SCHEDULE 1

SUPPLEMENTARY DESIGN GUIDELINES

SUPPLEMENTARY DESIGN GUIDELINES

This schedule contains supplementary design guidelines to be applied in conjunction with the Design Guidelines of the Master Municipal Construction Documents, dated 2022, both of which shall apply to all Works and Services constructed within the Town of Comox.

Supplementary Design Guidelines contained within this Schedule supplement or supersede the Master Municipal Construction Document (MMCD). Where the Town of Comox Supplementary Design Guidelines conflict with the MMCD, the Town of Comox Supplementary Design Guidelines shall take precedence.

Section number and clause numbers in the Town of Comox Supplementary Design Guidelines coincide with the MMCD numbering protocol.

TABLE OF CONTENTS

SECTION

1.0 GENERAL DESIGN CONSIDERATIONS
- 1.5 SEWERS IN COMMON TRENCH

2.0 WATER DISTRIBUTION
- 2.2 METERING
- 2.3 PER CAPITA DEMAND
- 2.7 WATER PRESSURE
- 2.8 HYDRAULIC DESIGN
- 2.9 MINIMUM PIPE DIAMETER
- 2.10 DEAD ENDS
- 2.14 VALVES
- 2.15 HYDRANTS
- 2.16 BLOW OFFS AND BLOW DOWNS
- 2.18 AIR VALVES
- 2.19 THRUST RESTRAINT
- 2.21 SERVICE CONNECTIONS
- 2.22 ALIGNMENTS AND CORRIDORS
- 2.25 PRESSURE REDUCING VALVE (PRV) STATIONS
- 2.26 ABANDONMENT
- 2.27 CROSS CONNECTION CONTROL

3.0 SANITARY SEWERS
- 3.1 GENERAL
- 3.2 PER CAPITA FLOW
- 3.3 NON-RESIDENTIAL FLOW
- 3.7 PIPE FLOW FORMULAS
- 3.9 ALIGNMENT
- 3.10 MINIMUM PIPE DIAMETER
- 3.12 CURVED SEWERS

3.13 DEPTH
3.14 MANHOLES
3.16 SERVICE CONNECTIONS
3.18 PUMP STATIONS

4.0 STORMWATER MANAGEMENT
4.3 STORMWATER MANAGEMENT PRINCIPLES
4.3.1 APPLICABLE REGULATORY POLICIES AND GUIDELINES
4.3.2 STORMWATER DESIGN CRITERIA
4.4 STORMWATER MANAGEMENT PLAN
4.11 STORM SEWER SYSTEM
4.11.6 ALIGNMENT
4.11.7 MINIMUM PIPE DIAMETER
4.11.9 CURVED SEWERS
4.11.10 SEWER DEPTH
4.11.12 MANHOLES
4.11.14 SERVICE CONNECTIONS
4.15 BEST MANAGEMENT PRACTICES (BMPs) FOR RUNOFF CONTROL
4.17 EROSION AND SEDIMENT CONTROL

6.0 ROADS
6.2 ROAD CLASSIFICATION
6.3 CROSS-SECTION ELEMENTS
6.4 ALIGNMENTS
6.5 INTERSECTIONS
6.9 CUL-DE-SAC
6.11 SIDEWALK AND PEDESTRIAN CROSSINGS
6.14 DRIVEWAY LOCATION AND WIDTH
6.16 UNDERGROUND UTILITY LOCATIONS
6.17 PAVEMENT ALTERNATIVES
6.21 STREET PARKING
6.22 SIGNAGE AND LANE MARKINGS
6.23 GREENWAYS
6.23 FIBRE OPTICS

7.0 ROADWAY LIGHTING
7.1 GENERAL
7.5 LIGHT SOURCES AND LUMINAIRES
7.17 DESIGN

SUPPLEMENTARY DESIGN GUIDELINES
GENERAL DESIGN CONSIDERATIONS

1.0 GENERAL DESIGN CONSIDERATIONS

1.5.3	**Sewers in Common Trench**	Replace Section	Mainline storm and sanitary sewers may not be installed in a common trench.

SUPPLEMENTARY DESIGN GUIDELINES
WATER DISTRIBUTION

2.0 WATER DISTRIBUTION

2.2 Metering

Replace Section

Meters shall be required on all single-family, single-family with secondary suite, multi-family, commercial, institutional and industrial developments. The water meter setter size shall be 25mm for all single-family residential homes without fire sprinklers unless there is a demonstrated need for a larger meter. All other meters must be sized in accordance with AWWA M22 and form contained in Appendix A. It should be noted that this methodology is based on the fixture value method and not the fixture unit method employed in the BC Building Code for piping within buildings.

Meters are to be sized and purchased by the developer per the Town's Approved Products List and deposited at the Town of Comox Public Works Yard for installation at Town cost prior to occupancy.

The maximum operating range for a water meter shall be less than 80% of the maximum instantaneous flow capacity as outlined by the meter manufacturer, with a maximum pressure loss of 48 kPa at the design flow rate. The size selection must not compromise the operating range or the long-term life of the meter and must ensure that pressures supplied to property are appropriate for the intended use.

For developments that are proposed to be phased, the meter chamber and piping must be sized for the meter required for the ultimate buildout of the development. However, the initial meter installed must also be sized to accurately capture the range of flows for the first phase.

The Qualified Professional Engineer must ensure the meter selection and installation requirements are appropriate for the designed application.

For applications where domestic and fire demands are supplied from the same internal system, refer to the Town's Approved Products List for acceptable systems.

For applications where fire demands are to be supplied from a designated fire system separate from the domestic system, refer to the Town's Approved

Products List. Approved backflow prevention shall be provided by the Developer and installed on private property to isolate the fire system from the Municipal System. A separate meter and service per the Town's Approved Products List.

Other water meter requirements are as follow:

1. Units of measurement shall be cubic metre
2. Water service meters shall be located within the public Right of Way located 300mm off the property line unless authorized by the Engineer.
3. Service boxes for water services larger than 40 mm diameter shall be as approved by the Engineer.
4. All meter lids shall be drilled to allow for the installation of "Touch Pad".
5. Bypasses shall be provided on all meters 50 mm diameter and larger.

Water service and meter installations are to follow typical installation requirements noted in the Supplementary Detail Drawing W11 (as applicable for size) and W15.

2.3 Per Capita Demand — Replace Section

In the absence of reliable water consumption records, the following per capita demands shall be applied to future residential development.

- Average annual daily demand (ADD) – 635 L/c/d
- Maximum day demand (MDD) – 2100 L/c/d
- Peak hour demand (PHD) – 3000 L/c/d

2.7 Water Pressure — Replace Section

Maximum allowable pressure	700 kPa (102 psi)
Minimum pressure at Peak Hour Demand (PHD)	350 kPa (51 psi)
Minimum pressure in system during design Maximum Day Demand plus Fire Flow (MDD+FF)	150 kPa (22psi)

			In exceptional circumstances or for brief periods design pressures of 280 kPa (41 psi) to 770 kPa (112 psi) are permitted. In areas where buildings may be expected to have automatic sprinklers, a special design is required to ensure a continuous supply to the sprinklers while providing adequate flow to standpipes and hydrants.
2.8	**Hydraulic Design**	Add to Section	The Engineer of Record shall apply the results from the water model into their design accordingly.
2.9	**Minimum Pipe Diameter**	Replace Section	Distribution mains: 200 mm Fire hydrant connections: 150 mm Cul-de-sacs without fire hydrants: 150mm Service connections: 25 mm ▪ All designations with fire sprinklers: 50 mm
2.10	**Dead Ends**	Replace Section	Runs of 150 mm main that are more than 200 m should be avoided by construction of additional cross mains, or by increasing the diameter of the long run main. Blow offs must be provided at the end of each dead ends as per MMCD Design Guidelines Section 2.16.
2.14	**Valves**	Replace Section	In general, valves should be located as follows: • In intersections in a cluster at the pipe intersection, there should be: ▪ Minimum three valves at 'X' intersections ▪ Minimum two valves at 'T' intersections • Not more than 20 service connections isolated • Not more than 200 m apart (except on feeder mains where spacing can be increased to 800 m) • Not more than 1 hydrant isolated. • 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 • 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 un-serviceability. All valves shall be gate valves of the same size as the main.
2.15	**Hydrants**	Replace Section	Fire hydrants should be located in general at street intersections and as follows: • In accordance with the latest "Water Supply for Public Fire Protection – A Guide to Recommended Practice", published by Fire Underwriters Survey • Not more than 90 m from a building. • 2.0 m back from curb or 0.5 m back of sidewalk. • Minimum 1.0 m clear of any other utility structure. • At property line in mid-block locations. • Located a minimum of 60 meters from the end of cul-de-sacs/dead end roads. Hydrants installations are to follow typical installation requirements noted in the Supplementary Detail Drawing W14. Head loss through the hydrant (s) should be calculated as:  Where: HL = Head loss (m) Q = Fire flow (m^3/s) The minimum pressure for all nodes of the system should be at least 150 kPa (22 psi) during fire flow events.
2.16	**Blow Offs and Blow Downs**	Add to Section	Location and installation shall be in accordance with Supplementary Detail Drawing W16.
2.18	**Air Valves**	Add to Section	Air valve chambers shall be located off the road; the use of standpipe vent pipes is prohibited. Location and installation shall be in accordance with Supplementary Detail Drawing W17.
2.19	**Thrust Restraint**	Add to Section	Mechanical thrust restraints can also be used in lieu of thrust blocks.
2.21	**Service Connections**	Add to Section	New service connections shall be designated at one service per parcel.

2.22	**Alignments and Corridors**	Replace Section	Water mains shall be located to serve all parcels directly. Where a road curves, bends shall be used at intervals to maintain the offset between intersections. Deflection of any sections of the water main is prohibited. Where the proposed travelled surface of a roadway is on a consistently ascending or descending grade, the main may be installed at a constant depth below such grade with appropriate vertical bends as necessary. On straight roads, watermains should have straight alignment with uniform offsets between intersections. For curved roads and alignments, design joint deflections should be limited to half the maximum deflection specified by the pipe manufacturer for a standard, 6m pipe length. Where the road grade fluctuates between ascending and descending, the main shall be laid on a uniform grade, avoiding unnecessary high and low points. Arcing of pipe is prohibited. Bends shall be used to negotiate horizontal and vertical turns. Horizontal and vertical curves should not coincide, and unnecessary curves should be avoided. Pipe alignment to be at a parallel offset with an established road right-of-way or property line. Mains on new roads must be located as indicated in the applicable road cross section Supplementary Detail Drawings.

2.25	**Pressure Reducing Valve (PRV) Stations**	Replace Section	General requirements for pressure reducing stations shall be as follows:
			▪ Include a dual Pressure Reduction Valve (PRV) arrangement with separate domestic and fire flow PRV's
			  ▪ Epoxy coated valve bodies both inside and out.
			  ▪ Fire flow PRV must be equipped with a position indicator (limit switch).
			  ▪ Domestic flow PRV must be equipped with position indicator and insertion flow meter.

    - Filters shall be provided on all valve control piping.
    - All piloting shall be set to fail close.
- Include a surge/high pressure relief valve with stainless steel mesh dichlorination basket (capable of housing a minimum of 8 – 65mm dichlorination pucks).
- Pressure relief valves and surge relief valves to include anti-cavitation trim where recommended by the manufacturer based on site specific differential pressures.
- Each PRV and surge relief valve must be provided with isolating valves such that individual components can be removed for repair and each component can be operated independently.
- Pressure gauges and pressure transducers complete with snubbers and isolating valves must be included to register both upstream and downstream pressure.
- All piping and fittings, including control piping, must be stainless steel.
- Grooved couplings must be included to assist in disassembly of piping as required.
- All equipment and controls must be mounted in an above ground secure, lockable cabinet, on a concrete foundation. The cabinet shall be as follows:
    - Include two separate compartments, including one for the electrical controls and another for the mechanical piping and valves. All compartment must be heated, lighted and the controls enclosure must be ventilated
    - Include removable roof hatch above the Mechanical compartment.
    - Fabricated from powder coated aluminum.
    - Include a rubber gasket between the aluminum kiosk and the concrete to prevent water leakage into the kiosk.

2.26 Abandonment Add Section

All mains are to be abandoned as part of the works, fitting shall be removed and the mains shall be filled with grout or Controlled Density Fill (CDF).

2.27	**Cross Connection Control**	Add Section	There shall be no connection between a public and a private potable water system, nor between either water system and a sewer or appurtenance thereto, which would permit the passage of private water or any sewage or polluted water into the potable public supply. No pipe, valve or fitting which has been exposed to raw sewage shall thereafter be included in a potable water system, either temporarily or permanently.

SUPPLEMENTARY DESIGN GUIDELINES
SANITARY SEWERS

3.0 SANITARY SEWERS

3.1 General — Add to Section

The quantity of sewage to be carried in a proposed sanitary sewer shall be determined by the Qualified Professional Engineer having regard for the type and extent of existing and ultimate development within the total area to be served.

The presence of an existing Town sewer does not imply that such is a suitable or adequate point of discharge. Where downstream facilities are inadequate to handle the increased flow from the proposed subdivision and/or development, a special design is required.

3.2 Per Capita Flow — Replace Section

Sanitary sewer design should be based on an average daily dry weather flow (ADWF) of 360 L/c/d.

3.3 Non-Residential Flow — Replace Section

Average dry weather flow (ADWF) for non-residential areas should be based on specific data related to the development or zoning.

In the absence of specific data, the following sewage quantities can be used:

Schools, pupils and staff	45 L/c/d
Hotel, full service	1,000 L/room
Motel	350 L/unit
Restaurant and pub	150 L/seat
Other retail and office	120 L/employee
Industrial	11,000 L/ha

3.7.1 Pipe Flow Formulas - Gravity Sewers — Delete

n = Roughness coefficient = 0.013 for all pipe.

Replace with

n = Roughness coefficient = 0.011 for PVC pipe and 0.013 for all other pipe material.

3.9 Alignment — Replace Section

Horizontal and vertical alignments should be straight lines between manholes for gravity sewers and between defined deflection points for force mains.

			Force main line and grade requirements are as indicated for water mains. Air release valves are required at high points.
3.10	**Minimum Pipe Diameter**	Replace Section	The minimum pipe diameter is 200mm except for the upstream section of a residential sewer where future extension is not possible, in which case 150mm is acceptable. Service connections: 100mm, min 2% Sewage force mains: 100mm Sewers must be designed to satisfy the following parameters: ▪ 200mm diameter: d/D < 0.5. ▪ 250mm diameter: d/D < 0.7. ▪ 300mm diameter and greater: d/D < 0.8. The minimum grade shall be that which results in a minimum velocity of 0.60 m/s when flowing full or half full.
3.12	**Curved Sewers**	Replace Section	Horizontal and vertical curves may not be formed using pipe joint deflections regardless of recommendations from the manufacturer. Horizontal and vertical adjustments in the sewer alignment shall only be achieved through the use of manholes connecting straight sections.
3.13	**Depth**	Add to Section	Where the depth of cover over the main exceeds 3.6 m, service drops should be provided in accordance with MMCD Standard Drawing S7.
3.14.2	**Manholes - Hydraulic Details**	Replace Table 3.14	Table 3.14 Drop Structures

Invert Difference	Structure
Up to 0.25 m	Inside Ramp
Greater than 0.6 m	Outside Ramp

Note that drop structures for drops between 0.25m and 0.6m are not permitted. Re-grading of the pipes should be completed.

3.16.3 Service Connections - Grade	Replace Section	Preferred grade from property line to sewer main is 2%. Any grades not meeting the preferred grade must be approved by the Town. The following are the absolute minimum grades to be met: ▪ 100 mm diameter pipe: 1.5% ▪ 150 mm diameter pipe: 0.6% Larger sizes should maintain grades in keeping with minimum velocity as described in section 3.8.
3.16.4 Service Connections - Details	Replace Section	Use standard wye fittings for connections to new mains. For connections to existing mains, use direct tapping only. The service connection centreline must not be below the sewer main centreline. Service connections may be permitted into manholes if: • The connection is not oriented against the flow in the main. • Manhole hydraulic requirements are met. • The connection enters the manhole so the service invert is no lower than the sewer main crown. • Benching is performed for each service connection into the manhole. Services that are decommissioned shall be disconnected at the main. If the service disconnection is temporary and will be reused with a pending development, then it may be disconnected at the property line. If a stub pipe must be left into a manhole, it shall be capped at such length as to extend outside the pavement surface above. Inspection chambers are required on residential connections unless the service is less than 2.5 m long and connects to a manhole. Control manholes are required on all industrial connections and on commercial connections where required by the local authority. Manholes are required on the sanitary main for service connections larger than 150 mm diameter. Connections shall be made in accordance with MMCD Standard Detail S7.

3.18	**Pump Stations**	Replace Section	Refer to Schedule 4 – Standards for Sanitary Lift Stations for sanitary lift station design guidelines.

SUPPLEMENTARY DESIGN GUIDELINES
STORMWATER MANAGEMENT

4.0 STORMWATER MANAGEMENT

4.3.1 Applicable Regulatory Policies and Guidelines	Add to Section	• Town of Comox Drainage Infrastructure Protection Bylaw • Town of Comox Runoff Control Bylaw • Town of Comox Northeast Comox Stormwater Management Plan • Town of Comox Anderton Servicing Area Stormwater Management Plan • BC Water Quality Guidelines • Canada Environmental Quality Guidelines
4.3.1.1 Applicable Regulatory Policies and Guidelines – North East Comox Stormwater Management	Add Section	Development that would be applicable under the North East Comox Neighbourhood Stormwater Management Plan should reference all relevant specifications and guidelines for the North East Comox Special Requirements, instead of the following stormwater management sections of the Supplementary Design Guidelines. See Schedule 7 for further information.
4.3.1.2 Applicable Regulatory Policies and Guidelines – Anderton Drainage Area	Add Section	Development that would be applicable under the Anderton Drainage Area Development Works Agreement should reference all relevant specifications and guidelines under that agreement, instead of the following stormwater management sections of the Supplementary Design Guidelines.
4.3.2.2 Stormwater Design Criteria - Stormwater Detention and Flow Rate Control	Add	All stormwater detention facilities shall be designed to limit post-development peak flows to equal to the corresponding pre-development peak flows for the 1 in 2, 1 in 5, 1 in 10 and 1 in 25-year return period storm events. Pre-Development Peak Runoff is defined as the runoff leaving the site based on the land use with the highest permeability over the previous 5 years. Pre-development flows for undeveloped areas shall be based on the land's natural state. This is typically defined as forested, unless it can be shown that another condition is applicable. For new developments and re-developments that eventually discharge into a creek, river, or wetland system, runoff volume controls are required to prevent erosion and shall recognize both peak flow rates and the duration of the peak flows.

		Overland escape routes must be provided to account for storms up to 1 in 100 year return period in a manner that does not result in negative downstream impact. Alternatively with Town approval a Development may optionally design the stormwater facility to limit post-development peak runoff to the 100 year pre-development for the 24-hour storm. Discharge at the downstream watercourse shall comply with the BC Water Quality Guidelines regarding watercourses and storm drainage systems, and shall be done to prevent erosion to streambeds and streambanks. New flows from development entering natural systems shall be confirmed to not increase flood risk to downstream properties or adversely affect the receiving ditch or channel.
4.3.2.3 Stormwater Quantity and Quality Control	Delete Section and Replace with the Following:	Stormwater Management Systems are to be used to capture rainfall on development lots and roadways. Captured rainfall volume should be infiltrated, evapotranspired, and/or re-used at the source. This is to promote the natural water balance and hydrology. Designs shall incorporate infiltration where possible. The infiltration potential is not consistent across the Town, therefore infrastructure will need to be sized to suit local conditions. It is understood that in some cases, infiltration may not be achievable. In such cases, management systems shall be sized to temporarily store the runoff, maximize infiltration and evapotranspiration potential, and allow some extent of discharge provided it's in the form of seepage and not *direct* runoff ('seepage' meaning the flow of water in a permeable medium and 'direct runoff' meaning stormwater drainage that is collected and conveyed away from the development). This could include but not be limited to planting areas, topsoiled areas, and other impervious surfaces.
4.4 Stormwater Management Plan	Add bullet	• Show that major storm systems do not negatively impact any properties downstream.
4.11.6 Storm Sewer System - Alignment	Replace Section	Horizontal and vertical alignments are to be straight lines between manholes.
4.11.7 Storm Sewer System -	Delete bullets	• Storm Sewers 250 mm

	Minimum Pipe Diameter		• Culverts
			  • Crossing Driveways 300 mm
			• Service Connections
			  • Residential 100 mm

		Replace with	• Storm Sewers 300 mm
			Except for the upstream section of a residential storm sewer where future extension is not possible, in which case 250mm is acceptable.
			• Culverts
			  • Crossing Driveways 450 mm
			• Service Connections
			  • Residential 150 mm

4.11.9	**Storm Sewer System - Curved Sewers**	Replace with	Horizontal and vertical curves may not be formed using pipe joint deflections regardless of recommendations from the manufacturer. Horizontal and vertical adjustments in the sewer alignment shall only be achieved using manhole connecting straight sections.
4.11.10	**Storm Sewer System - Sewer Depth**	Delete	In no case shall the cover be less than 0.9m or greater than 6.0m without the approval of the local authority
		Replace with	In no case shall the cover be less than 1.0m as measured from finished grade.
4.11.12	**Storm Sewer System - Manholes**	Delete Bullets	Locations: Manholes are required at the following locations: • Every change in grade, except as indicated in the Curved Sewers section • Every change in direction, except as indicated in the Curved Sewers section • Downstream of Curved sewers • 150 m maximum spacing for pipes smaller than 900 mm diameter • 250 m maximum spacing for pipes 900 mm diameter and larger
		Add Bullets	• 125 m maximum spacing for pipes smaller than 900mm diameter

			• 200 m maximum spacing for pipes 900mm diameter and larger
4.11.14	**Storm Sewer System - Service Connections**	Delete Sentence	Every legal lot and each unit of a residential duplex is to be provided with a separate service connection.
		Replace Sentence	Every legal lot is to be provided with a separate service connection.
		Add to Section	Refer to Supplementary Detail Drawing S19 for service connections.
4.15.1	**Best Management Practices (BMPs) for Runoff Control - General**	Add to Section	The application of Best Management Practices is encouraged on individual properties and will be considered on a case-by-case basis for installation on Town land where practical and supported by the Town's capacity for maintenance and operations. All stormwater facilities intended to be maintained and operated by the Town requires the Qualified Professional Engineer to provide a maintenance manual that includes operating, maintenance, and monitoring procedures, as well as the following information where applicable: ▪ Record drawings of the completed facility. ▪ A description of the facility operation including design flows, design depths, and schematic diagrams of the inlet and outlet structures, connections, controls, valves, bypass, overflows, etc. ▪ Applicable vegetation maintenance. ▪ Applicable environmental regulations and best management practices. ▪ Recommended monitoring and inspection schedule, including a list of manufacturer's operation, service, and repair instruction and parts list. ▪ Calculations for sediment yield / discharge.
4.17	**Erosion and Sediment Control (ESC)**	Add to Section	Erosion control shall be undertaken per the Town of Comox Drainage Infrastructure Protection Bylaw.

