GRADE REFLECTORIZED WHITE, BOTH SIDES. (SEE CR-G102 FOR SIGNALIZED INTERSECTION SIGNAGE)

SIGN POSITION CONFORMING TO ARTICLE 1.15 OF RTAC MANUAL "UNIFORM TRAFFIC CONTROL DEVICES FOR CANADA".

ALL OTHER REGULATORY SIGNS TO BE MOUNTED ON ROUND POSTS AND CONFORM TO MOT OR TAC STANDARDS.

- ① STANDARD SIZE = 600 X 600. SIGNS AT COLLECTORS AND ARTERIALS TO BE 750 x 750
- ② POST 50mmØ GALVANIZED SCHEDULE 40 PIPE
- ③ 25 Ø PIN 250 LONG
- ④ HEAVY DUTY CAST ALUMINUM FITTING
- ⑤ DRILLED TO SUIT
- ⑥ FOR PLACEMENT IN NATIVE MATERIAL.
- ⑦ FOR PLACEMENT IN PORTLAND OR ASPHALT CONCRETE SURFACE, USE APPROVED KNOCK OFF BASE.



ALL DIMENSIONS IN MILLIMETRES, UNLESS OTHERWISE SHOWN.

O:\CAD\5210-00-R393 Standards\Rev-DWGs\CR-G101.dwg May 04, 2010 4:47:51pm



City of
**Campbell
River**

SCALE:
N.T.S.

APPROVED:
CCR

DATE:
APRIL 2010

STREET NAME AND STOP SIGN

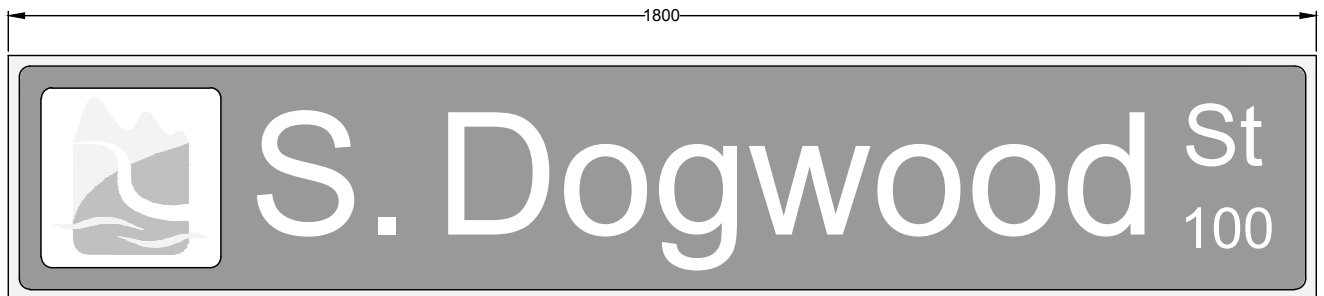
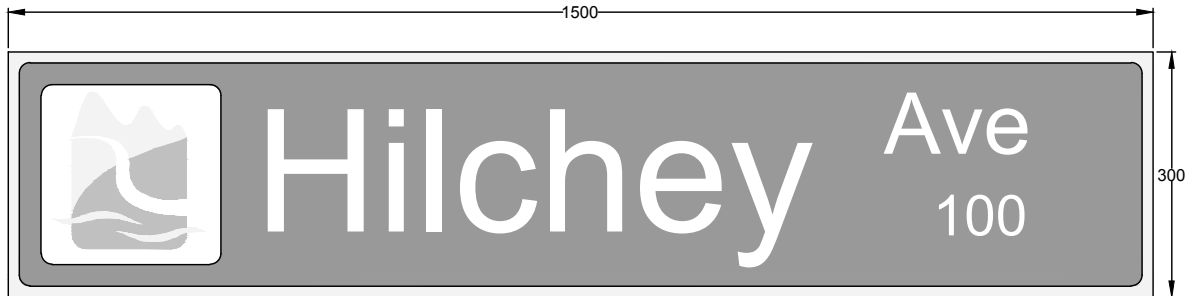
DRAWING NO.
CR-G101

DISK REF.

SHEET OF

REV. 1

O:\CAD\5210-00-R393_Standards\Rev-DWGs\CR-G102.dwg May 04, 2010 4:50:36pm



SIGNALIZED INTERSECTION STREET SIGN FACE SHALL BE
NON-REFLECTIVE COLOURED BACKGROUND WITH DIAMOND GRADE
REFLECTORIZED WHITE CHARACTERS, BOTH SIDES.

REFER TO DRAWING CR-G101 FOR ADDITIONAL SIGNAGE DETAILS

ALL DIMENSIONS IN MILLIMETRES UNLESS NOTED OTHERWISE.



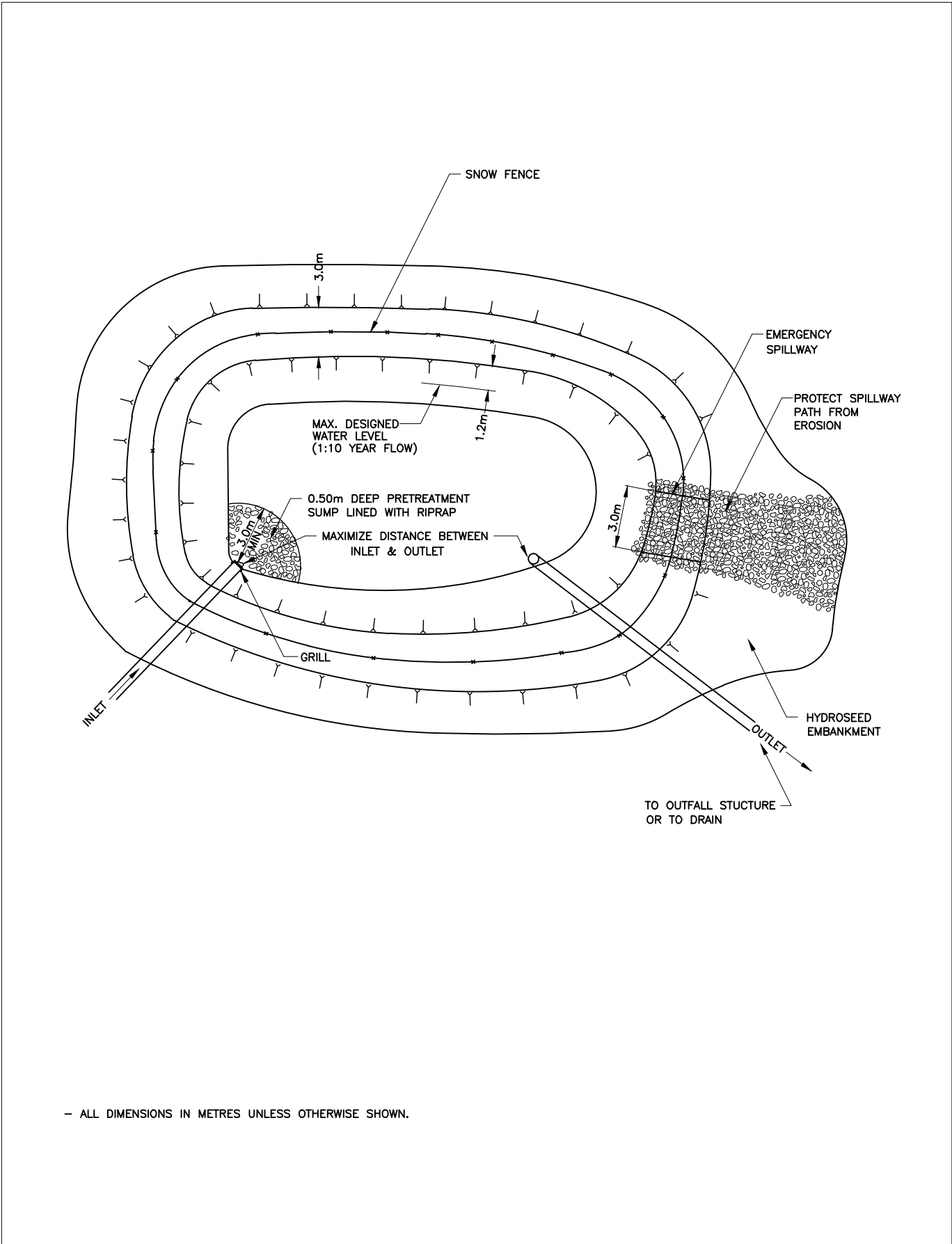
City of
**Campbell
River**

SCALE:	N.T.S.
APPROVED:	CCR
DATE:	APRIL 2010

SIGNAGE FOR SIGNALIZED
INTERSECTIONS

DRAWING NO.	CR-G102
DISK REF.	
SHEET OF	
REV.	1

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City of
**Campbell
River**

SCALE:
N.T.S.