Figure 4.1: Intensity Duration Frequency Curves Comox A –BCHP ID: 1021830
Years of Record: 1963-2006 (40 Years)

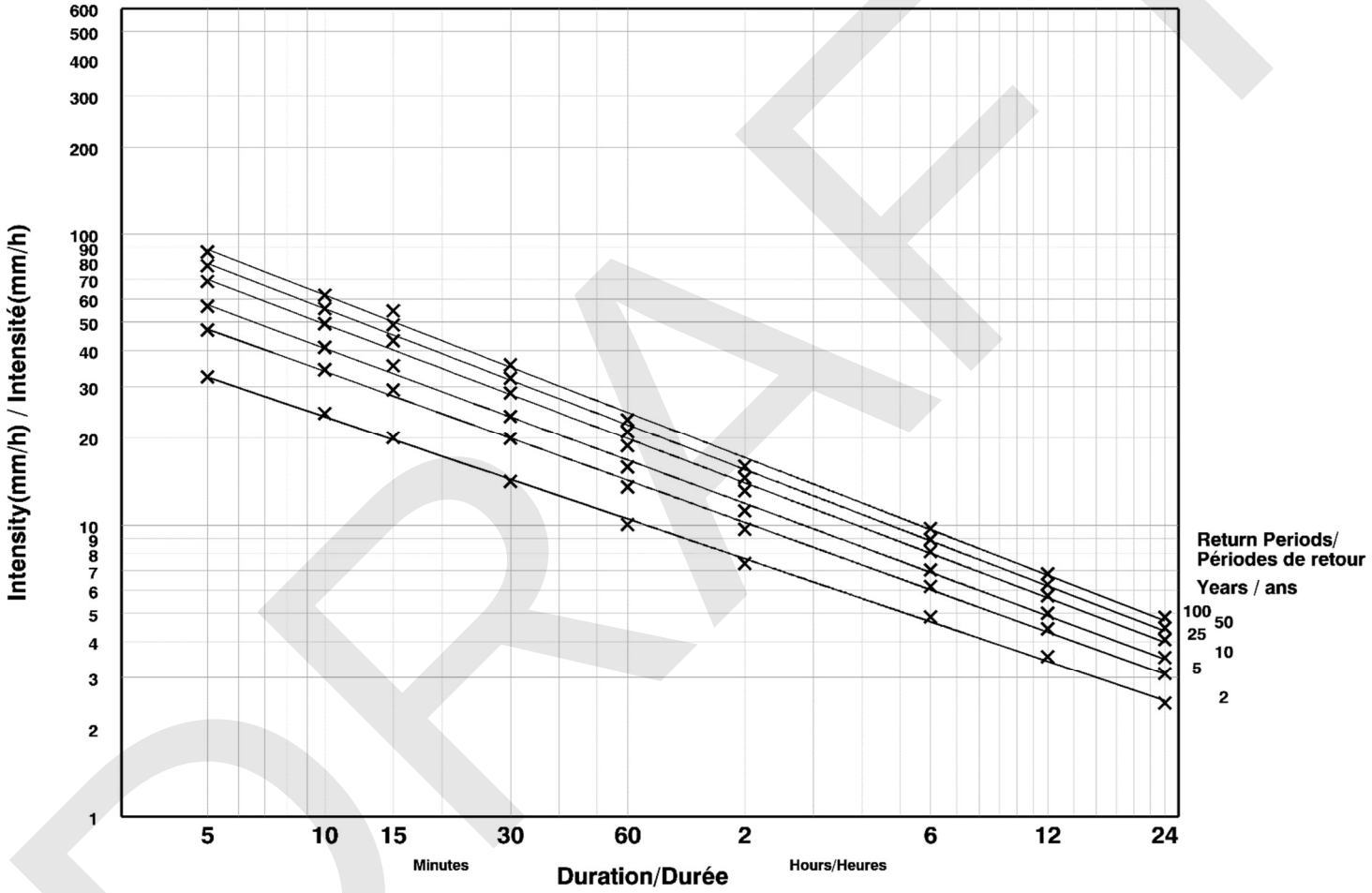


Table 4.4.1: IDF Curve Intensity Summary Table (mm/hr)
Comox A ID 1021830

Time		Return Frequency					
Minutes	**Hours**	**2 Years**	**5 Years**	**10 Years**	**25 Years**	**50 Years**	**100 Years**
15	0.25	20.0	29.3	35.5	43.2	49.0	54.7
30	0.5	14.2	19.9	23.8	28.6	32.2	35.7
60	1	10.1	13.6	15.9	18.8	21.0	23.1
120	2	7.4	9.7	11.2	13.1	14.6	16.0
360	6	4.9	6.2	7.0	8.1	9.0	9.8
720	12	3.5	4.4	5.0	5.7	6.3	6.8
1440	24	2.5	3.1	3.5	4.1	4.5	4.9

Table 4.4.2: Interpolation Equation of IDF Curve – Historical Data for Comox A ID 1021830
$R = A * T^B$ where: R = Rainfall (mm/hr), A and B = Coefficients, based on return period

Parameters	Return Frequency					
	2 Years	**5 Years**	**10 Years**	**25 Years**	**50 Years**	**100 Years**
A	10.5	14.3	16.8	19.9	22.2	24.5
B	-0.452	-0.482	-0.495	-0.506	-0.513	-0.518

Note: Coefficients are based on historical data – When using this table, 15% must be added to resulting intensities

SUPPLEMENTARY DESIGN GUIDELINES
ROADS

6.0 ROADS

6.2	**Road Classification**	Replace Bullet	• A public lane (or alley) is a roadway with the primary function of providing land access, typically at the rear of abutting properties. Public lanes are not generally intended to carry through traffic. Lanes should run straight between local roads without corners or T-intersections. Refer to Supplementary Detail Drawing R17.
6.3	**Cross-Section Elements**	Delete Table 6.1, Table 6.2 and Table 6.3	Replace with Table 6.1 noted below.

Table 6.1: Road Cross Section Requirements

Classification	ROW Width (m)	Design Speed (km/h)	Pavement Configuration	Sidewalk	Parking
Local - A	20	50	- Two 3.0m travel lanes	- Width varies from 1.5m to 1.8m, depending on configuration with boulevard	Combined with travel lanes
Local - B	20	50	- Two 4.2m travel lanes	- Width varies from 1.5m to 1.8m, depending on configuration with boulevard	Combined with travel lanes
Local - C	20	50	- Two 4.5m travel lanes	- Width varies from 1.5m to 1.8m, depending on configuration with boulevard	Combined with travel lanes
Minor Collector	20	50	- Two 4.3m travel lanes (shared bike and vehicle) - 2.4m parking lane on alternating sides – see note in parking column	- Width varies from 1.5m to 1.8m, depending on configuration with boulevard	2.4m “flex” space for parking, boulevards, pull-outs, bus stops, etc
Major Collector	20	50	- Two 3.3m travel lanes - Two 1.8m bike lane separated by solid paint marking - 2.4m parking lane on alternating sides	- Width varies from 1.5m to 1.8m, depending on configuration with boulevard	2.4m parking on alternating sides
Arterial (2 Lanes)	25	50	- Two 3.3m travel lanes - Two 1.8m bike lane separated by solid paint marking	- Width varies from 2.0m to 2.4m, depending on configuration with boulevard	None
Arterial (3 Lanes)	25	50	- Two 3.3m travel lanes - One 3.3m two-way left turning lane - Two 1.8m bike lane separated by solid paint marking	- Width varies from 2.0m to 2.4m, depending on configuration with boulevard	None
Arterial (4 Lanes)	25	50	- Four 3.3m travel lanes - Two 1.8m bike lane separated by solid paint marking	- Width varies from 2.0m to 2.4m, depending on configuration with boulevard	None

Rural	20	50	- Two 3.0m travel lanes - For roads with bike lanes, two 1.8m bike lanes and 0.5m gravel shoulder on outer edges of the paved section	None	None
Downtown	18.3	50	- Two 3.3m travel lanes - Two 2.4m parking lanes (bump-outs at intersections)	- Required on both sides - 1.8m sidewalk with 1.6m boulevard for softscape landscaping	2.4m parking lanes on both sides

6.4	**Alignments**	Delete Table 6.4 – Alignment Standards	Replace as follow:

Table 6.4: Alignment Standards

Classification	Design Speed (km/h)	Min. Radius (m)	Grade** (%)		K-Value	
					Crest Curve	Sag Curve
			Desired	Absolute	Min.	Min.
Arterial	50	TAC*	8	8	10	11
Collector	50	TAC*	10	10	7	11
Local	50	35	12	15	4	7
Rural	50	120	10	10	10	11
Lane	30	25	12	12	4	7
Downtown	50	TAC*	10	10	7	11
Driveway Multi-Family	-	-	0.5	12	-	-
Driveway Single Family	-	-	0.5	15	-	-
Driveway ICI				12		

*Note: Minimum Sight Distance is per TAC
** Minimum grade is 0.5% for all roads

6.4.2	**Alignments - Vertical Curves**	Add	Horizontal curves to be avoided coincident with sharp vertical curves.
6.4.3	**Alignments - Cross Slopes**	Delete	Minimum and maximum values vary by design speed between are 1.5% and 4.0%
		Add	Minimum and maximum values shall be between 2.0% and 4.0%
6.5.1	**Intersections - General**	Replace with	The guidelines provided are general considerations for intersection design. The BC Supplement to TAC Geometric Design Guide and the TAC Geometric Design Guide (Chapter 2.3) should be consulted for reference as part of the intersection design process Intersections should be as close to right angles. The angle may be reduced to a minimum 80 degrees where no other alternative exists due to site characteristics.

		The minimum spacing between intersections is measured from centerline to centerline and should be as follow: • Arterial: 250 m • Collector: 100 m • Local: 60 m
6.5.2 Intersections – Curb Returns	Add to Section	Curb return radii at an intersection shall have a minimum radius of 10.5m. A larger radius may be required to facilitate the movements of larger vehicles in industrial and commercial areas, or buses.
6.5.3 Intersections - Corner Cuts	Replace Section	All property corners at an intersection shall be provided with a minimum 6m radius or equivalent corner cut.
6.9.1 Cul-De-Sac - Temporary Cul-De-Sac	Add Section	Temporary cul-de-sacs that are to be extended in the future shall be designed with gravel turnarounds beyond the right-of-way dedication. Vehicle 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. A statutory right-of-way shall be extended to the frontage of all lots around cul-de-sac bulbs
6.11.1 Sidewalk and Pedestrian Crossings - Sidewalk	Replace Section	Sidewalk requirement varies by road class and is outlined in Table 6.1. Sidewalk construction shall be conformed to Supplementary Detail Drawings C21 and Supplementary Specifications.
6.11.3 Sidewalk and Pedestrian Crossings - Pedestrian Connections	Add Section	A pedestrian connection is a specific pathway designated for connecting two adjacent local streets or the end of a cul-de-sac. It shall be surfaced with concrete or asphalt with centre valley drainage or crossfall to curb. A pedestrian connection connecting a turning area of a cul-de-sac street to an adjacent street shall be provided where a cul-de-sac street is longer than 120 metres in length, as measured to the centre of the turning bulb. When such a connection is provided, the length of the cul-de-sac street may be increased to 230 metres.

			A pedestrian connection connecting a street to an adjacent street shall be provided at the mid-point of a street where continuous street frontage exceeds 370 metres; where a pedestrian connection is provided, frontage may be increased to a maximum of 500 metres. Pedestrian connection widths shall be as specified in Supplementary Standard Drawing R19.
6.14.3	**Driveway Location and Width**	Replace Section	Subject to compatibility with local bylaws, use the following dimensions. • Residential Zones: Driveways located on corner lots should be no more than 2 m from the lot corner farthest from the intersection. Provision of adequate sight distance should be considered in accordance with TAC Geometric Design Guidelines • Minimum and maximum widths of driveways and driveway crossings shall be in accordance with Town of Comox Bylaw 1920 Comox Highway Use. Driveways should be paired where possible. Refer to Supplementary Detail Drawing G10 for preferred utility locations. Driveway and lane crossing shall conform to Supplementary Detail Drawing C16.
6.14.6	**Access Management**	Add	Driveway access means the portion of land providing vehicular access to or from a property up to the curb, edge of pavement or travel surface from servicing ROW. Driveway access to an arterial road will be considered for approval only if access to a lower road classification is not available. Hammerhead turnaround facilities on private driveways shall extend perpendicularly a minimum of 20 m beyond the centre of the driveway to accommodate the turning movements of emergency vehicles. Provide “No Parking” signs.
6.16	**Underground Utility Locations**	Delete Bullets	• Water mains under a sidewalk • Sanitary sewers at pavement centre line • Storm sewer 1.2 m from sanitary sewer.

		Add	• Electrical, telephone and gas in boulevard Water mains, sanitary sewers, storm sewers and other shallow utilities shall be located per road cross section Supplementary Detail Drawings.
6.17.3	**Pavement Alternatives**	Delete Table 6.17.3.1 Minimum Pavement Structure for Asphaltic Concrete (A.C.) Pavement	Replace with the following:

Table 6.17.3: Roadway Base Design

Classification	Minimum Thickness
Walkways	50 mm A.C. surface course
	100 mm base course
	-
Lanes	50 mm A.C. surface course
	100 mm base course
	250 mm subbase
Local / Rural	50 mm A.C. surface course
	130 mm base course
	230 mm subbase
Collector	35 mm A.C surface course
	40 mm A.C. lower course
	150 mm base course
	300 mm subbase
Arterial	40 mm A.C surface course
	60 mm A.C. lower course
	150 mm base course
	300 mm subbase

6.21	**Street Parking**	Replace Section	Street parking areas shall be designed in accordance with road cross section Supplementary Detail Drawings.
6.22	**Signage and Lane Markings**	Add Section	Pavement markings should be in accordance with the latest edition of TAC Manual of Uniform Traffic Control Devices. Town signage requirements can be referenced at Supplementary Detail Drawing R18.

6.23 Greenways Add Section

Greenways are intended to carry pedestrian and non-motorized traffic only.

6.23.1 Adjacent to Local Street

Where shown on Map C-1 Greenways Network-Adjacent to local Street, the street profile of a Class 1 Greenway as shown in Figure C-1 applies, except:

- Lot 1, District lot 93, Comox District, Plan 2175,
- Amended Parcel A (DD 20783N)
- Plan 1507R, 834 RW and 32578
- South West of Plan 834 RW

where a Class 2 Greenway as shown in Figure C-2 applies.

Boulevards must be planted with street trees in accordance with Schedule 5 – Landscape Standards. Boulevards should also be serviced with underground irrigation, including meter, setter, and controller. To allow for canopy trees, street lighting conduits within Greenways Network Boulevards must be 0.3 m back of the curb line, and must sweep to the light standard.

6.23.2 Dedicated Walkways

Where shown on Map C-2, the width and location of Dedicated Walkways shall be varied to accommodate environmentally sensitive areas, required engineering, include existing trees and natural features of public value, and to create public focal points and visual diversity.

6.24 Fibre Optics Add Section

Refer to Schedule 6 – Town of Comox Fibre Optic Construction Standards for details regarding the design and installation of fibre optics throughout the Town.

SUPPLEMENTARY DESIGN GUIDELINES
ROADWAY LIGHTING

7.0 ROADWAY LIGHTING

7.1	**General**	Add to Section	Relevant publications of the Illuminating Society of North America (IESNA) including RP-8-14
7.5.1	**Light Sources and Luminaires**	Delete	Common light sources are LED, High Pressure Sodium (HPS) and Metal Halide (MH) however LED have the best efficacy and overall life cycle and are most commonly used.
		Replace with	Light sources shall be LED. The selection process shall be done in consultation with the Town and will only include luminaire manufacturers listed in the most current version of the Town's Approved Product List.
7.17.2	**Design – Decorative Lighting**	Add to Section	Refer to Supplementary Detail Drawing E11 for further details on acceptable decorative lighting. Refer to MMCD Standard Detail Drawings E4.1 and E4.2 for details on the Type 2 Luminaire Pole. Refer to BC Ministry of Transportation and Infrastructure Drawing MS316.1 for details on the Type 4A Luminaire Pole.

SCHEDULE 2

SUPPLEMENTARY CONSTRUCTION SPECIFICATIONS

CONSTRUCTION SUPPLEMENTARY SPECIFICATIONS

This schedule contains supplementary specifications to be applied in conjunction with the Specification of the Master Municipal Construction Documents, dated 2019, both of which shall apply to all Works and Services constructed within the Town of Comox.

Supplementary Specifications contained within this Schedule supplement or supersede the Master Municipal Construction Document (MMCD). Where the Town of Comox Supplementary Specifications conflict with the MMCD, the Town of Comox Supplementary Specifications shall take precedence.

Section number and clause numbers in the Town of Comox Supplementary Specifications coincide with the MMCD numbering protocol.

TABLE OF CONTENTS

SECTION

01 55 00S	TRAFFIC CONTROL, VEHICLE ACCESS AND PARKING
01 57 01S	ENVIRONMENTAL PROTECTION
03 30 20S	CONCRETE WALKS, CURBS AND GUTTERS
31 11 01S	CLEARING AND GRUBBING
32 12 16S	HOT-MIX ASPHALT CONCRETE PAVING
32 13 13S	PORTLAND CEMENT CONCRETE PAVING
32 93 01S	PLANTING OF TREES, SHRUBS AND GROUND COVERS
33 11 01S	WATERWORKS
33 30 01S	SANITARY SEWERS
33 40 01S	STORM SEWERS

MMCD Section 01 55 00S TRAFFIC CONTROL, VEHICLE ACCESS AND PARKING

1.0	**General**	Delete Subsection 1.0.4 and replace with the following	Give minimum 48h notice or as otherwise required by local bylaws to local police, fire departments, emergency services, BC Transit, and municipal works authorities prior to beginning construction and comply in all respects with their requirements.
		Add Subsection 1.0.7 as follows	Approval of Town's Highway Use permit required prior to any full or partial sidewalk or walkway closure.
1.4	**Traffic Management**	Add Subsection 1.4.10(6)	Any signs placed on site shall adhere to the current Town of Comox Sign Bylaw.
		Add Subsection 1.4.10(7)	Traffic control and warning devices shall be in accordance with the most recent Province of British Columbia Ministry of Transportation "Standard Specifications for Highway Construction".

MMCD Section 01 57 01S ENVIRONMENTAL PROTECTION

1.0 GENERAL

1.2	**Temporary Erosion and Sediment Controls**	Subsection 1.2.2(1) amend to read	Work around watercourses shall be done in accordance with the most recent version of the “Land Development Guidelines” published by the Provincial Ministry of Environment, the BC Water Quality Guidelines, and the Town of Comox Drainage Infrastructure Protection Bylaw.
1.4	**Environmental Protection**	Subsection 1.4.1 amend to read	Fires and burning rubbish shall only be in accordance with current Provincial and Municipal regulations and the Town of Comox Fire Regulation Bylaw.
1.4	**Environmental Protection**	Subsection 1.4.2 add	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 Areas Protection Regulations and the Town of Comox Drainage Infrastructure Protection Bylaw.

MMCD Section 03 30 20S CONCRETE WALKS, CURBS AND GUTTERS

2.0 PRODUCTS

2.1 Materials

Add Subsection 2.1.7

Use curbs as shown in Supplemental Detail Drawing C18.

Add Subsection 2.1.8

2.1.8 The following section outlines material requirements for a standardized aesthetic appearance of exposed aggregate concrete walkways.

.1 Concrete mixes and material under this section shall also meet Section 03 30 53 with the following criteria specific to exposed aggregate:

- Cement content: 300 kg/m^3
- Supplementary Cementing Materials (SCM) content: 30 kg/m^3
- Air content: 6 – 9%
- Air entrainment admixture: as required to achieve specified air content and in conformance with ASTM C260
- Slump: 80 +/- 30mm
- Water reducing admixture: as required to achieve desired workability and conformance with ASTM C494
- Maximum water cementing materials ratio: 0.45
- Curing: type 3 (wet 7 days minimum)
- Admixtures containing calcium chloride not permitted
- Coarse aggregate shall be non-staining and non-reactive to alkali conditions
- Coarse aggregate to be natural round stone not subject to mechanical fracture except as described:
    - Max 15% content of naturally angular and

fractured particles, per particle count
    - Max 10% content of thin, flat or elongated particles, per particle count
    - Samples to be submitted to Owner
- Fine aggregate to be natural sand with gradation in conformance with CSA Table 10, FA 1
- Combined aggregate content shall be proportioned such that concrete has a minimum coarse aggregate (>5mm diameter) content of 43% of total concrete volume. If pumping is required and allowable by Owner, the minimum coarse aggregate content shall be 39% of total concrete volume. Satisfactory pumping shall be confirmed prior to commencement of work.

.2 Acceptable surface retardant (spray-applied water-soluble surface retarder) – approved products are included in the Approved Products List.

3.0 EXECUTION

3.19 Testing Add Subsection 3.19

3.19.1 Portland Cement concrete shall be tested for slump, compressive strength and air content.

3.19.2 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 per

60 m^3 poured of a specified strength. Samples shall be obtained, handled and tested in accordance with CSA-CAN3-A23.2.

3.19.3 For extruded curbing installed by a slip-form curbing machine using a no-slump mix design, the slump test is not required.

3.19.4 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.

3.19.5 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.

3.19.6 Should any of the concrete be found to be unacceptable a report by a Professional Engineer shall be submitted to the Town for approval detailing the extent of the work required to remove and replace the unacceptable concrete or recommendations for acceptance of the work.

Add Subsection 3.20

3.20.1 Internal vibration and/or vibrating screed are not permitted for exposed aggregate finishing.

3.20.2 Follow surface retardant manufacturer's recommendations for application. Do not apply surface retardant until all bleed water has evaporated. Finish to match surrounding concrete in colour, profile, and texture.

3.20.3 Depth of aggregate exposure to be within 15% of sample.

MMCD Section 31 11 01S CLEARING AND GRUBBING

3.0 EXECUTION

3.5	**Removal and Disposal**	Delete 3.5.3 and replace with the following	Fires and burning of rubbish on site shall only be carried out in accordance with Provincial and Municipal Regulations and Town of Comox Fire Regulation Bylaw.

MMCD Section 32 12 16S HOT-MIX ASPHALT CONCRETE PAVING

3.0 EXECUTION

3.5 Placing

Add Subsection 3.5.8 as Follows

All placements 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

Replace Subsection 3.6.1 with the following

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 Town.

3.13 Testing

Add new Subsection 3.13 Testing as follows

3.13.1 For a paving project of 99 tonnes or less lots the 75 blow Marshall Density maybe obtained by averaging the results from briquettes made from materials from the same source using the same mix design.