APPROVED:
CCR

DATE:
APRIL 2010

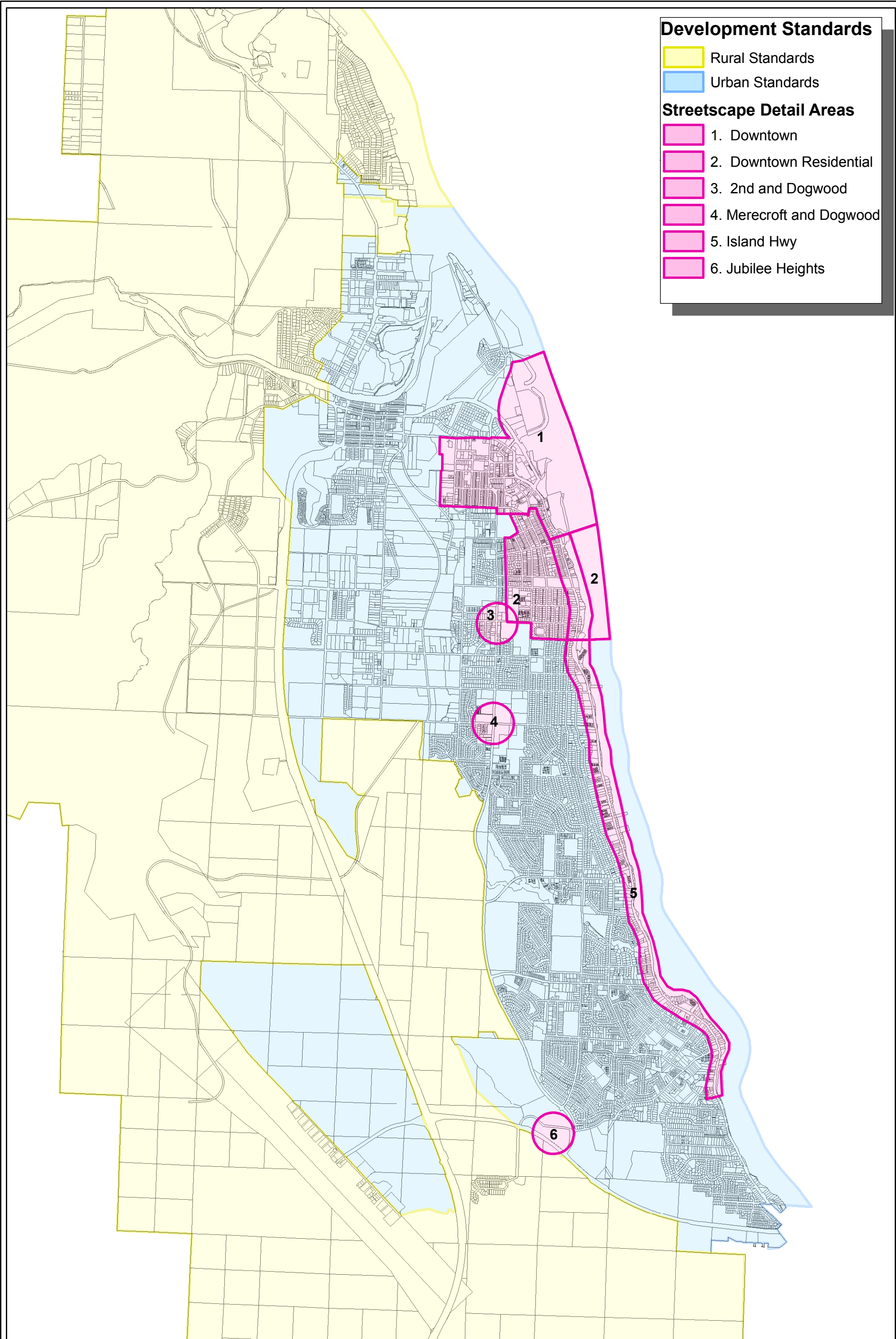
EROSION AND SEDIMENT CONTROLS
SEDIMENT CONTROL BASIN
PLAN VIEW

DRAWING NO.
CR-ES123

DISK REF.

SHEET OF

REV. 1



Development Standards

- Rural Standards
- Urban Standards

Streetscape Detail Areas

- 1. Downtown
- 2. Downtown Residential
- 3. 2nd and Dogwood
- 4. Merecroft and Dogwood
- 5. Island Hwy
- 6. Jubilee Heights



CITY OF
CAMPBELL RIVER
Land Use Department

**Map A: Development Standards
2010 Design Standards**

REF://.../GIS/Engineering/Confidential/mapdocuments/LandUse/Map_A_DevelopmentStandards.mxd



1:40,000

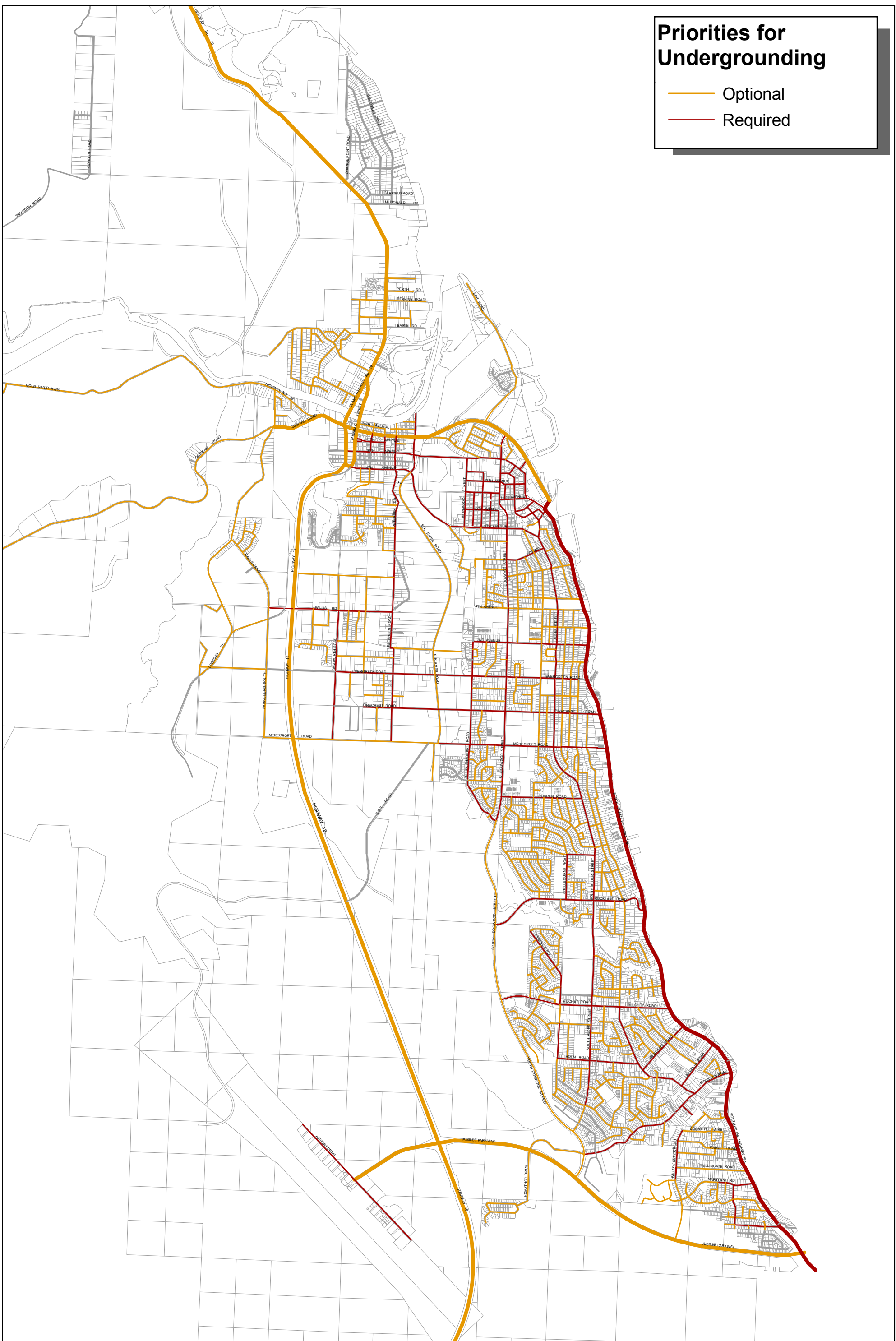
Projection: UTM Zone 10 Datum: NAD 83

Date: April 20, 2010

This map indicates subdivision relationship only and should not be used to establish legal lot size or dimensions. This map has been produced using data from a variety of sources and may not be complete or accurate. The City of Campbell River is not responsible for any errors or omissions.

Priorities for Undergrounding

- Optional
- Required



CITY OF CAMPBELL RIVER
Land Use Department

Map B: Priorities for Undergrounding Electrical 2010 Design Standards

REF://.../GIS/Engineering/Confidential/mapdocuments/LandUse/Map_B_PrioritiesForUndergroundingElectrical.mxd