3.13.2 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 Town an asphalt pavement design and construction approval procedure.

3.13.3 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.

MMCD Section 32 13 13S PORTLAND CEMENT CONCRETE PAVING

2.0 PRODUCTS

2.1	**Materials**	Delete Subsection 2.1.4 and replace with the Following	Concrete mixes and materials: to Section 03 30 53 – Cast-in-Place Concrete meeting CSA A23.1. Exposure Class C2. The average 28-day compressive strength shall be in accordance with the specification 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.

MMCD Section 32 93 01S PLANTING OF TREES, SHRUBS, AND GROUND COVER

2.0 PRODUCTS

2.6	**Guying collar**	Delete Subsection 2.6.1 and replace with the following	Structures to stabilize trees to follow Canadian Landscape Standards Section 6.3.10.
2.13	**Root barrier**	Add Subsection 2.13.1	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 Subsection 2.14.1 as follows	Structural soils to follow Canadian Landscape Standards Section 5.2.9 for Engineered Soil.
2.15	**Tree gate and frame**	Add Subsection 2.15.1 as follows	Tree grates and frames shall be subject to approval of the Town, based on shop drawings provided at the time of design submission.

3.0 EXECUTION

3.11	**Guarantee / Maintenance**	Delete Subsection 3.11.1 and replace with the following	A two year maintenance period will apply for landscape work. Contractor to guarantee all materials and workmanship for a period of two full years from date of Total Performance, unless specified otherwise in Contract Documents.

MMCD Section 33 11 01S WATERWORKS

1.0 GENERAL

1.7	**Scheduling of Work**	Add Subsection 1.7.6	Submit a Hydrant Use Permit to the Town's Public Works Department, should the use of a hydrant be required. Refer to the application form for further details.

2.0 PRODUCTS

2.5	**Service Connections, Pipe, Joints and Fittings**	Add Subsection 2.5.6	For service connections greater than 50mm, refer to Supplemental Detail Drawing W11 for product information and arrangement of meter box.

3.0 EXECUTION

3.7	**Valve Installation**	Add Subsection 3.7.5	Extension pieces shall be used where the valve operator nut bury is greater than 1.2m.
3.19	**Testing Procedure**	Subsection 3.19.7 add	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 test will not be accepted if the leakage exceeds the quantity determined by the following formula.:

$$L = \frac{ND\sqrt{P}}{130{,}400}$$

L = Allowable leakage (L/hr)
N = Number of joints
D = Nominal diameter of the pipe (mm)
P = The average test pressure (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.

3.21	**Disinfection and Flushing Procedures**	Subsection 3.21.2 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.

Add Subsection 3.21.10	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.

MMCD Section 33 30 01S SANITARY SEWERS

3.0 EXECUTION

3.10	**Service Connection Installation**	Add the following to Subsection 3.10.2	Marker to be set so that top protrudes at least 0.5m above existing grade and painted red.
3.18	**Video Inspection**	Delete Subsection 3.18.1 and Replace with the following	Prior to completing paving works, the Contractor shall video inspect all sewer mains including existing mains where service connections were upgraded. The video inspection report shall be in the form specified by the Contact Administrator. Copies of the video and written reports shall be forwarded to the Contact Administrator when available.

MMCD Section 33 40 01S STORM SEWERS

3.0 EXECUTION

3.10	**Service Connection Installation**	Add the following to Subsection 3.10.2	Marker to be set so that top protrudes at least 0.5m above existing grade and painted green.
3.12	**Inspection and Testing**	Delete Subsection 3.12.1 and Replace with the following	Prior to completing paving works, the Contractor shall video inspect all sewer mains including existing mains where service connections were upgraded. The video inspection report shall be in the form specified by the Contact Administrator. Copies of the video and written reports shall be forwarded to the Contact Administrator when available.

SCHEDULE 3

SUPPLEMENTARY STANDARD DETAIL DRAWINGS

SUPPLEMENTARY STANDARD DETAIL DRAWINGS

This schedule contains supplementary standard detail drawings to be applied in conjunction with the Standard Detail Drawings of the Master Municipal Construction Documents, dated 2019, both of which shall apply to all Works and Services constructed within the Town of Comox.

Supplementary Standard Detail Drawings contained within this Schedule supplement or supersede the Master Municipal Construction Document (MMCD). Where the Town of Comox Supplementary Standard Detail Drawings are in conflict with the MMCD, the Town of Comox Supplementary Standard Detail Drawings shall take precedence.

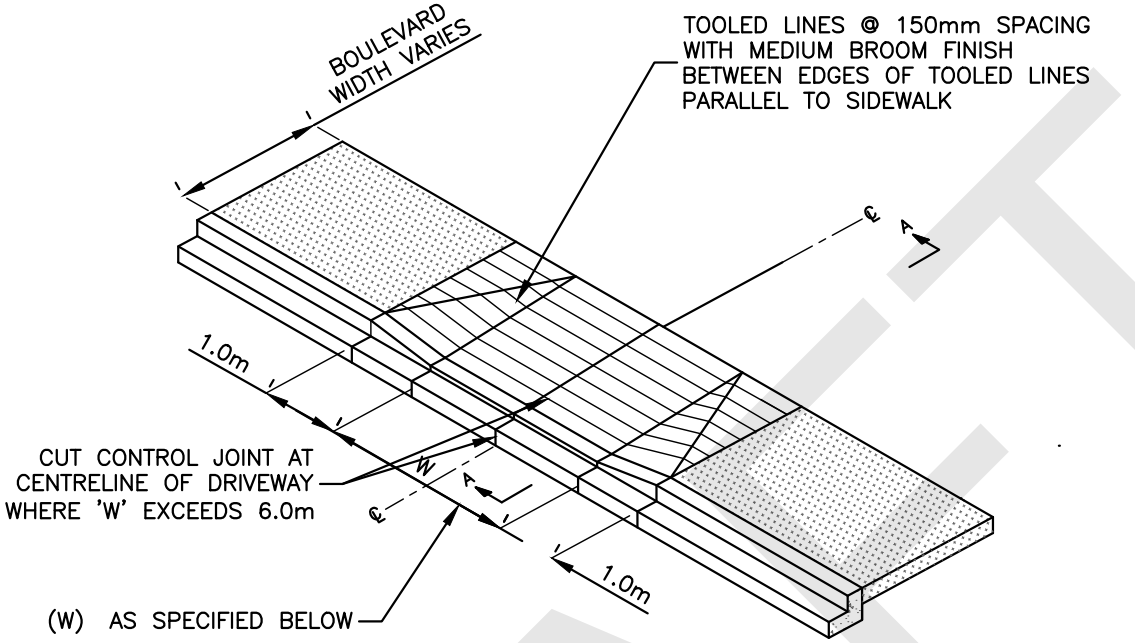
TABLE OF CONTENTS

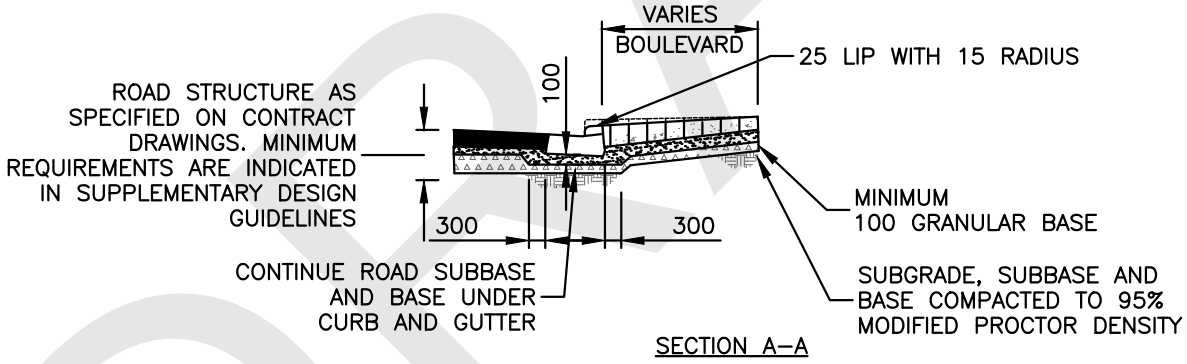
Drawing No.	Drawing Name
C16	LANE AND DRIVEWAY CROSSING
C17	PEDESTRIAN RAMP
C18	CONCRETE BARRIER CURB
C19	CONCRETE ROLLOVER CURB
C20	ASPHALT ROLLOVER CURB
C21	SIDEWALK
E11	DECORATIVE POST TOP STREET LIGHT STANDARD
G9	CUL-DE-SAC WITH TYPICAL UTILITY LOCATIONS
G10	PREFERRED SERIVCE AND DRIVEWAY LOCATIONS
R9	DOWNTOWN ROAD CROSS SECTION
R10	RURAL ROAD WITH DITCHING CROSS SECTIONS
R11	MINOR COLLECTOR ROAD CROSS SECTION
R12	MAJOR COLLECTOR ROAD CROSS SECTION
R13	ARTERIAL (4-LANE) ROAD CROSS SECTION
R14	ARTERIAL (2-LANE) ROAD CROSS SECTION
R15	ARTERIAL (3-LANE) ROAD CROSS SECTION
R16a	LOCAL ROAD A CROSS SECTION
R16b	LOCAL ROAD B CROSS SECTION
R16c	LOCAL ROAD C CROSS SECTION
R17	LANE
R18	STREET NAME AND STOP SIGN
R19	PEDESTRIAN CONNECTION
S18	CULVERT HEADWALL
S19	STORM SEWER SERVICE CONNECTION
S20	CATCH BASIN WITH FLAT GRATE
S21	CATCH BASIN WITH COMBINED INLET
S22	PRECAST RISER MANHOLE

W11	WATER METER FOR SERVICES GREATER THAN 50mm
W12	THRUST BLOCK ARRANGEMENTS (PART 1 OF 2)
W13	THRUST BLOCK ARRANGEMENTS (PART 2 OF 2)
W14	HYDRANT
W15	25mm WATER SERVICE CONNECTION
W16	BLOW OFF ASSEMBLY
W17	AIR VALVE ASSEMBLY

LANDSCAPE DETAIL DRAWINGS

L1	IRRIGATION BACKFLOW PREVENTION (PART 1 OF 2)
L2	IRRIGATION BACKFLOW PREVENTION (PART 2 OF 2)
L3	TREE PROTECTION
L4	SPLIT RAIL CEDAR FENCE
L5	SHRUB PLANTING
L6	COMMUNITY PATHWAY
L7	NATURE TRAIL
L8	TREE PLANTING
L9	TREE PLANTING ADJACENT TO SIDEWALK
L10	TREE PLANTNG WITH SOIL CELL
L11	TREE PLANTING WITH STRUCTURAL SOIL





SECTION A–A

NOTE:

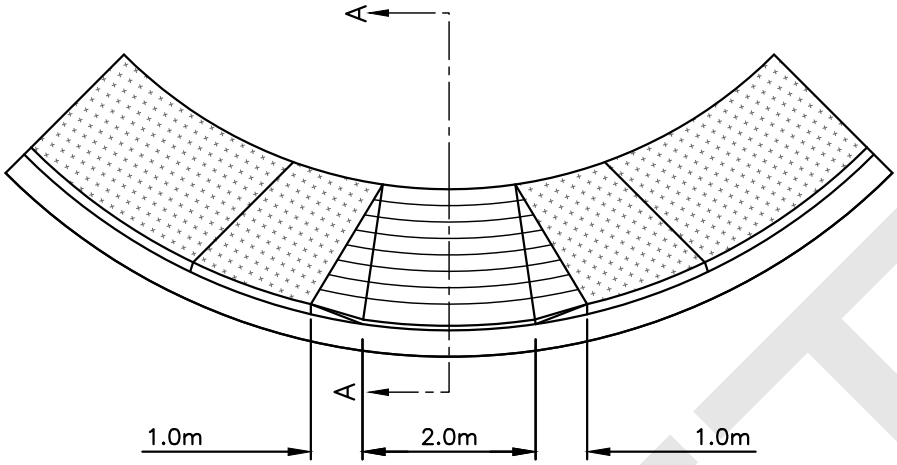
1. ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED.
2. DRIVEWAYS ORIENTATED AT 90° TO CURB, UNLESS SPECIFIED OTHERWISE ON CONTRACT DRAWINGS.
3. MINOR VARIATION IN CROSS SECTION WILL BE CONSIDERED TO ACCOMMODATE EXTRUDING MACHINES.
4. WIDTH (W) OPTIONS AS PER TOWN OF COMOX HIGHWAY USE BYLAW.

TOWN OF COMOX

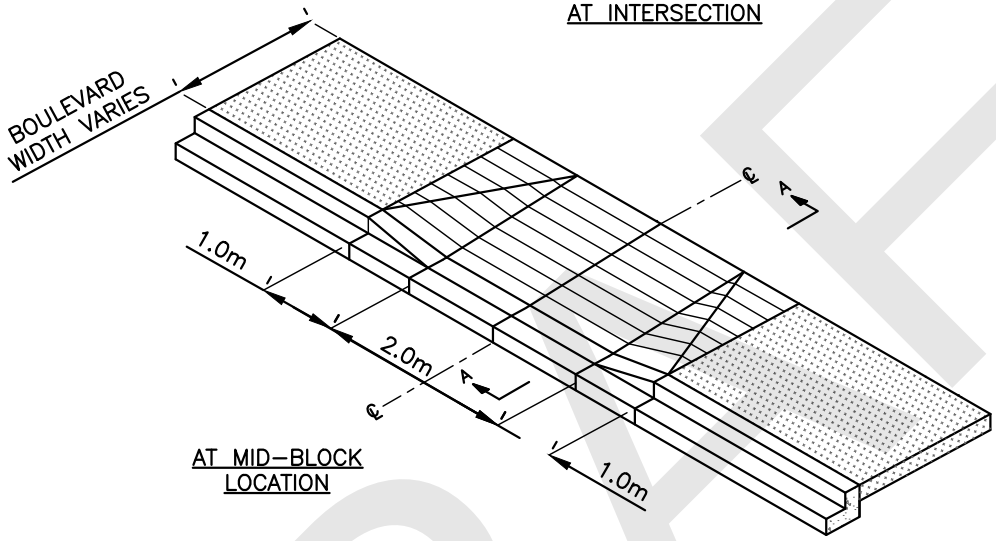
LANE AND DRIVEWAY CROSSING

DRAWING NUMBER	C16
REVISION NUMBER	A
SCALE	N.T.S.

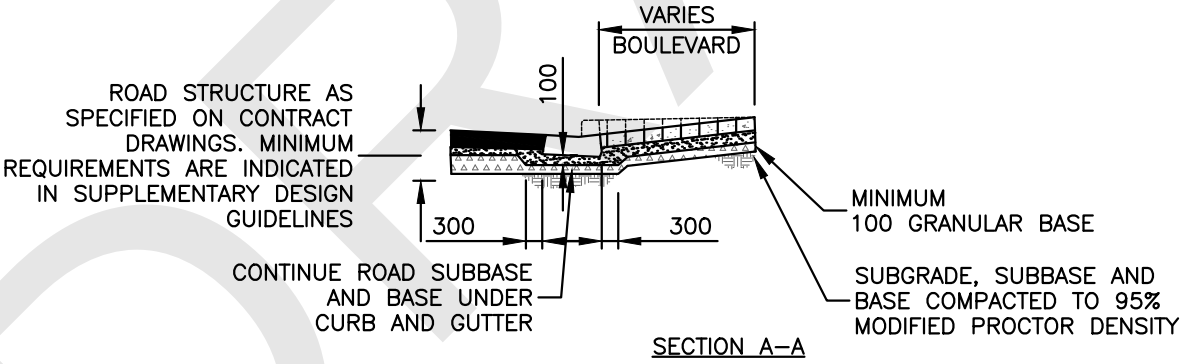
January 2025



AT INTERSECTION



AT MID–BLOCK
LOCATION



SECTION A–A

NOTE:

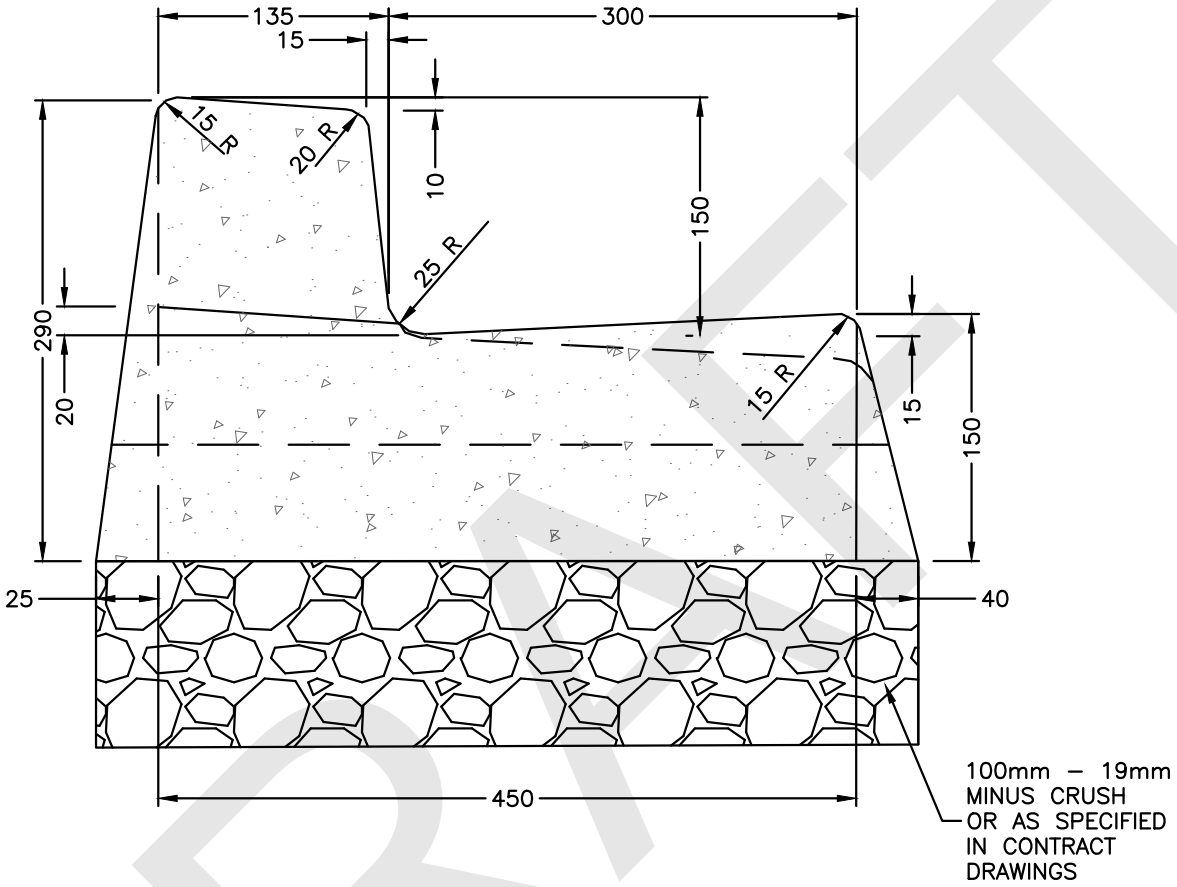
1. ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED.
2. DESIGN MAY BE ADJUSTED TO SUIT LOCATION BUT SHOULD BE CONSISTENT WITH THIS STANDARD.
3. ALL RAMPS TO BE SHAPED BY CONTINUOUS SCREEDING FROM END TO END USING STRAIGHT SCREED RESTING ON FORMS FRONT AND BACK. SURFACE TO BE VERY COARSE BROOM FINISHED, DIFFERING IN TEXTURE AND APPEARANCE FROM ADJACENT SIDEWALKS.

TOWN OF COMOX

PEDESTRIAN RAMP

DRAWING NUMBER	C17
REVISION NUMBER	A
SCALE	N.T.S.

January 2025



NOTE:

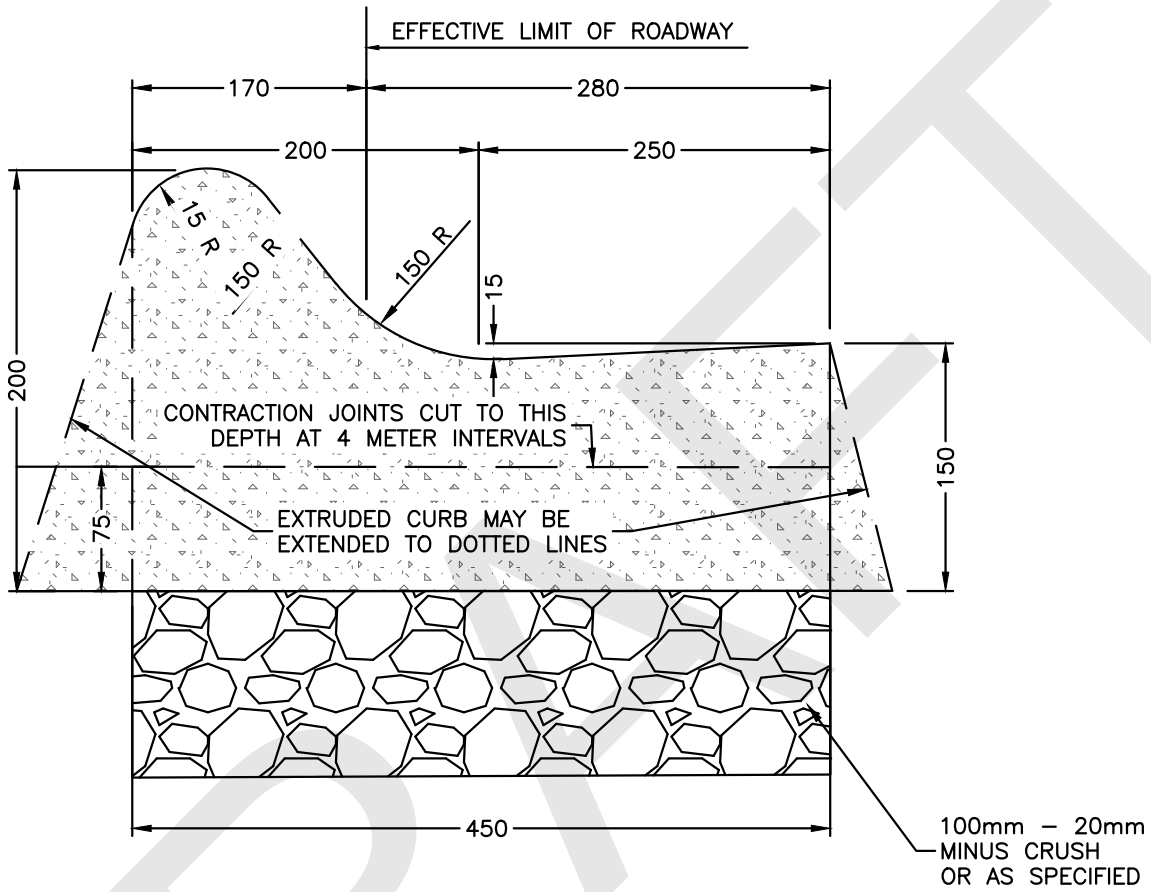
1. CONCRETE TO BE CLASS C2 WITH 28–DAY COMPRESSIVE STRENGTH OF 32 MPA AND BRUSHED FINISH.
2. 15mm EXPANSION JOINT AT TANGENT POINTS AND AT THE END OF EACH DAYS POUR.
3. 1/3 DEEP TOOLED CONTRACTION JOINT EVERY 3 METERS.
4. MINOR VARIATIONS IN CROSS SECTIONS WILL BE CONSIDERED TO ACCOMMODATE EXTRUDING OR SLIPFORM MACHINES.
5. ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.