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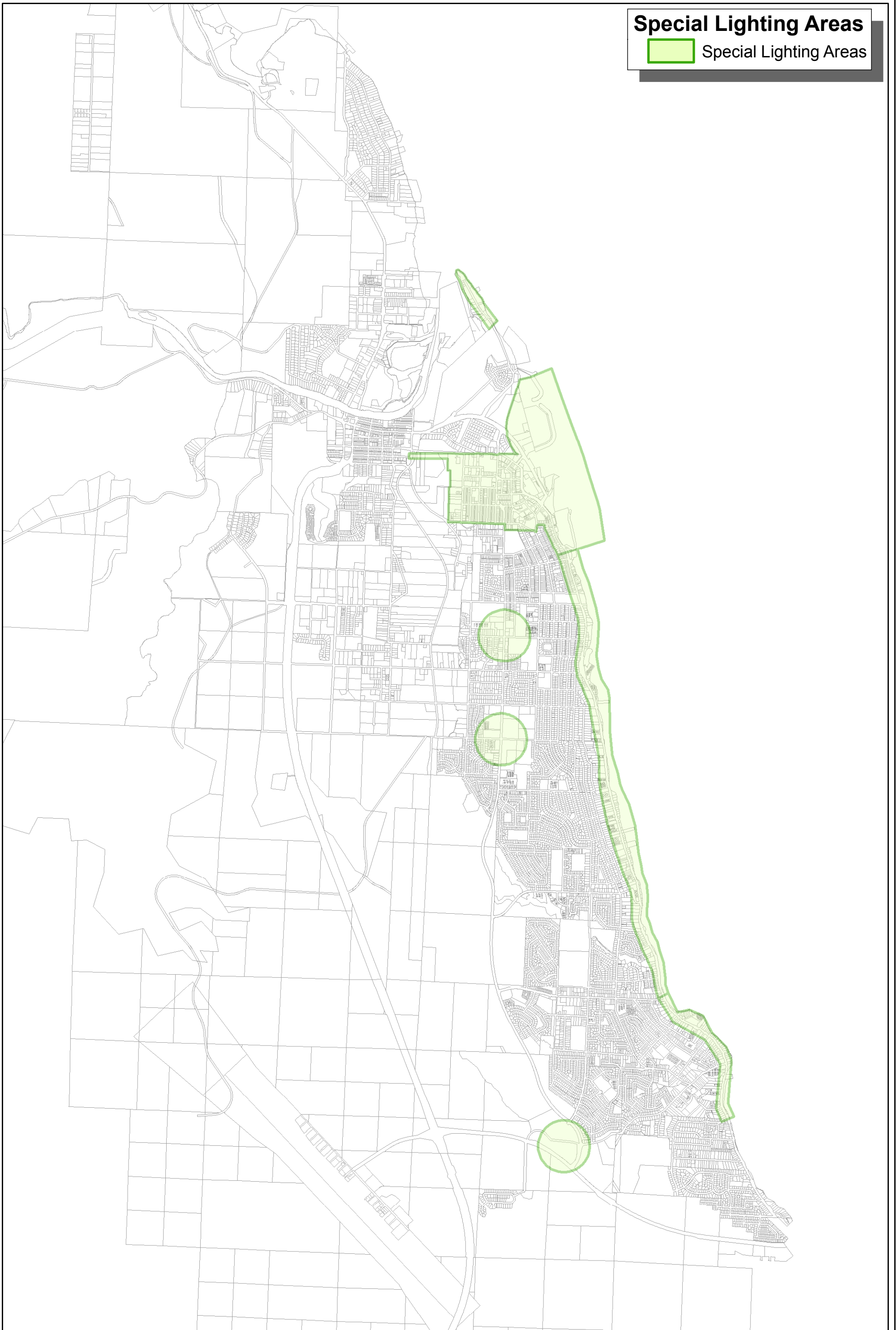
Projection: UTM Zone 10 Datum: NAD 83

Date: April 21, 2010

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Special Lighting Areas

 Special Lighting Areas



CITY OF
CAMPBELL RIVER
Land Use Department

Map C: Special Lighting Areas 2010 Design Standards

REF://.../GIS/Engineering/Confidential/mapdocuments/LandUse/
Map_C_SpecialLightingAreas.mxd

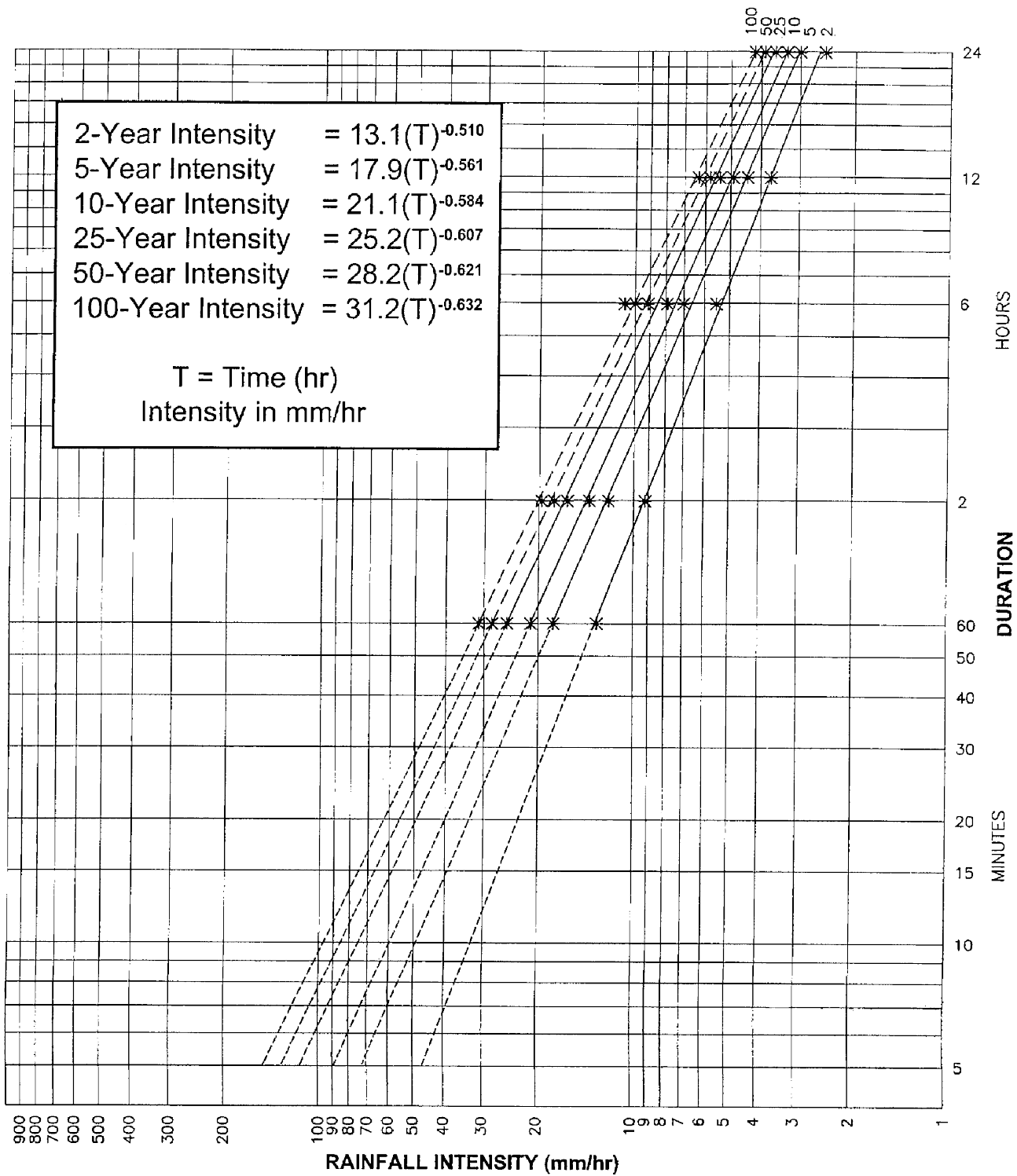


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Projection: UTM Zone 10 Datum: NAD 83

Date: April 21, 2010

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Curves are published by Environment Canada.
Data from the Campbell River Sewage Treatment
Plant, 18 Years of Record - 1973 to 1990.

WARNING: 50 and 100 Year
curves are uncertain due to
short period of record.

Durations below 1 hour are
extrapolated from
Environment Canada curves.

It is recommended that equations
be used for determining rainfall
intensities. See inset above.



City of
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APRIL 2010

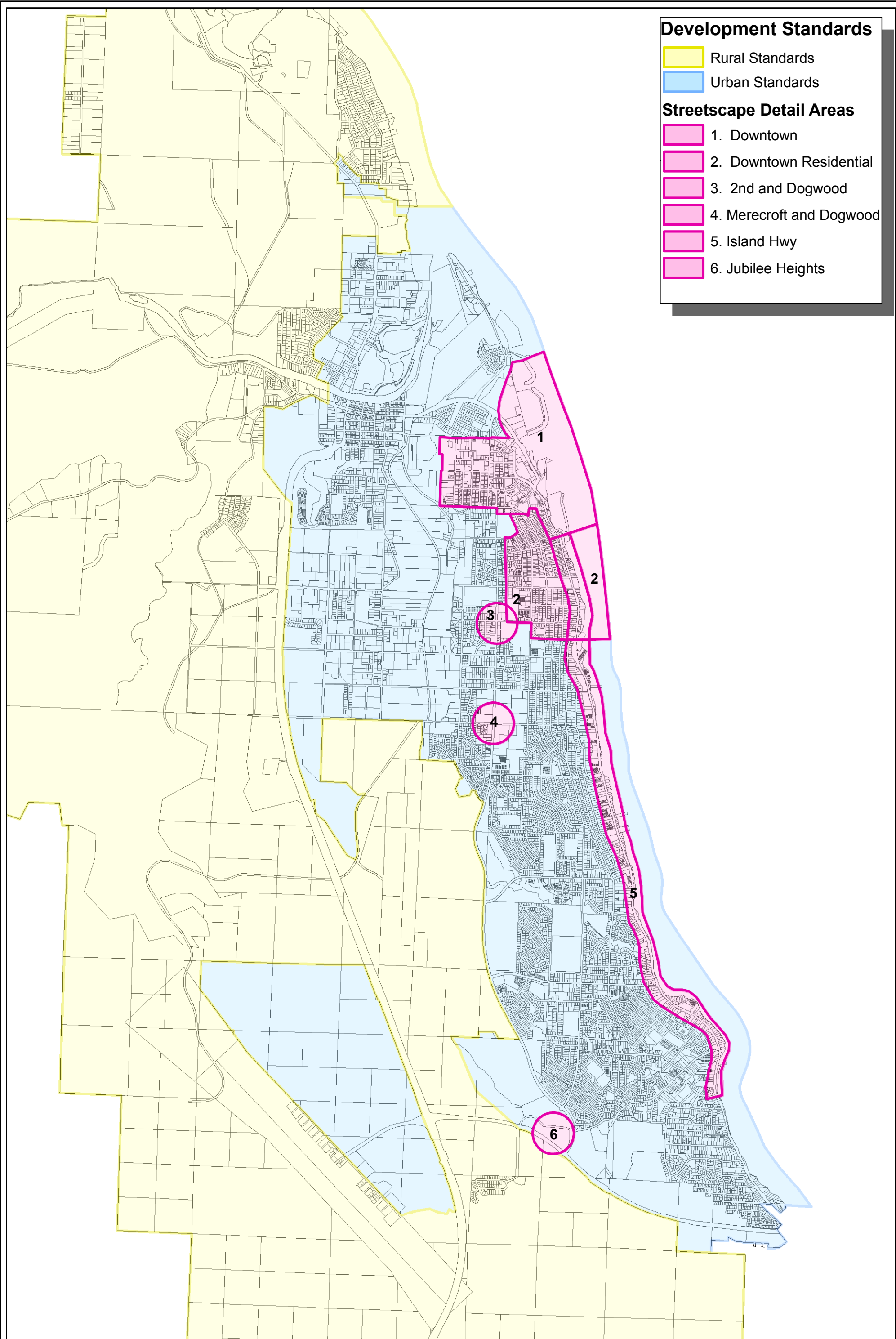
**RAINFALL INTENSITY, DURATION
& FREQUENCY CURVE**