TOWN OF COMOX

CONCRETE BARRIER CURB

DRAWING NUMBER	REVISION NUMBER	SCALE
C18	A	N.T.S.

January 2025



NOTE:

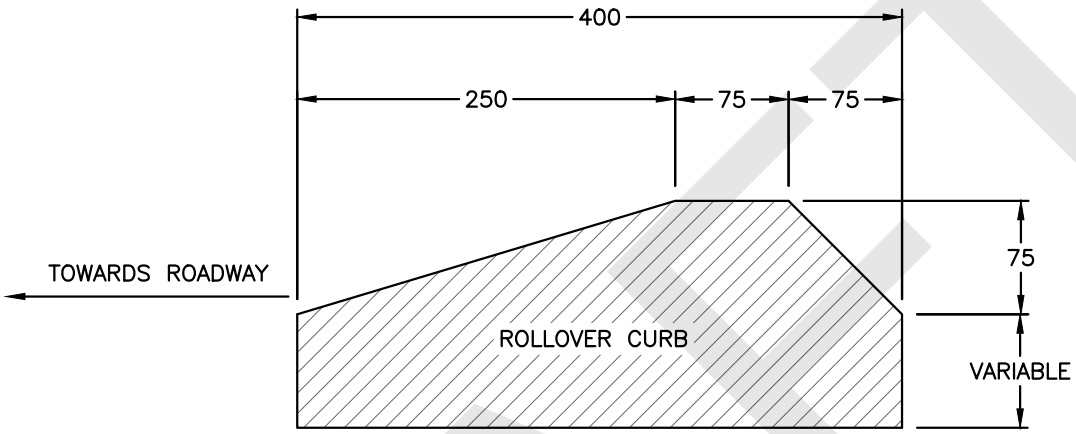
1. CONCRETE TO BE CLASS C2 WITH 28–DAY COMPRESSIVE STRENGTH OF 32 MPA AND BRUSHED FINISH.
2. 15mm EXPANSION JOINT AT TANGENT POINTS AND AT THE END OF EACH DAYS POUR.
3. 1/3 DEEP TOOLED CONTRACTION JOINT EVERY 3 METERS.
4. MINOR VARIATIONS IN CROSS SECTIONS WILL BE CONSIDERED TO ACCOMMODATE EXTRUDING OR SLIPFORM MACHINES.
5. ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.

January 2025

TOWN OF COMOX

CONCRETE ROLLOVER CURB

DRAWING NUMBER	REVISION NUMBER	SCALE
C19	A	N.T.S.



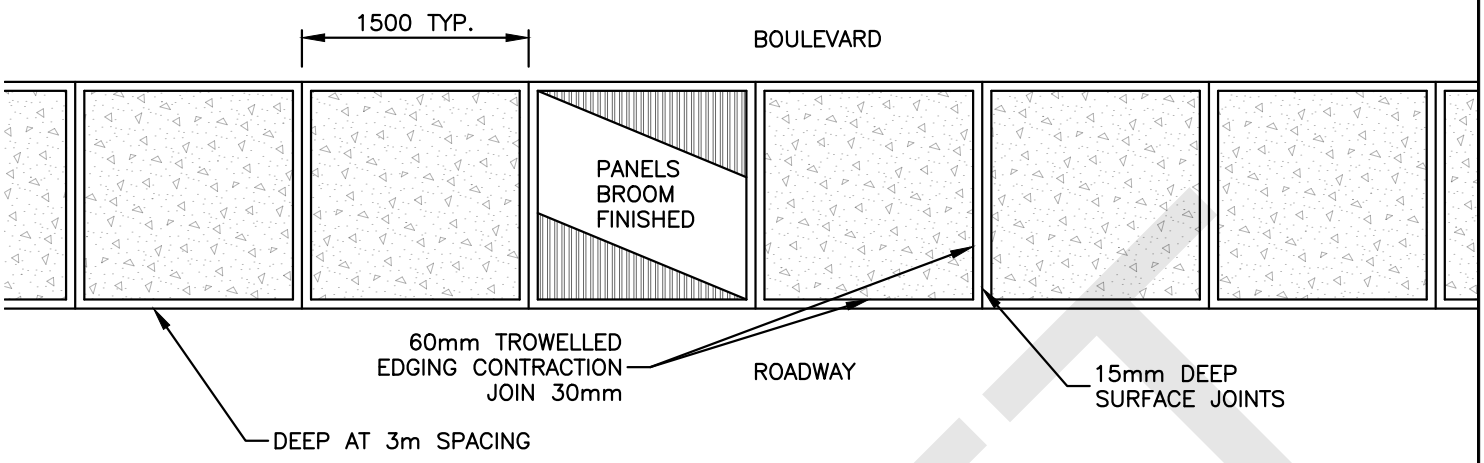
NOTE:
1. ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. NOT TO SCALE.

TOWN OF COMOX

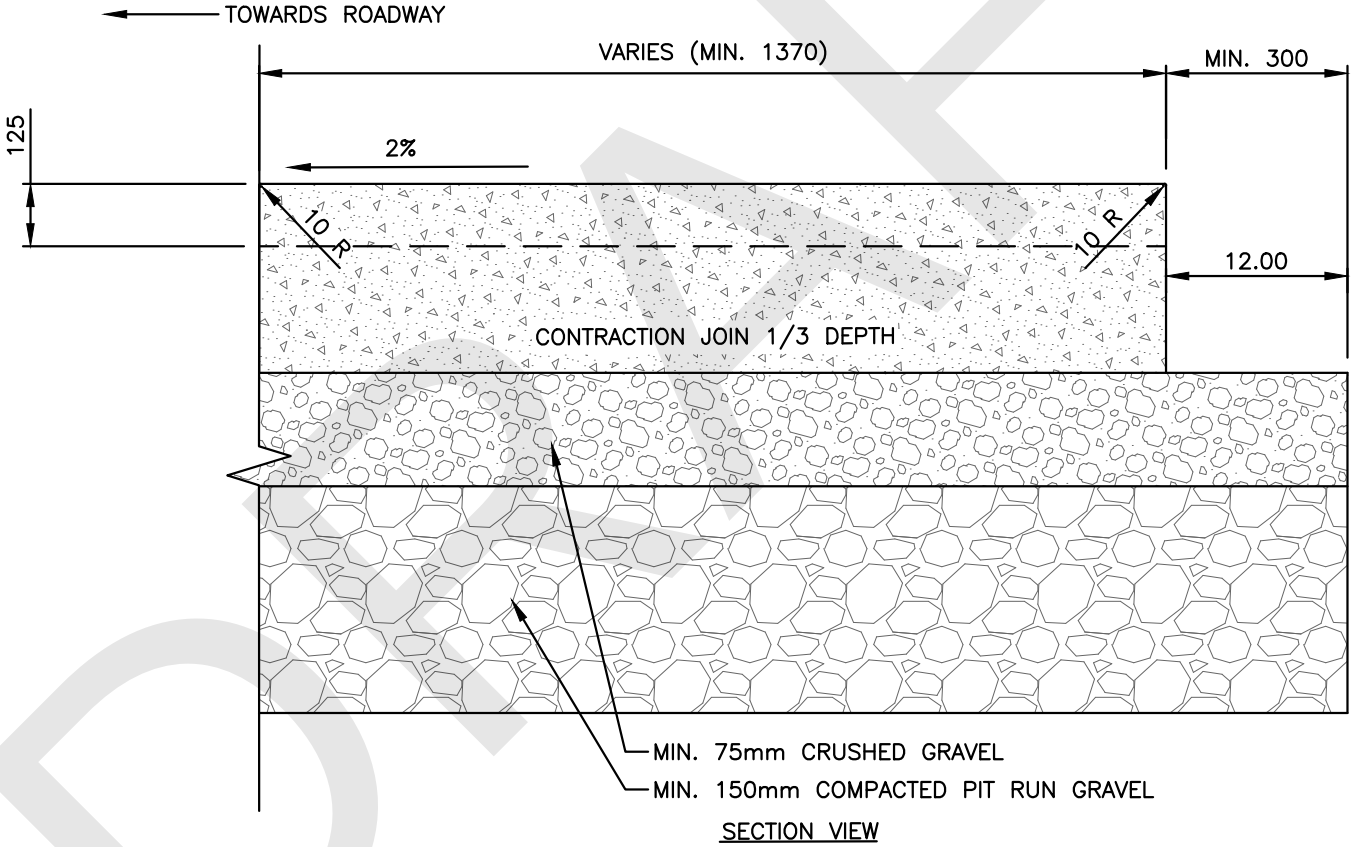
ASPHALT ROLLOVER CURB

DRAWING NUMBER	C20
REVISION NUMBER	A
SCALE	N.T.S.

January 2025



PLAN VIEW



SECTION VIEW

NOTE:

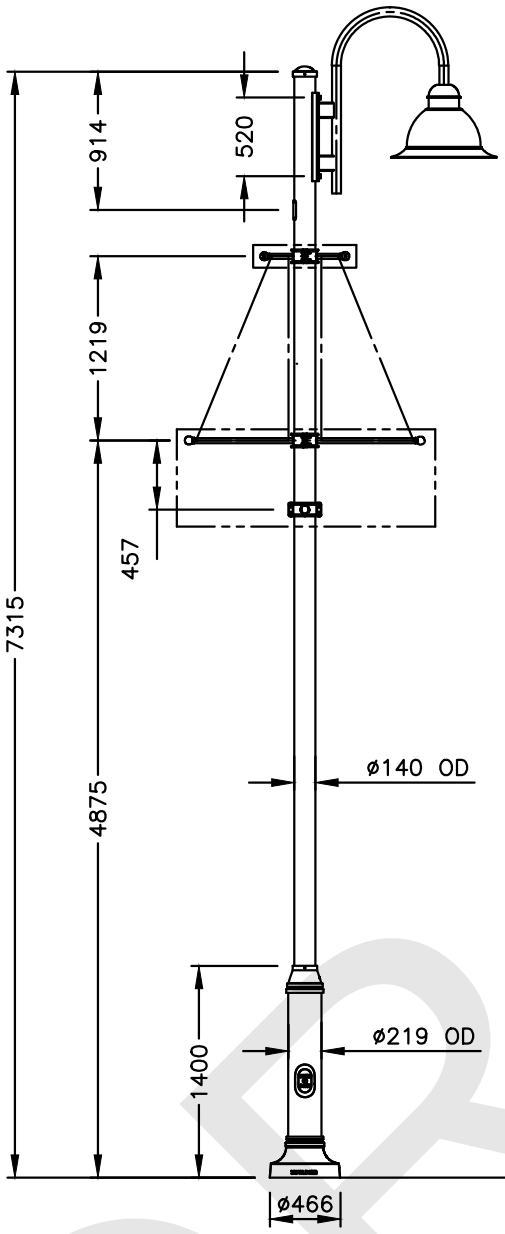
1. CONCRETE TO BE CLASS C–2 WITH A 28 DAY COMPRESSIVE STRENGTH OF 32 MPa.
2. 15mm EXPANSION JOINTS AT TANGENT POINTS AND AT THE END OF EACH DAYS POUR.
3. MINOR VARIATIONS IN CROSS SECTION WILL BE CONSIDERED TO ACCOMMODATE EXTRUDING OR SLIPFORM MACHINES.
4. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.

TOWN OF COMOX

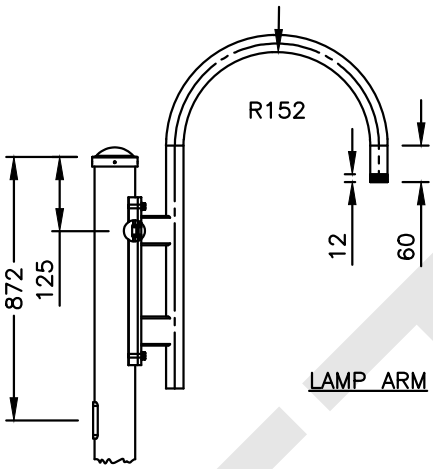
SIDEWALK

DRAWING NUMBER	REVISION NUMBER	SCALE
C21	A	N.T.S.

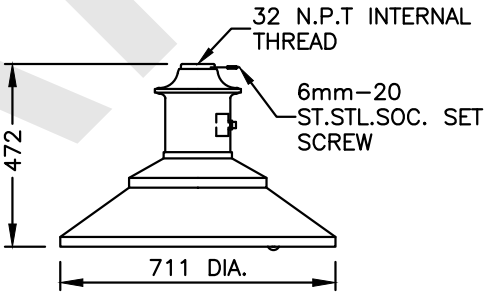
January 2025



TYPICAL INSTALLATION



LAMP ARM



LAMP HEAD

NOTE:

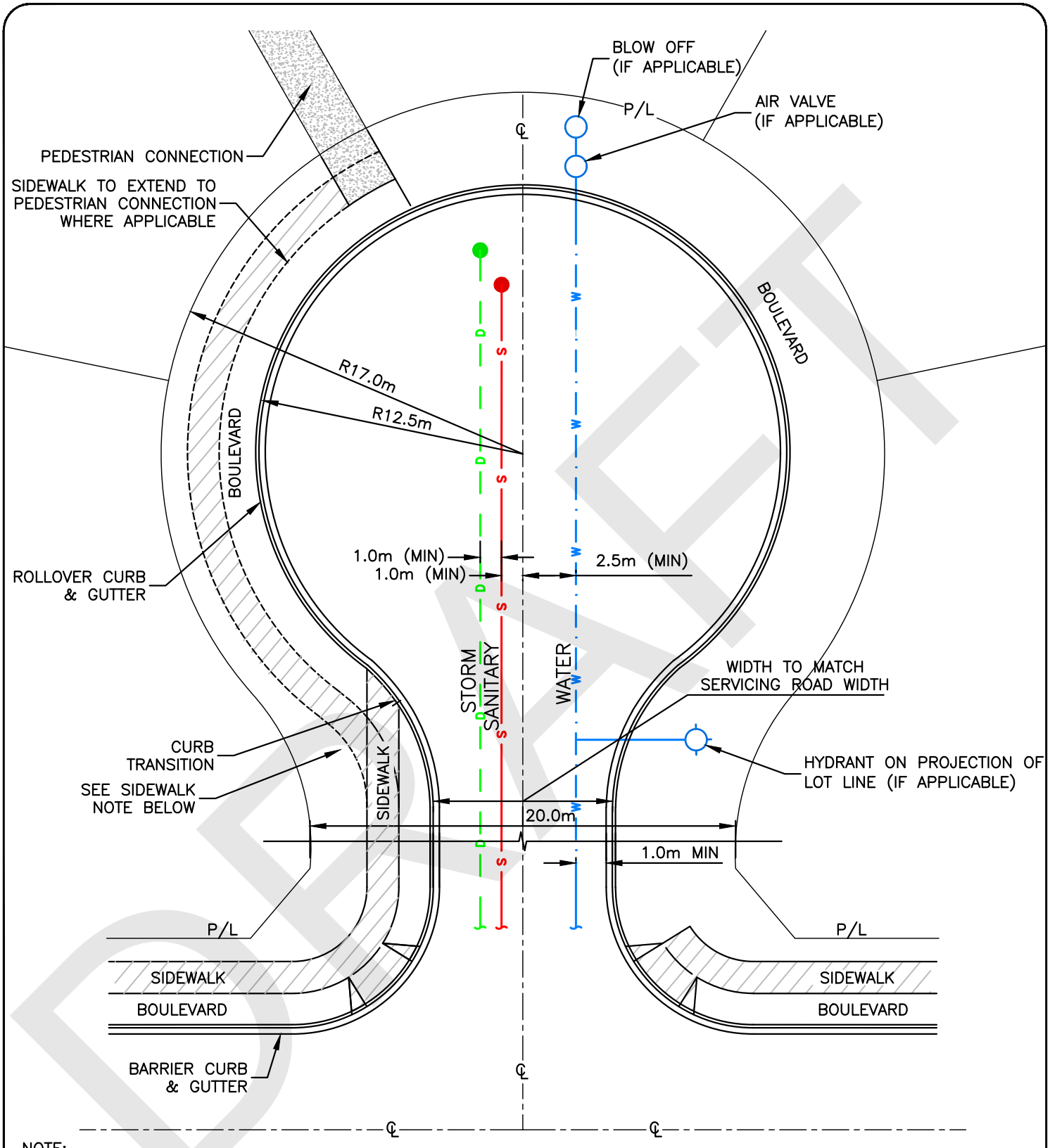
1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.

TOWN OF COMOX

DECORATIVE POST TOP STREETLIGHT STANDARD

DRAWING NUMBER	E11
REVISION NUMBER	A
SCALE	N.T.S.

January 2025



NOTE:

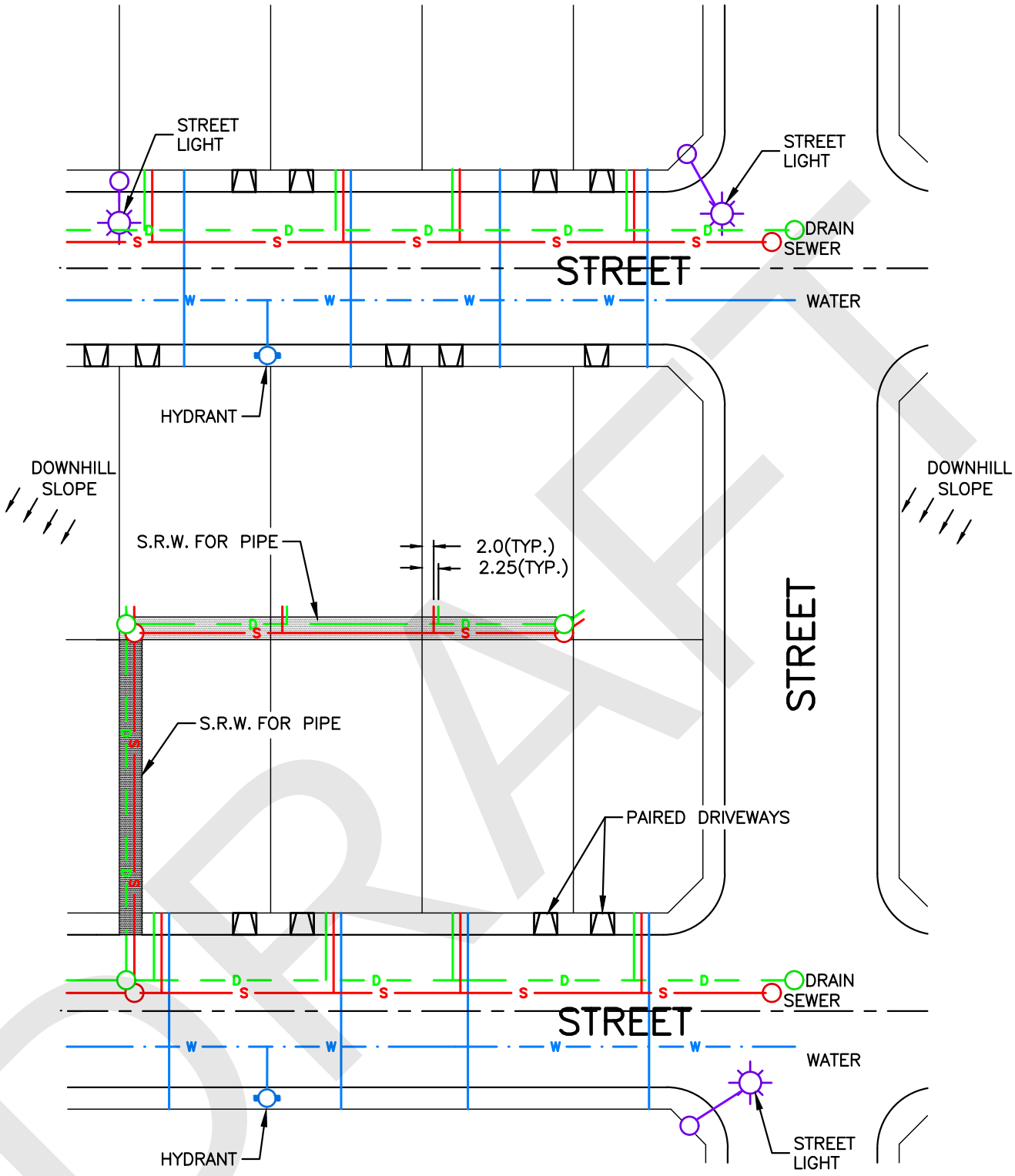
1. SIDEWALK ONE SIDE REQUIRED FOR ALL CUL DE SACS. ALSO WHERE CUL DE SAC HAS PEDESTRIAN CONNECTION THE SIDEWALK SHOULD EXTEND TO CONNECT TO THE PEDESTRIAN CONNECTION.

January 2025

TOWN OF COMOX

CUL DE SAC
WITH TYPICAL UTILITY LOCATIONS

DRAWING NUMBER	G9
REVISION NUMBER	A
SCALE	N.T.S.



NOTES:

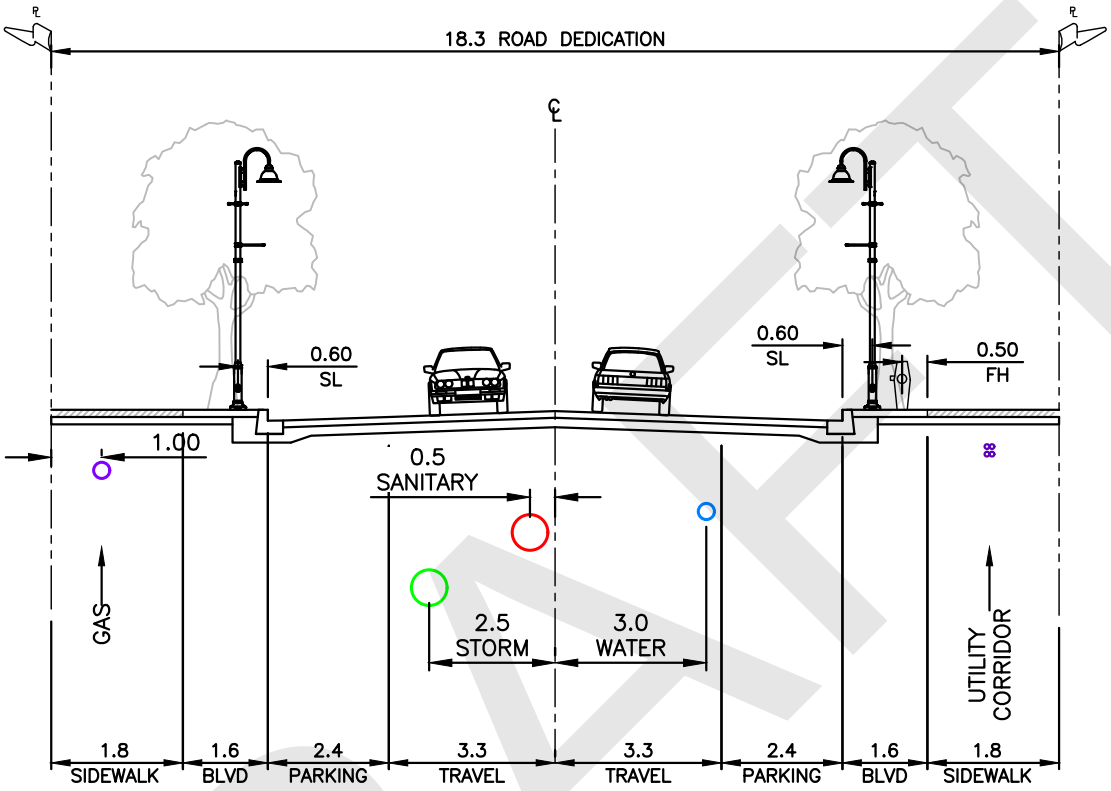
1. ALL DIMENSIONS IN METERS UNLESS OTHERWISE NOTED.
2. MINIMUM COVER OF WATER SERVICE TO BE 1.0m.

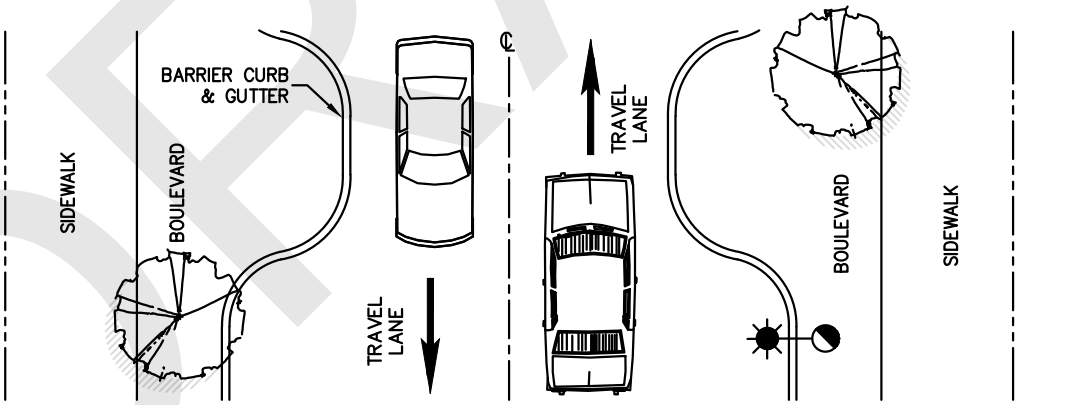
TOWN OF COMOX

PREFERRED SERVICE AND DRIVEWAY LOCATIONS

DRAWING NUMBER	G10
REVISION NUMBER	A
SCALE	N.T.S.

January 2025





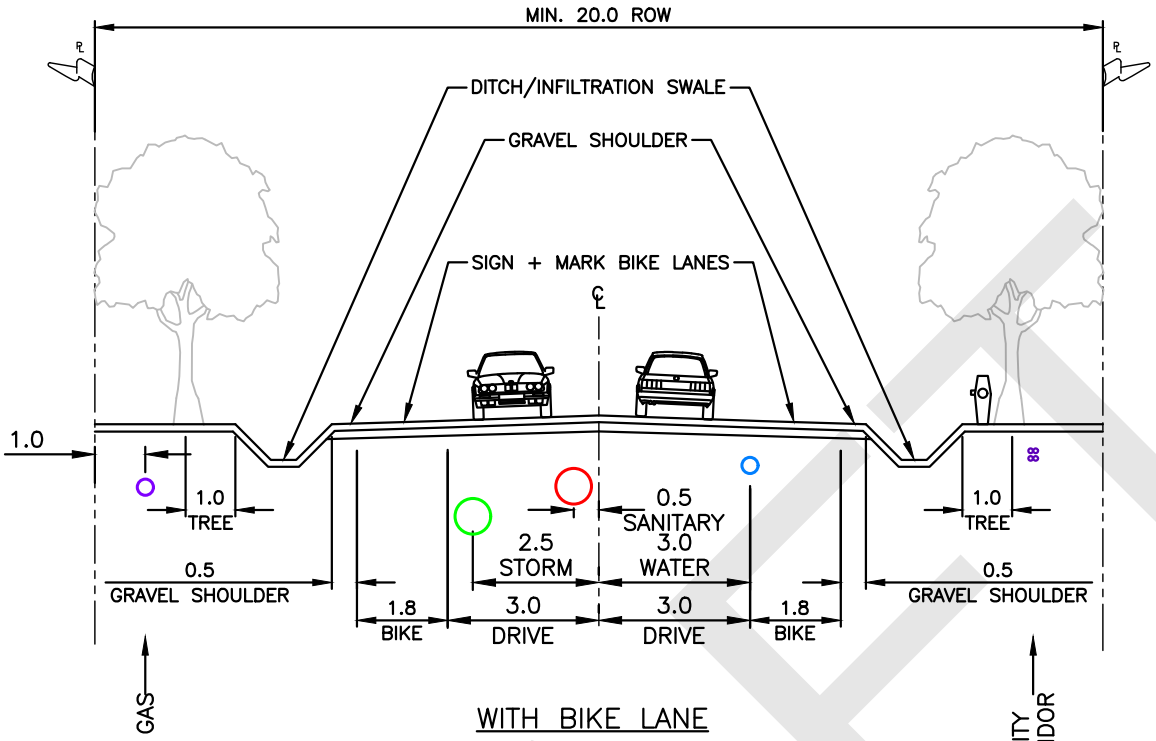
NOTE:
1. ALL DIMENSION ARE IN METERS UNLESS OTHERWISE NOTED.
2. SIDEWALKS WIDTH TO BE 1.8m OR TO THE BOULEVARD, WHICHEVER IS GREATER.
3. TREES AND LIGHTS TO BE STAGGERED; TREES TO BE CENTERED IN BOULEVARDS.
4. BULB OUTS TO BE LOCATED AT INTERSECTIONS.

TOWN OF COMOX

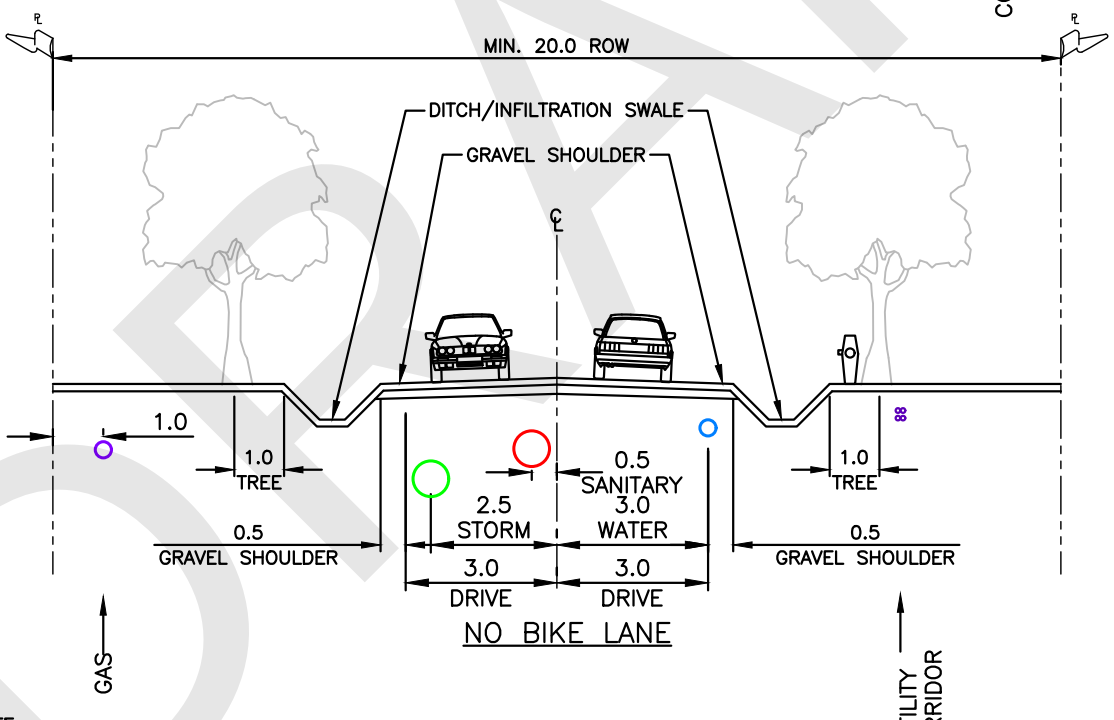
DOWNTOWN ROAD CROSS SECTION

DRAWING NUMBER	R9
REVISION NUMBER	A
SCALE	N.T.S.

January 2025



WITH BIKE LANE



NO BIKE LANE

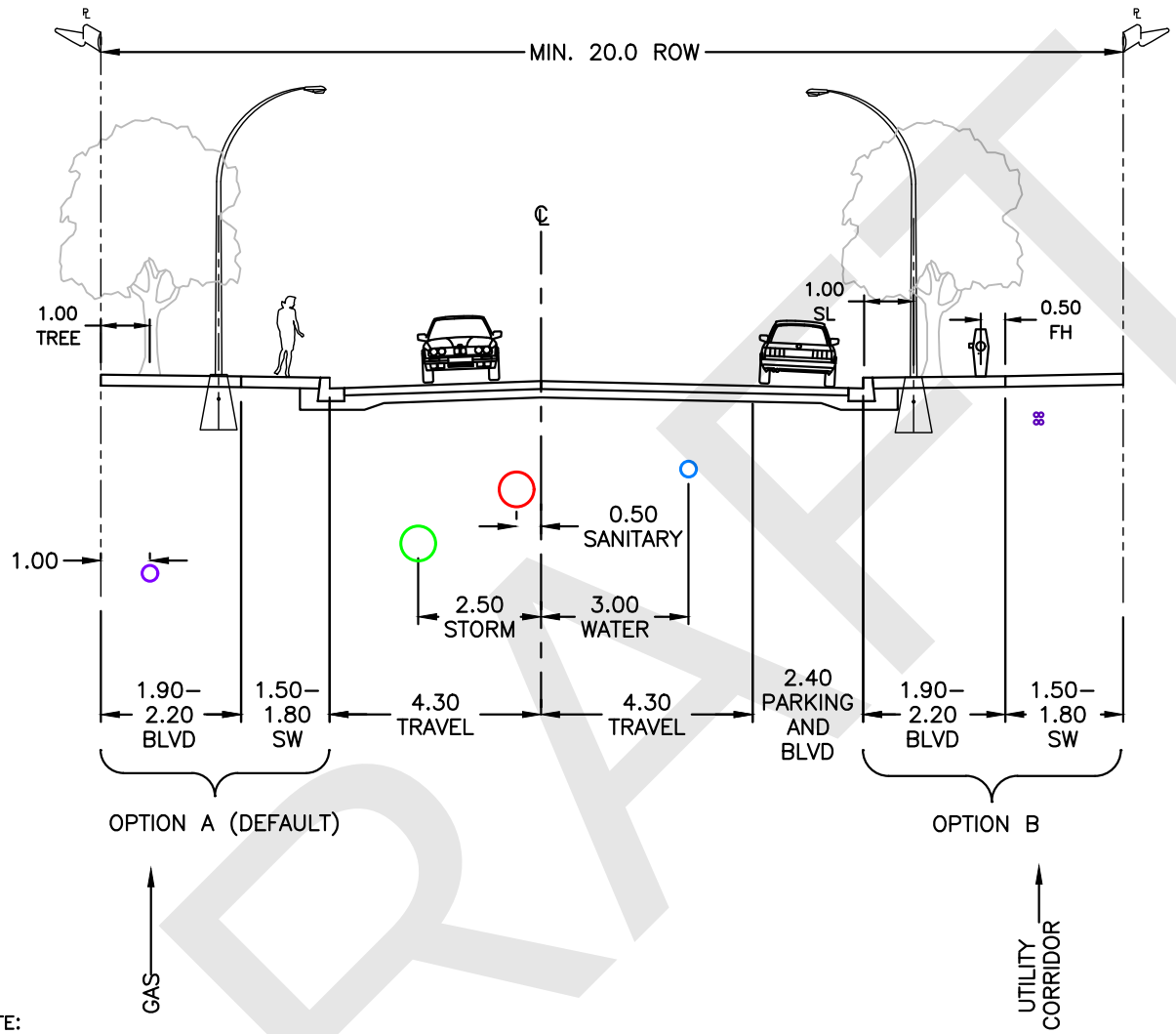
NOTE:
1. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED.
2. SECTION SHOWN FOR RURAL ROAD WITH DITCHING.
3. BIKE LANE WIDTH OF 1.5m WITH 0.3m HATCH AREA ALONG DRIVE AISLES.
4. BIKE LANES TO BE DELINEATED BY SOLID WHITE THERMOPLASTIC MARKING.

TOWN OF COMOX

RURAL ROAD WITH DITCHING CROSS SECTIONS

DRAWING NUMBER	R10
REVISION NUMBER	A
SCALE	N.T.S.

January 2025



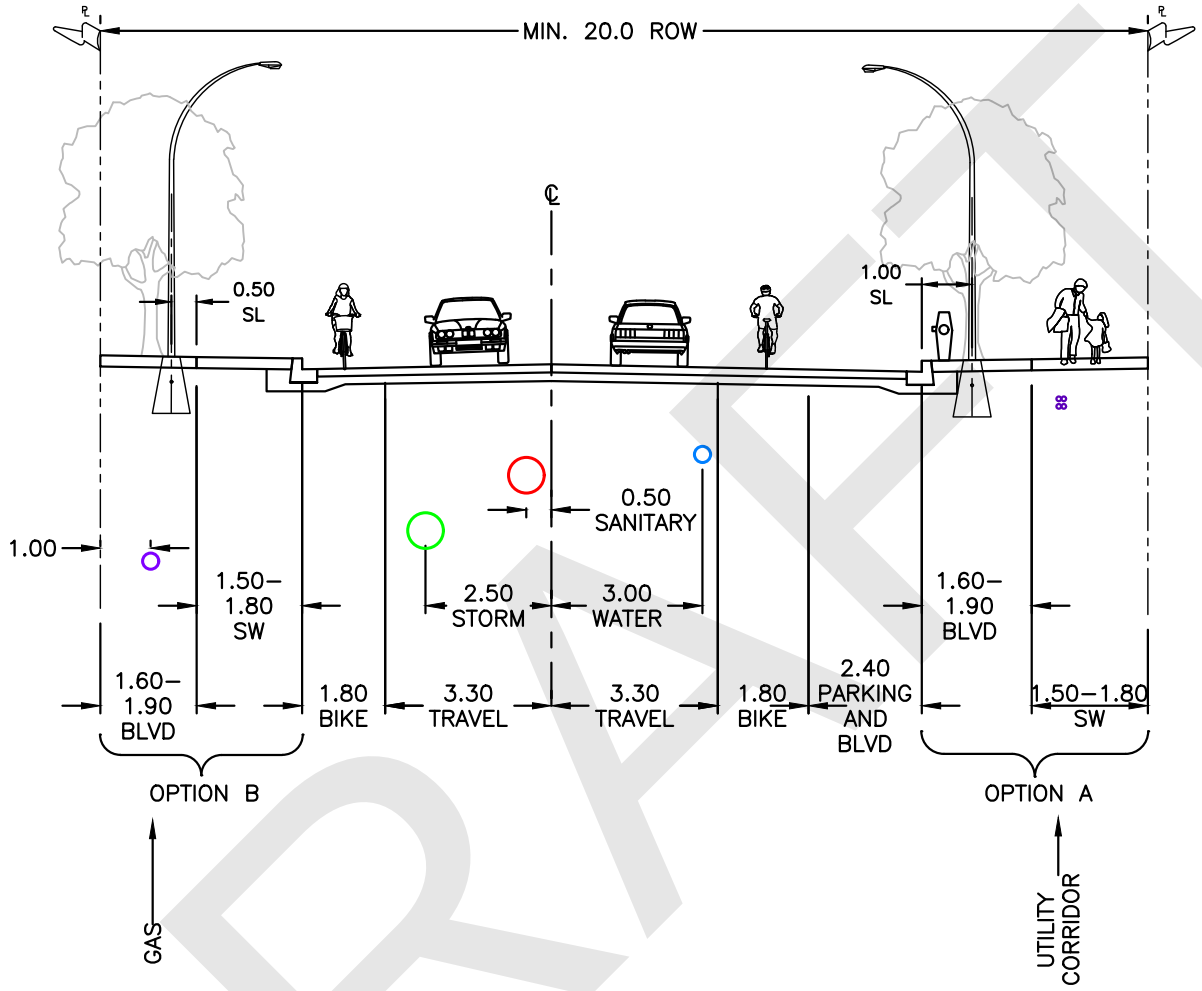
NOTE:
1. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED.
2. SIDEWALK WIDTH TO BE 1.8m WITH THE OPTION TO DECREASE TO 1.5m DEPENDING ON EXISTING NEIGHBOURHOOD CHARACTER (TREES, DRIVEWAY GRADES, & UTILITY LOCATIONS).
3. SEE LANDSCAPE DESIGN GUIDELINES AND SPECIFICATIONS ON PARKING AND BOULEVARD TREATMENT.
4. SIDEWALKS ON BOTH SIDES OF ROAD WITH THE OPTION FOR SIDEWALK ON ONE SIDE ONLY DEPENDING UPON PEDESTRIAN VOLUME AND EXISTING NEIGHBOURHOOD CHARACTER (TREES, DRIVEWAY GRADES, & UTILITY LOCATIONS).
5. BOULEVARD WIDTH OF 1.9m IF SIDEWALK IS 1.8m.
6. BOULEVARD WIDTH OF 2.2m IF SIDEWALK IS 1.5m.

January 2025

TOWN OF COMOX

MINOR COLLECTOR ROAD CROSS SECTION

DRAWING NUMBER	R11
REVISION NUMBER	A
SCALE	N.T.S.



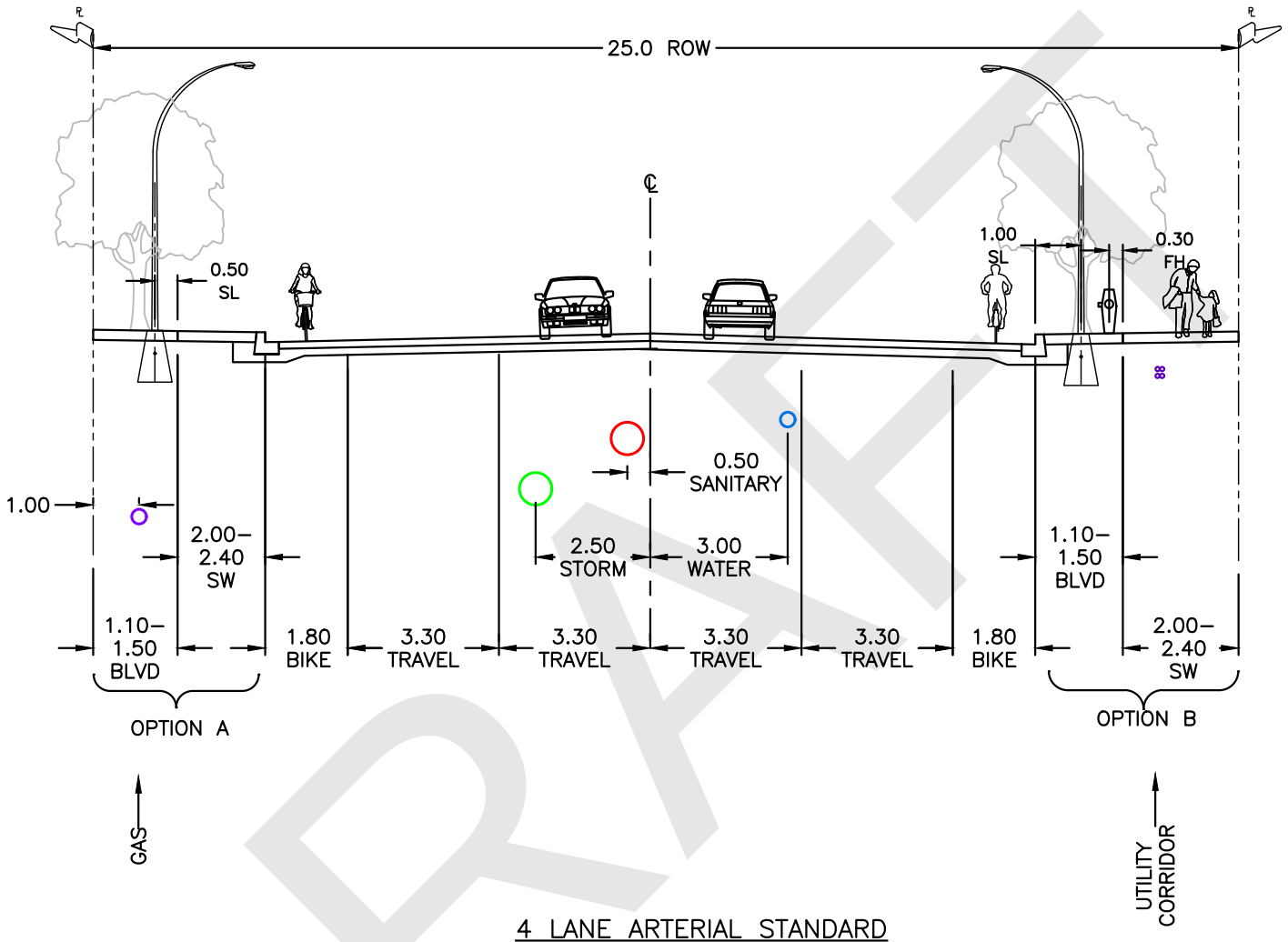
NOTE:
1. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED.
2. SEE LANDSCAPE DESIGN GUIDELINES AND SPECIFICATIONS ON PARKING AND BOULEVARD TREATMENT.
3. OPTION A IS THE DEFAULT LAYOUT UNLESS THERE IS A CONFLICT WITH THE EXISTING NEIBOURHOOD CHARACTER (TREES, STREETLIGHTS, DRIVEWAY GRADES, & UTILITY LOCATIONS), THEN OPTION B WILL BE USED.
4. SIDEWALK WIDTH TO BE 1.8m WITH THE OPTION TO DECREASE TO 1.5m DEPENDING ON EXISTING NEIGHBOURHOOD CHARACTER (TREES, STREETLIGHTS, DRIVEWAY GRADES, & UTILITY LOCATIONS).
5. BIKE LANES TO BE DELINEATED BY SOLID WHITE THERMOPLASTIC MARKING.