DRAWING NO.
CR-S50

DISK REF.

SHEET OF

REV. 1



Development Standards

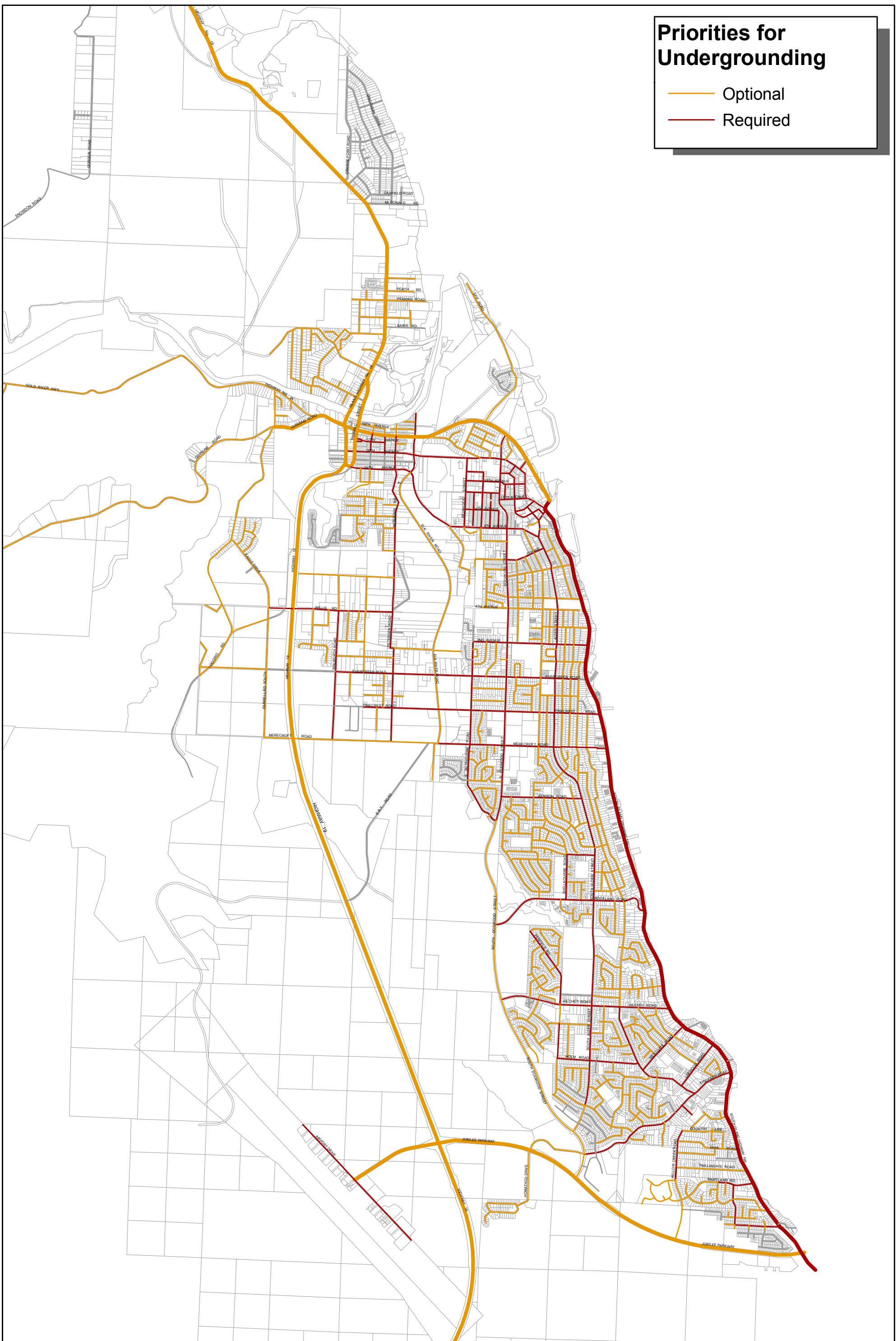
- Rural Standards
- Urban Standards

Streetscape Detail Areas

- 1. Downtown
- 2. Downtown Residential
- 3. 2nd and Dogwood
- 4. Merecroft and Dogwood
- 5. Island Hwy
- 6. Jubilee Heights