TOWN OF COMOX

MAJOR COLLECTOR ROAD
ROAD CROSS SECTION

DRAWING NUMBER	R12
REVISION NUMBER	A
SCALE	N.T.S.

January 2025



4 LANE ARTERIAL STANDARD

NOTE:
1. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED.
2. SIDEWALK WIDTH TO BE 2.4m WITH THE OPTION TO DECREASE TO 2.0m DEPENDING ON EXISTING NEIGHBOURHOOD CHARACTER (TREES, STREETLIGHTS, DRIVEWAY GRADES, & UTILITY LOCATIONS).
3. OPTION A IS THE DEFAULT LAYOUT UNLESS THERE IS A CONFLICT WITH THE EXISTING NEIGHBOURHOOD CHARACTER (TREES, STREETLIGHTS, DRIVEWAY GRADES, & UTILITY LOCATIONS), THEN OPTION B WILL BE USED.
4. BIKE LANES TO BE DELINEATED BY SOLID WHITE THERMOPLASTIC MARKING.

TOWN OF COMOX

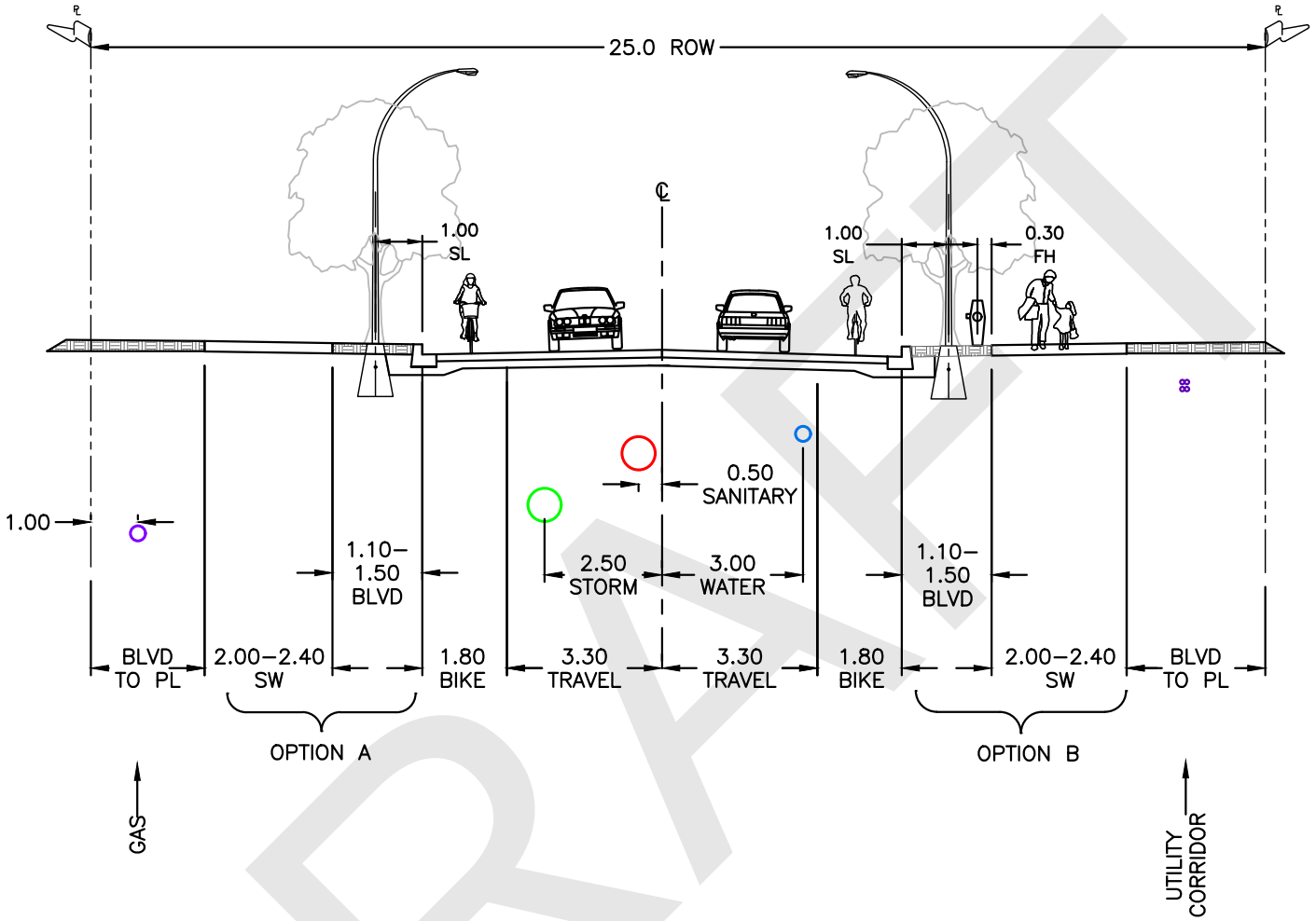
ARTERIAL (4–LANE) CROSS SECTION

DRAWING NUMBER: R13

REVISION NUMBER: A

SCALE: N.T.S.

January 2025



2 LANE ARTERIAL STANDARD

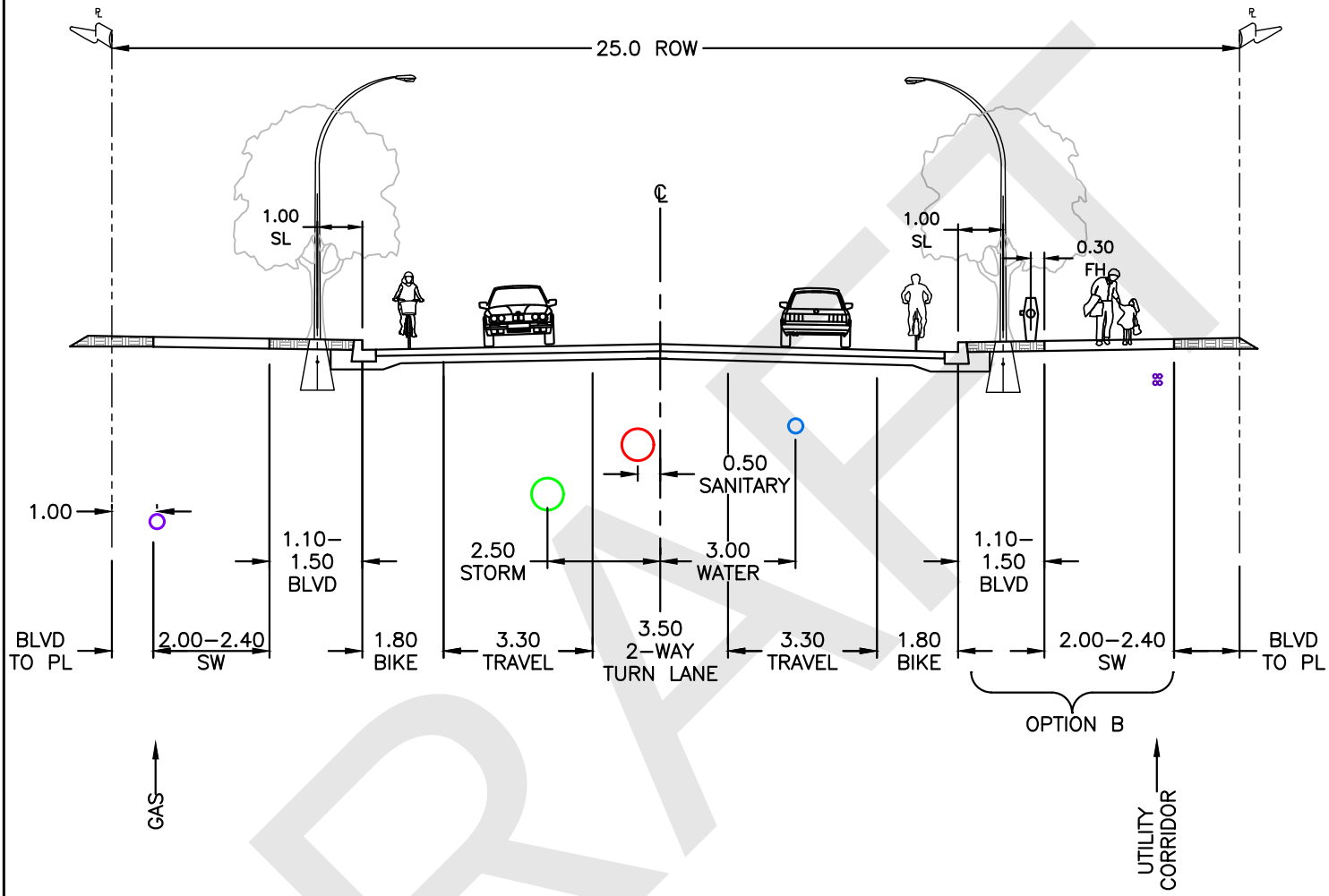
NOTE:
1. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED.
2. BOULEVARD DEFAULT OF 1.1m WITH THE OPTION TO INCREASE TO 1.5m IF CONFLICT WITH EXISTING NEIGHBOURHOOD CHARACTER (TREES, STREETLIGHTS, DRIVEWAY GRADES, & UTILITY LOCATIONS).
3. SIDEWALK WIDTH TO BE 2.4m WITH THE OPTION TO DECREASE TO 2.0m DEPENDING ON EXISTING NEIGHBOURHOOD CHARACTER (TREES, STREETLIGHTS, DRIVEWAY GRADES, & UTILITY LOCATIONS).
4. OPTION A IS THE DEFAULT LAYOUT UNLESS THERE IS A CONFLICT WITH THE EXISTING NEIGHBOURHOOD CHARACTER (TREES, STREETLIGHTS, DRIVEWAY GRADES, & UTILITY LOCATIONS), THEN OPTION B WILL BE USED.
5. BIKE LANES TO BE DELINEATED BY SOLID WHITE THERMOPLASTIC MARKING.

TOWN OF COMOX

ARTERIAL (2–LANE) CROSS SECTION

DRAWING NUMBER	R14
REVISION NUMBER	A
SCALE	N.T.S.

January 2025



3 LANE ARTERIAL STANDARD

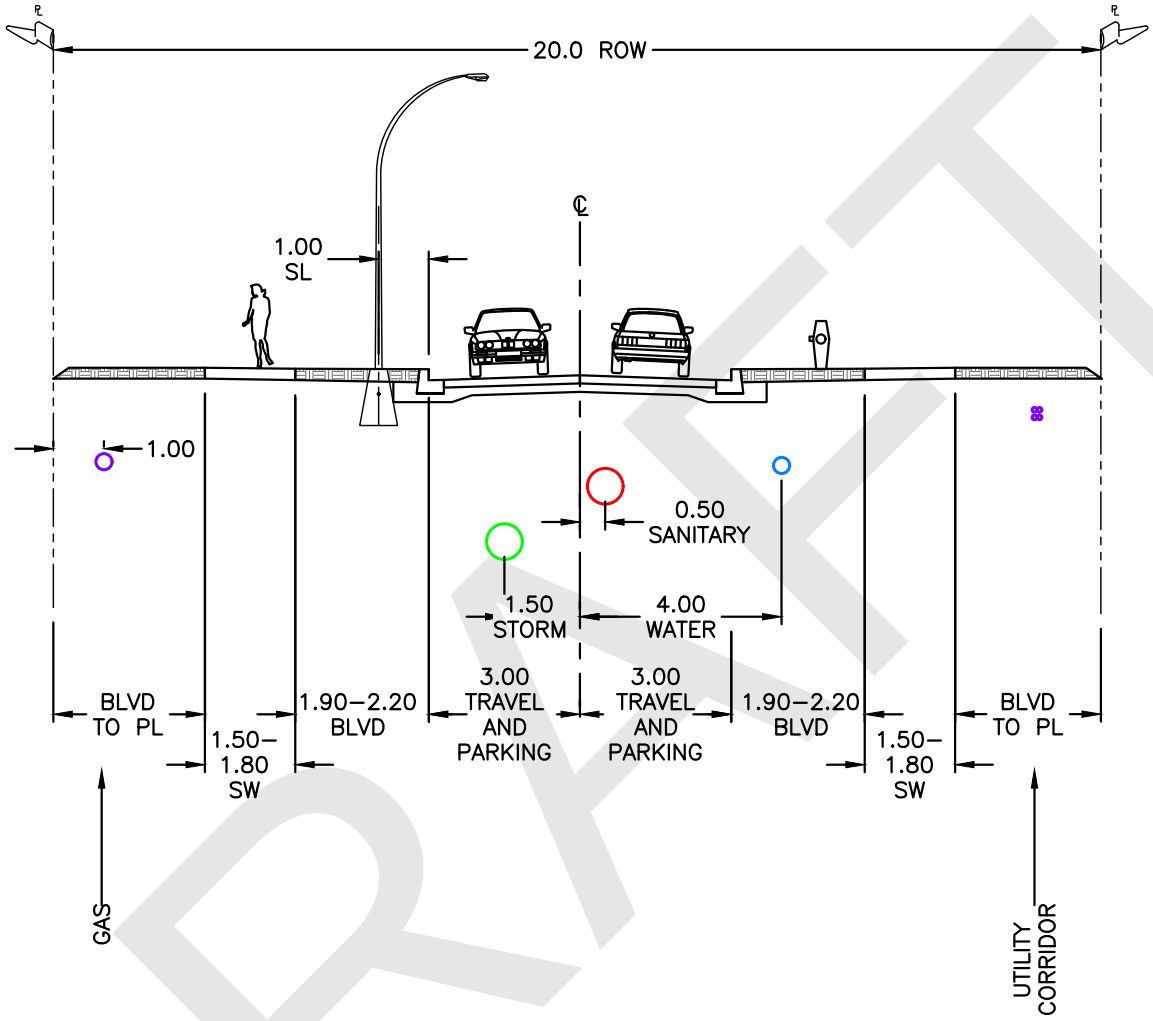
NOTE:
1. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED.
2. SIDEWALK WIDTH TO BE 2.4m WITH THE OPTION TO DECREASE TO 2.0m DEPENDING ON EXISTING NEIGHBOURHOOD CHARACTER (TREES, STREETLIGHTS, DRIVEWAY GRADES, & UTILITY LOCATIONS).
3. OPTION A IS THE DEFAULT LAYOUT UNLESS THERE IS A CONFLICT WITH THE EXISTING NEIGHBOURHOOD CHARACTER (TREES, STREETLIGHTS, DRIVEWAY GRADES, & UTILITY LOCATIONS), THEN OPTION B WILL BE USED.
4. BIKE LANES TO BE DELINEATED BY SOLID WHITE THERMOPLASTIC MARKING.

TOWN OF COMOX

ARTERIAL (3–LANE) CROSS SECTION

DRAWING NUMBER	R15
REVISION NUMBER	A
SCALE	N.T.S.

January 2025



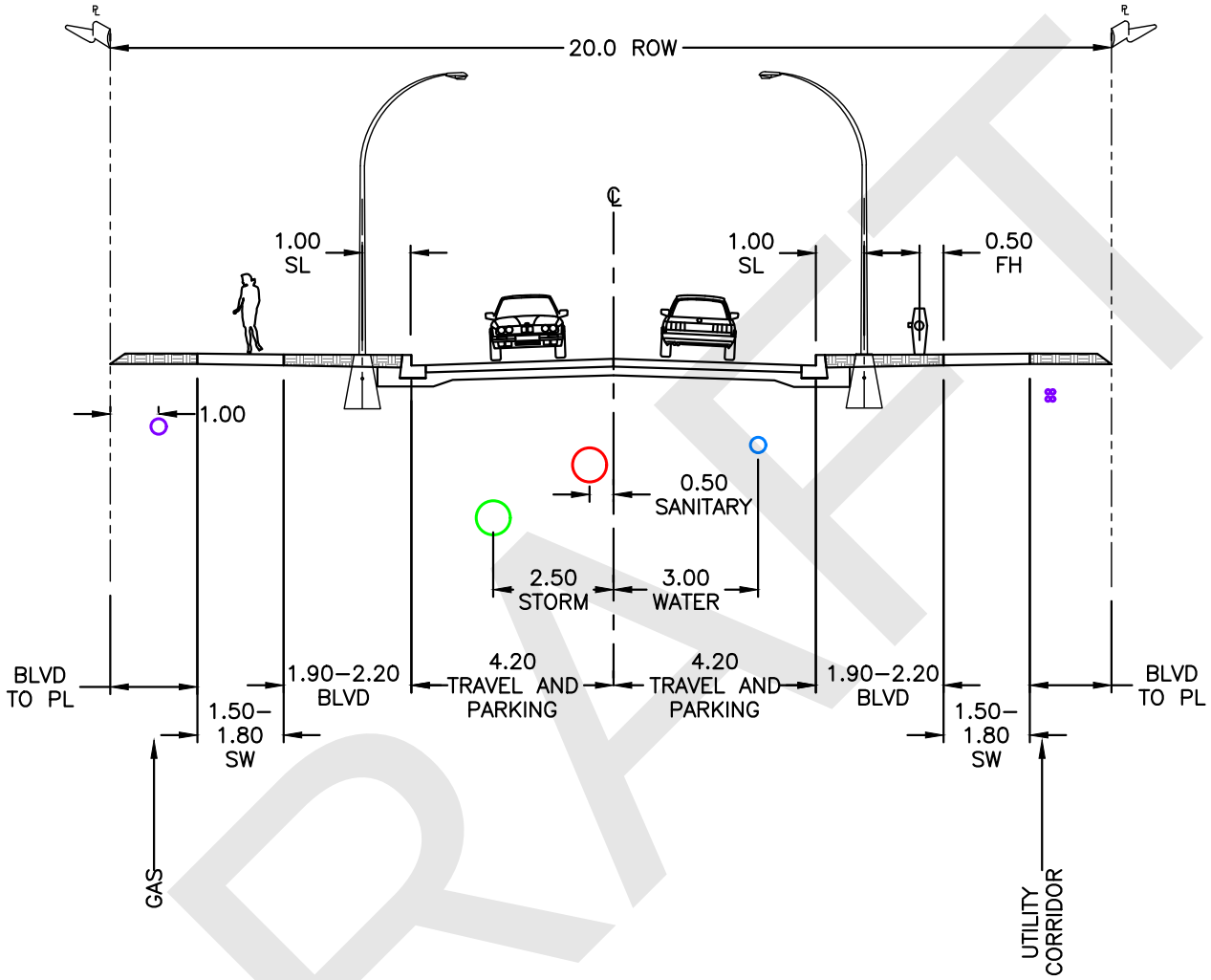
NOTE:
1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. BOULEVARD WIDTH OF 1.9m IF SIDEWALK IS 1.8m.
3. BOULEVARD WIDTH OF 2.2m IF SIDEWALK IS 1.5m.

TOWN OF COMOX

LOCAL ROAD A
CROSS SECTION

DRAWING NUMBER	R16a
REVISION NUMBER	A
SCALE	N.T.S.

January 2025



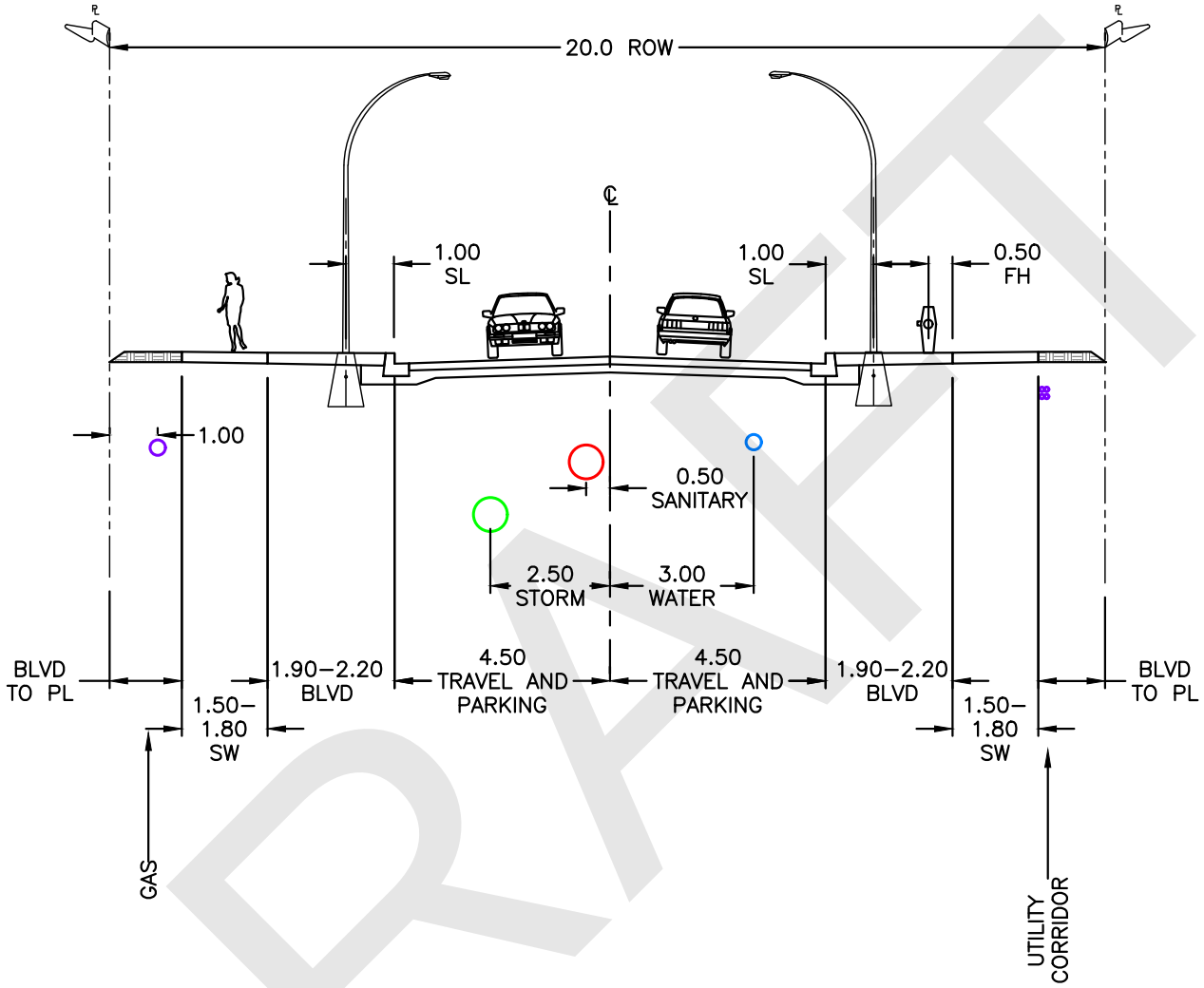
NOTE:
1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. BOULEVARD WIDTH OF 1.9m IF SIDEWALK IS 1.8m.
3. BOULEVARD WIDTH OF 2.2m IF SIDEWALK IS 1.5m.

TOWN OF COMOX

LOCAL ROAD B
CROSS SECTION

DRAWING NUMBER	R16b
REVISION NUMBER	A
SCALE	N.T.S.

January 2025



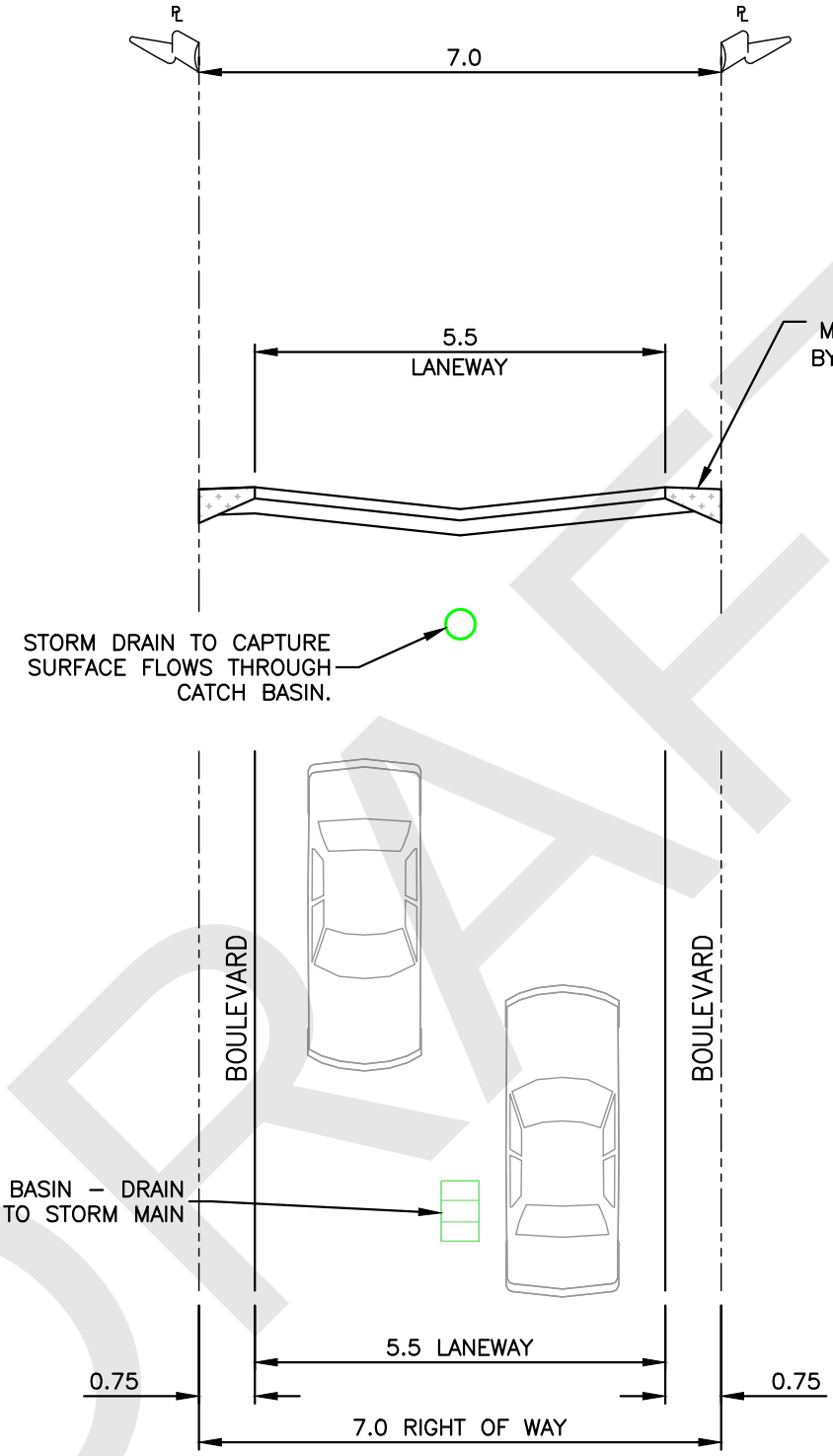
NOTE:
1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. BOULEVARD WIDTH OF 1.9m IF SIDEWALK IS 1.8m.
3. BOULEVARD WIDTH OF 2.2m IF SIDEWALK IS 1.5m.

TOWN OF COMOX

LOCAL ROAD C
CROSS SECTION

DRAWING NUMBER	R16c
REVISION NUMBER	A
SCALE	N.T.S.

January 2025



NOTE:

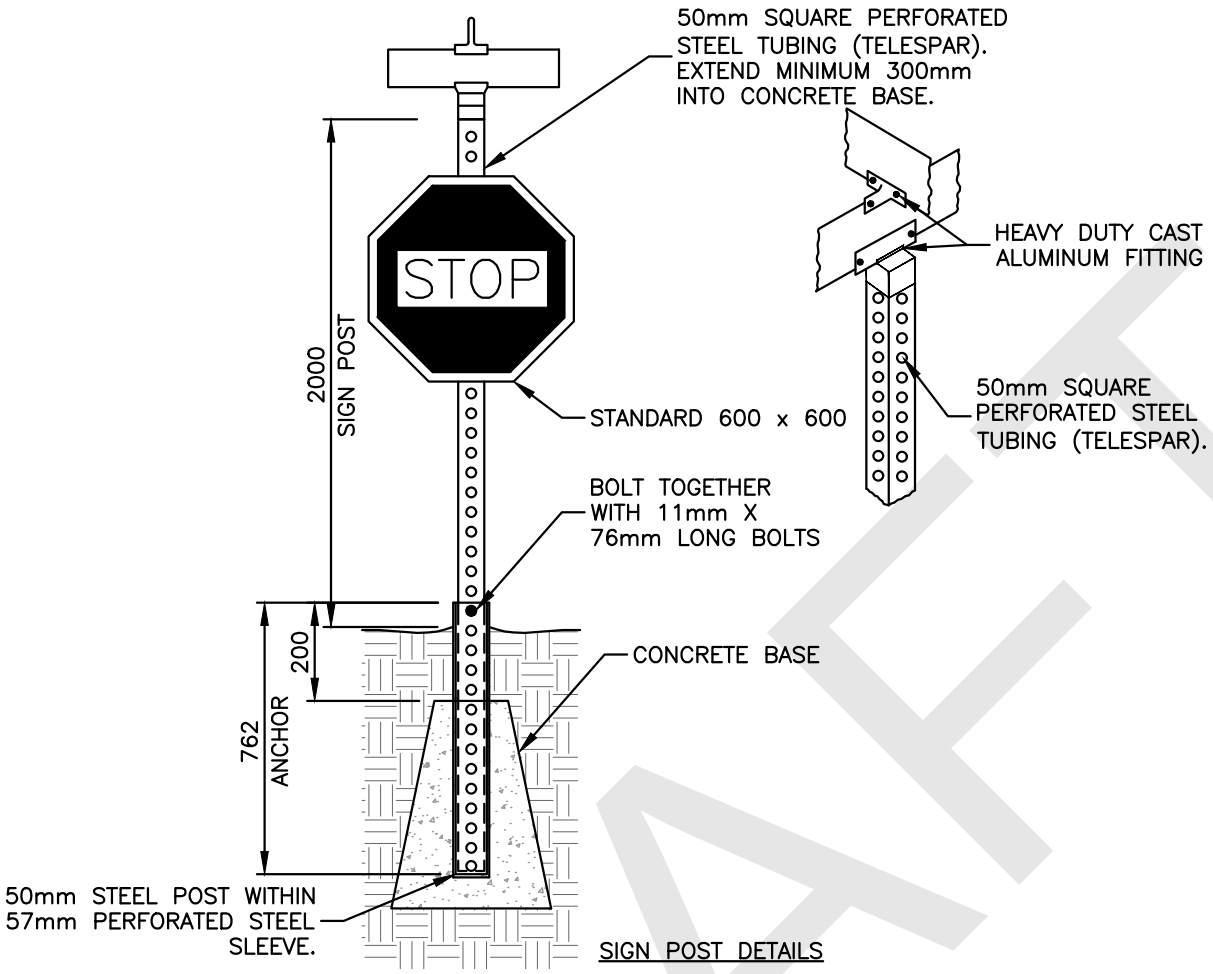
1. ALL DIMENSIONS IN METERS UNLESS OTHERWISE NOTED.

TOWN OF COMOX

LANE

DRAWING NUMBER	REVISION NUMBER	SCALE
R17	A	N.T.S.

January 2025



SIGN POST DETAILS

Substrate		Main Text	
Material	6" (150mm) extruded aluminum	**Height**	3.875" - 100mm
Length	16" - 32" with 2" increments	**Font**	Helvetica Compact
Sides	Double sided	**Force**	80%
Colour	Blue EG	**Colour**	White EG
Reflectiviy	ASTM 1	**CAP**	Upper case
Logo		**End Text**	
Size	3.875" - 100mm	**Size**	3.875" - 100mm
Placement	Left, 1" from edge	**CAP**	Upper case
Other		**Alignment**	Justified center

SIGN DETAILS

NOTE:

1. ALL DIMENSIONS IN MILLIMETERS UNLESS NOTED OTHERWISE.
2. STREET NAME SIGNS AND SIGN POSITION SHALL CONFORM TO THE MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES FOR CANADA.
3. STOP SIGN BLANK SHALL BE 12 ga. (0.0081) S0SH32 ALLOY ALUMINUM OR EQUAL.
4. STOP SIGN FACE SHALL BE STANDARD 600 x 600 ENGINEERING GRADE REFLECTORIZED WHITE OR REFLECTORIZED RED.

TOWN OF COMOX

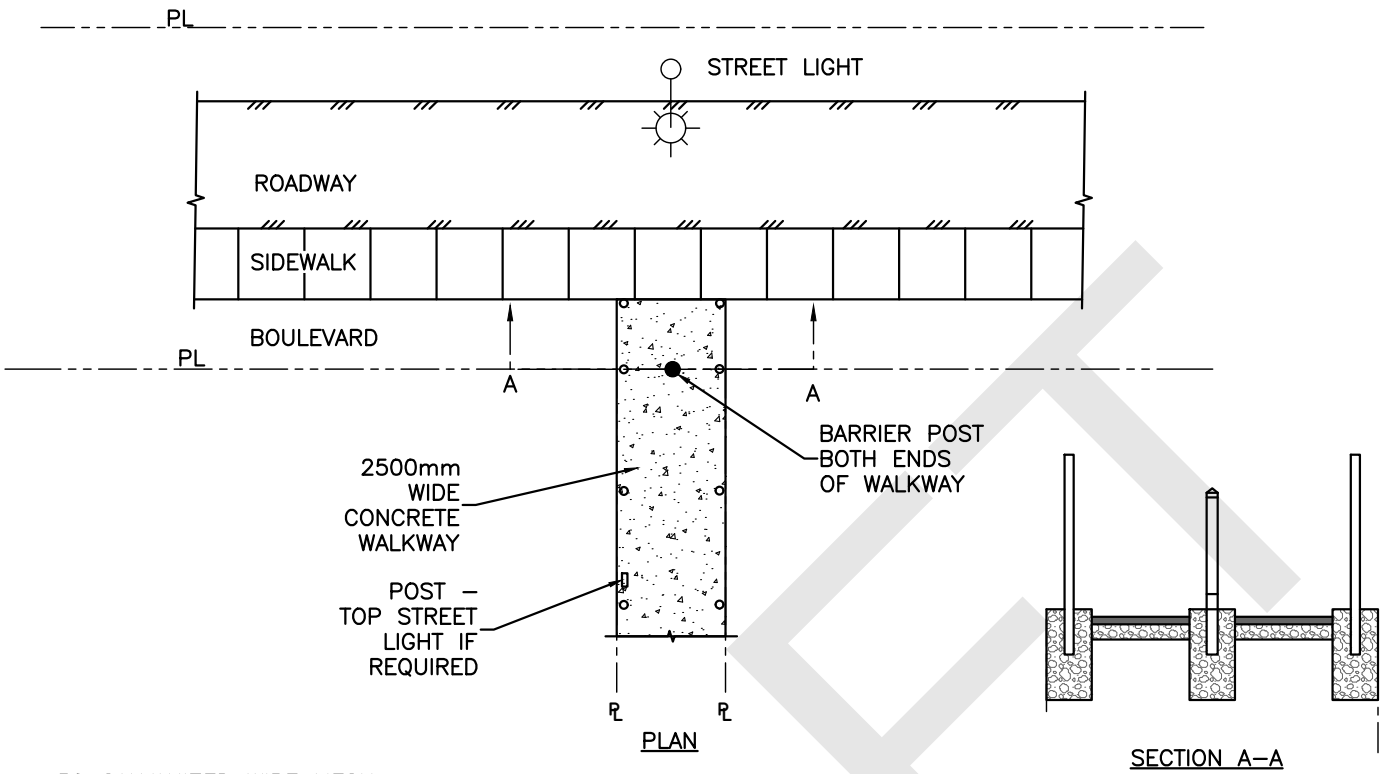
STREET NAME AND STOP SIGN

DRAWING NUMBER R18

REVISION NUMBER A

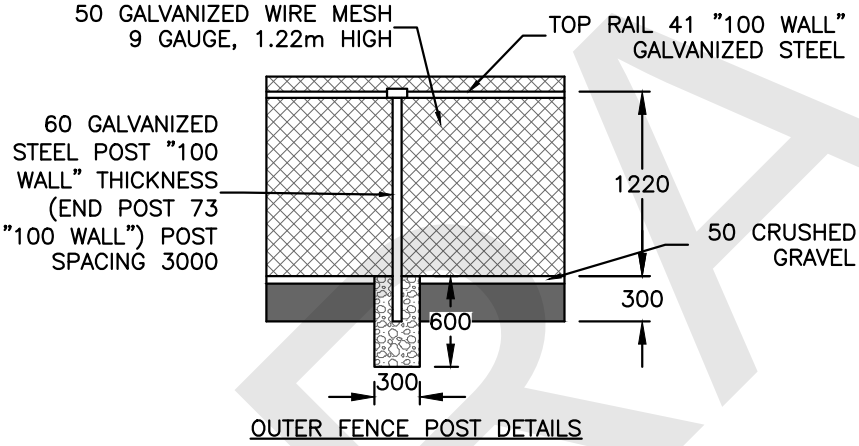
SCALE N.T.S.

January 2025

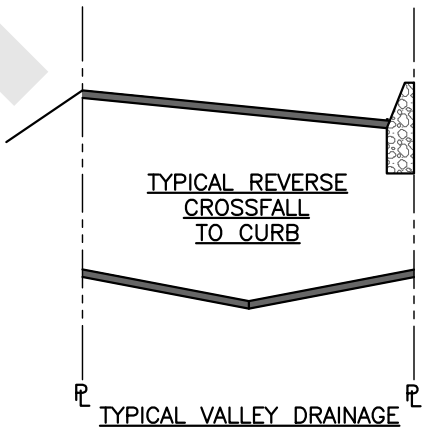


PLAN

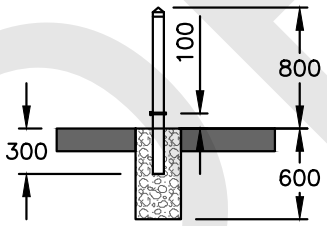
SECTION A–A



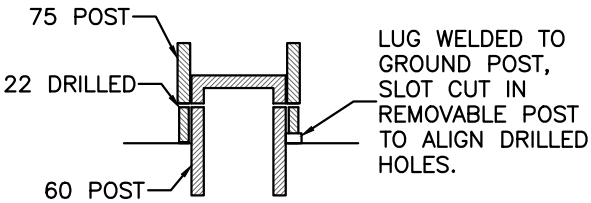
OUTER FENCE POST DETAILS



TYPICAL VALLEY DRAINAGE



BARRIER POST OVERALL DIMENSIONS



– BASE DETAIL

NOTE:

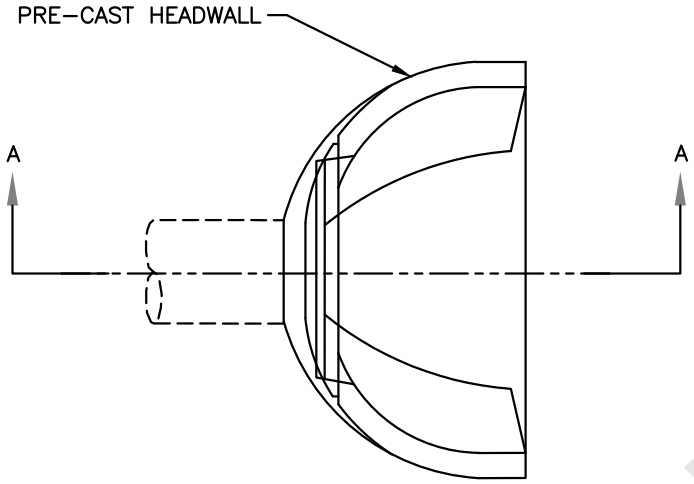
1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.
2. SLOPE OF WALKWAY TO BE MIN. OF 2% WITH POSITIVE DRAINAGE.

January 2025

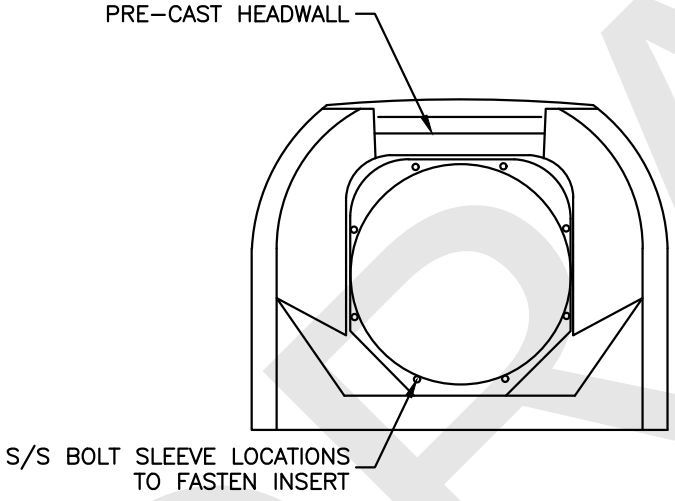
TOWN OF COMOX

PEDESTRIAN CONNECTION

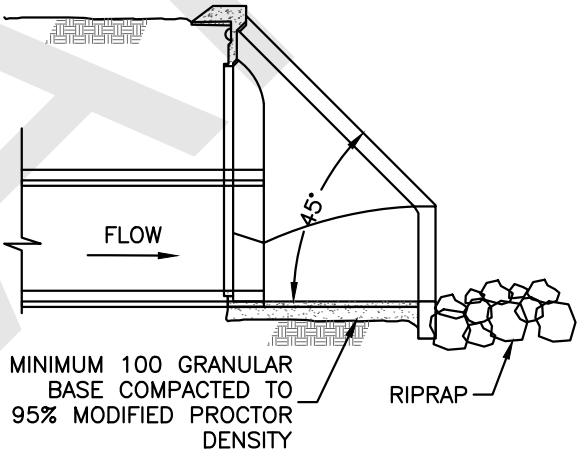
DRAWING NUMBER	R19
REVISION NUMBER	A
SCALE	N.T.S.



PLAN



ELEVATION



SECTION A–A

NOTE:

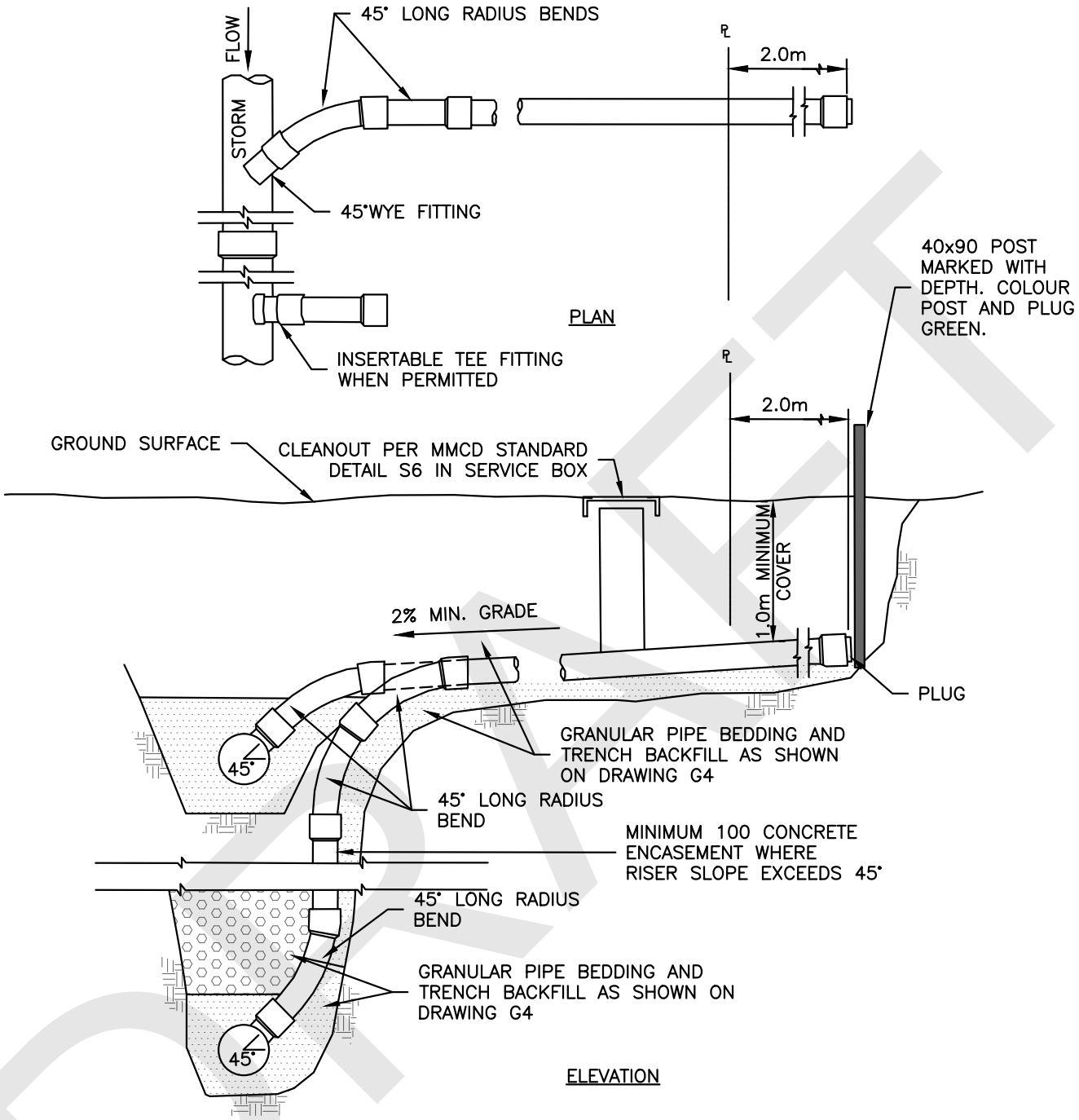
1. SAFETY GRILLAGE MAY BE SPECIFIED SHOULD DEBRIS MANAGEMENT BE REQUIRED AT THE CULVERT LOCATION.