Priorities for Undergrounding

- Optional
- Required



CITY OF CAMPBELL RIVER
Land Use Department

Map B: Priorities for Undergrounding Electrical 2010 Design Standards

REF://...GIS\Engineering\Confidential\mapdocuments\LandUse\Map_B_PrioritiesForUndergroundingElectrical.mxd



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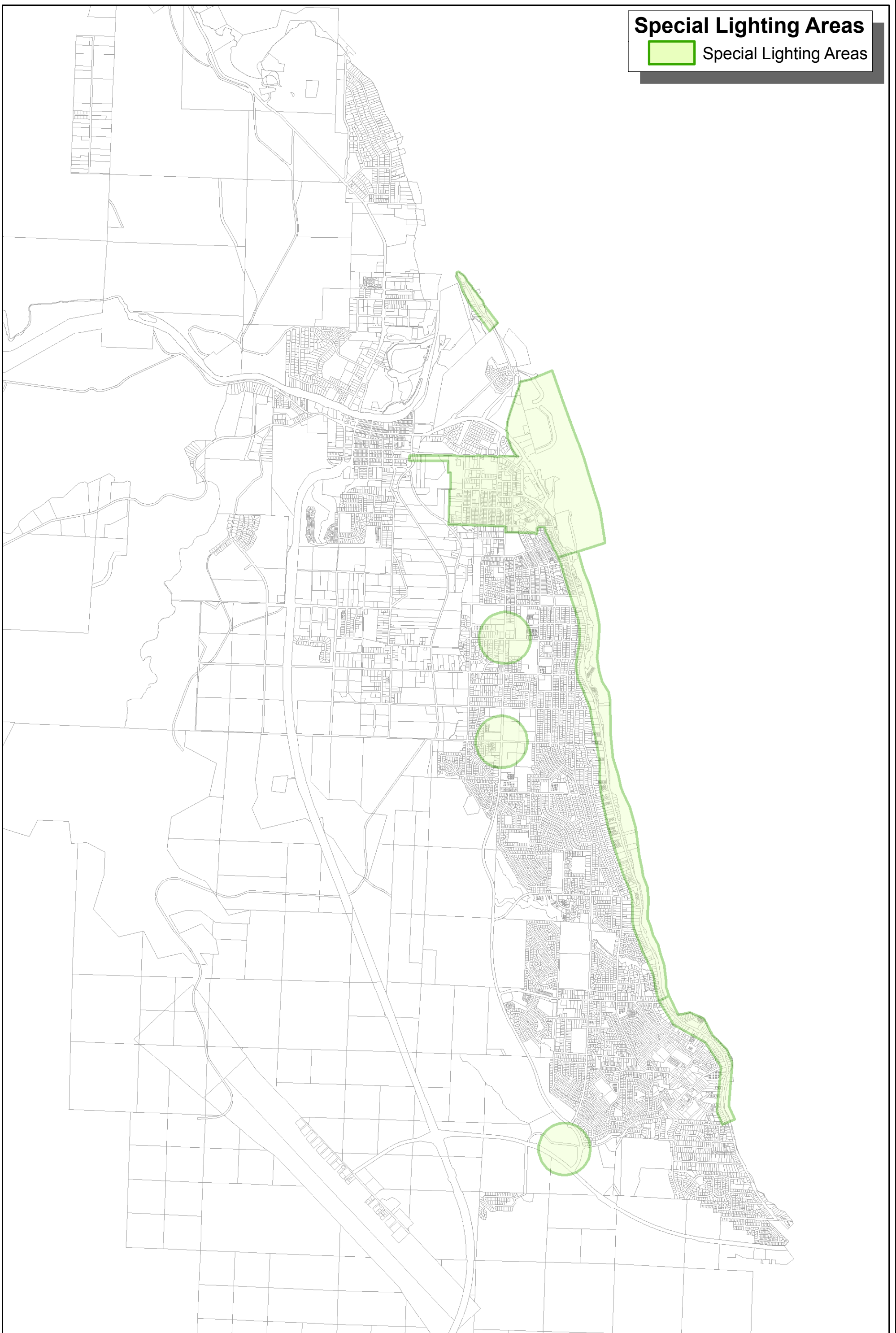
Projection: UTM Zone 10 Datum: NAD 83

Date: April 21, 2010

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Special Lighting Areas

 Special Lighting Areas



CITY OF
CAMPBELL RIVER
Land Use Department

Map C: Special Lighting Areas 2010 Design Standards

REF://.../GIS/Engineering/Confidential/mapdocuments/LandUse/
Map_C_SpecialLightingAreas.mxd



1:40,000

Projection: UTM Zone 10 Datum: NAD 83

Date: April 21, 2010

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