January 2025

TOWN OF COMOX

CULVERT HEADWALL

DRAWING NUMBER	S18
REVISION NUMBER	A
SCALE	N.T.S.



NOTE:

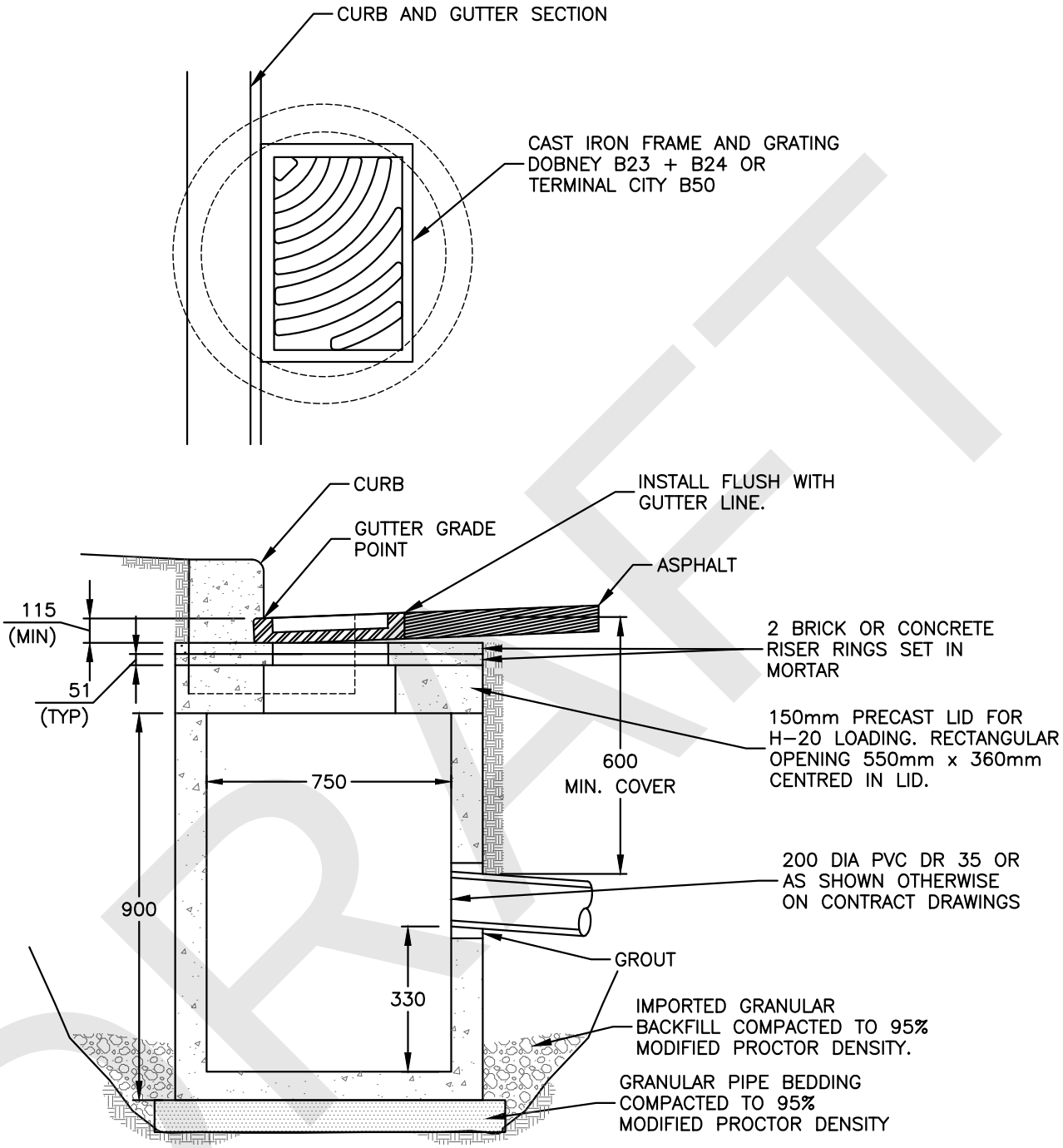
1. CONCRETE STORM SEWER PIPES TO BE PROVIDED WITH SUPPLIER INSTALLED PVC STUB.
2. CONNECTIONS TO BE 100 MINIMUM OR LARGER AS SPECIFIED ON CONTRACT DRAWINGS.
3. RISER TYPE SERVICE TO BE USED ONLY WHEN SERVICE IS MORE THAN 2.4m ABOVE WYE INVERT OR AS DIRECTED BY CONTRACT ADMINISTRATOR.
4. LOCATION OF SERVICE AND MARKER AS SHOWN ON CONTRACT DRAWINGS.
5. ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED.

TOWN OF COMOX

STORM SEWER SERVICE CONNECTION

DRAWING NUMBER	S19
REVISION NUMBER	A
SCALE	N.T.S.

January 2025



NOTE:

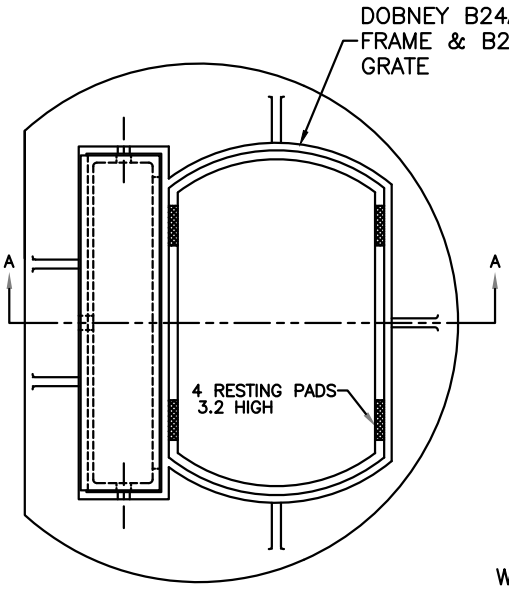
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE SHOWN.
2. PRECAST UNITS c/w BASE AND H–20 RATING, APPROVED BY CONTRACT ADMINISTRATOR, ARE ACCEPTABLE.

TOWN OF COMOX

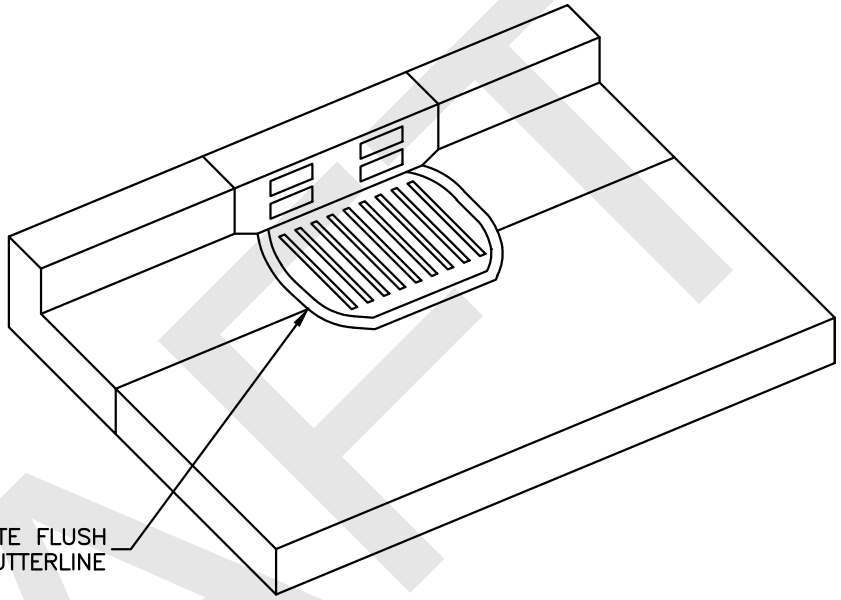
CATCH BASIN WITH FLAT GRATE

DRAWING NUMBER	REVISION NUMBER	SCALE
S20	A	N.T.S.

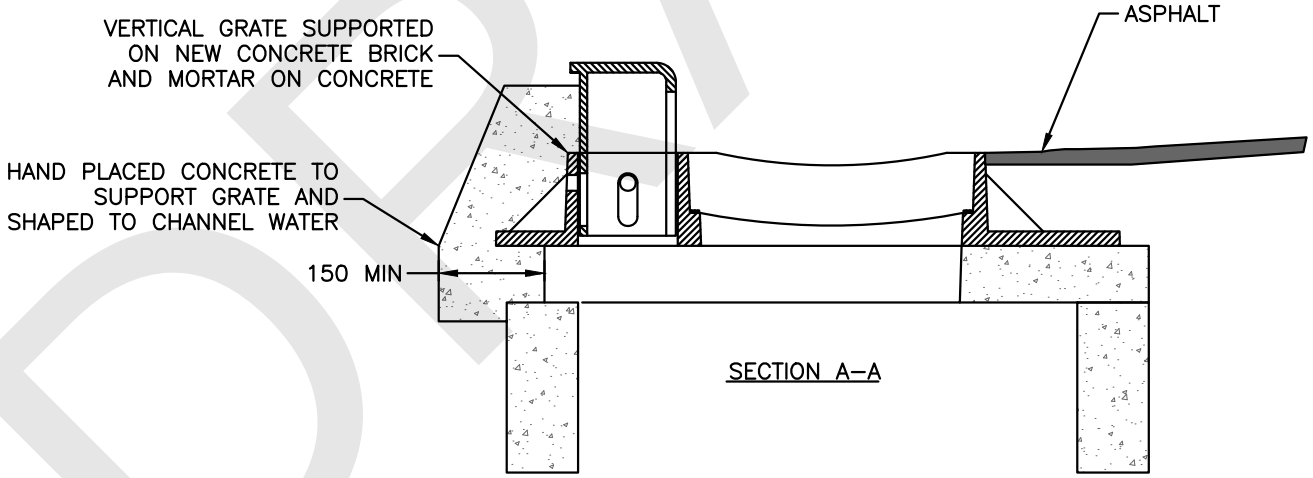
January 2025



PLAN VIEW



ISOMETRIC VIEW



SECTION A–A

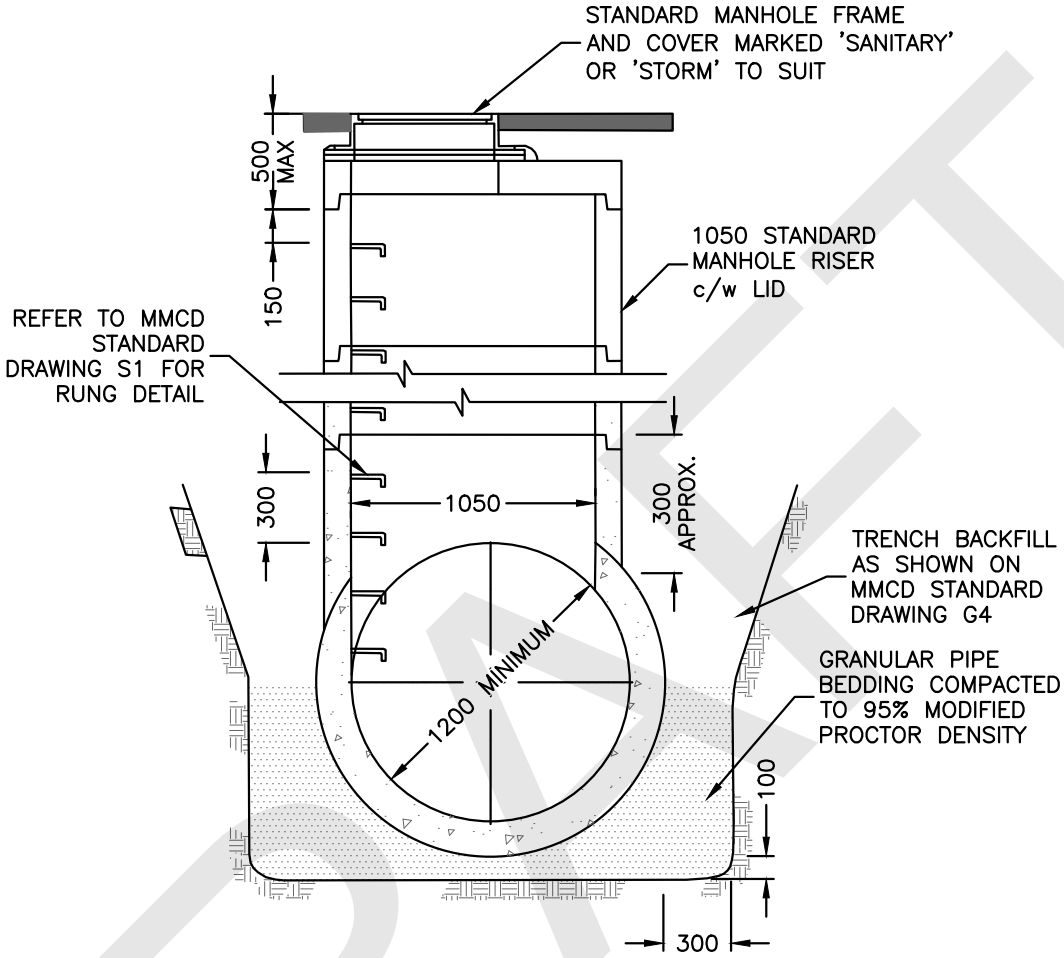
NOTES
1. DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED.

TOWN OF COMOX

CATCH BASIN WITH COMBINED INLET

DRAWING NUMBER	S21
REVISION NUMBER	A
SCALE	N.T.S.

January 2025



ELEVATION

NOTE:

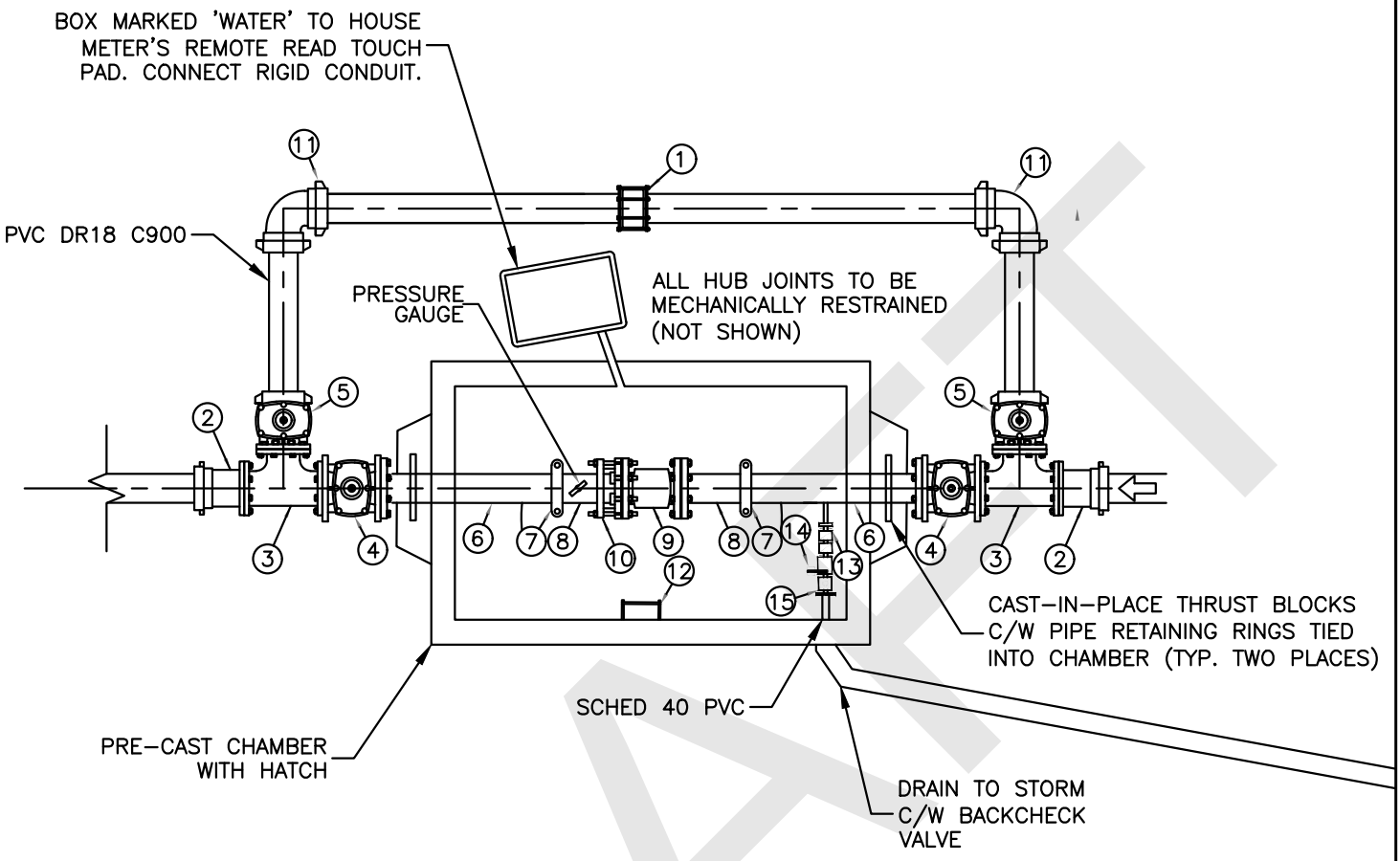
1. PRECAST RISER MANHOLES SUBJECT TO TOWN APPROVAL.
2. MAXIMUM DEPTH TO FIRST RUNG IS 500mm. WHEN HANDHOLD IS INSTALLED BETWEEN TOP AND FIRST RUNG, MAXIMUM DEPTH MAY BE INCREASED TO 660mm.
3. REFER TO CONTRACT DRAWINGS, SECTIONS 33 40 01 OR 33 30 01 AS APPLICABLE AND SECTION 33 44 01 FOR DETAILED SPECIFICATIONS.
4. ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED.

TOWN OF COMOX

PRECAST RISER MANHOLE

DRAWING NUMBER	S22
REVISION NUMBER	A
SCALE	N.T.S.

January 2025



ITEM	DESCRIPTION	QTY
1	PIPE COUPLER	2
2	FLxH ADAPTER	2
3	FL TEE	2
4	FL GATE VALVE (NORMALLY OPEN) C/W STD VALVE BOX	2
5	FLxH GATE VALVE (NORMALLY CLOSED) C/W LOCKABLE VALVE BOX	2
6	S.S. SCH10 FLxGRV SPOOL	2
7	S.S. GROOVE COUPLER	2
8	S.S. SCH10 FLxGRV SPOOL	2
9	SENSUS HYDROVERSE METER	1
10	DISMANTLING JOINT	1
11	90° HxH BEND	2
12	GALVANIZED MANHOLE LADDER (SET)	1
13	DOUBLE CHECK BACKFLOW PREVENTER ASSEMBLY	1
14	FLOAT VALVE c/w PVC FLOAT ROD AND FLOAT	1
15	BLUE FLUID EJECTOR	1

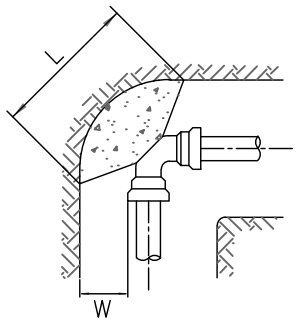
NOTE: PIPE SIZE TO MATCH SERVICE SIZE.

January 2025

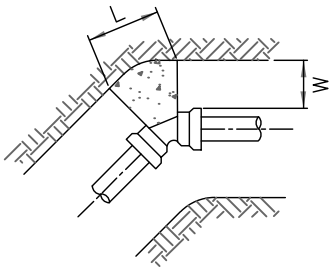
TOWN OF COMOX

WATER METER FOR SERVICES GREATER THAN 50mm

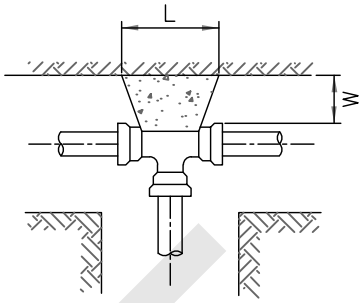
DRAWING NUMBER	W11
REVISION NUMBER	A
SCALE	N.T.S.



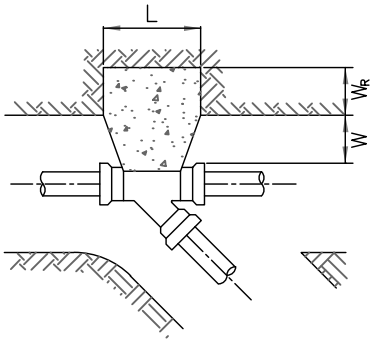
HORIZONTAL 90° BEND



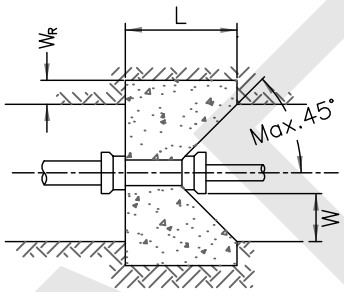
HORIZONTAL 45° BEND



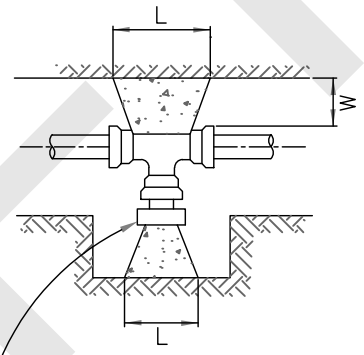
TEE



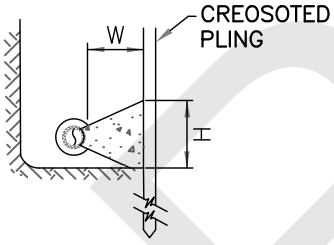
WYE



REDUCER

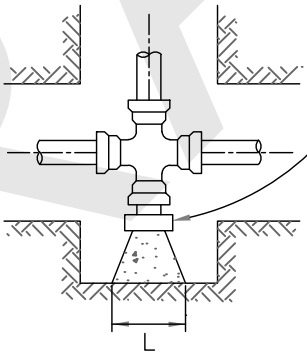


TEE WITH PLUG

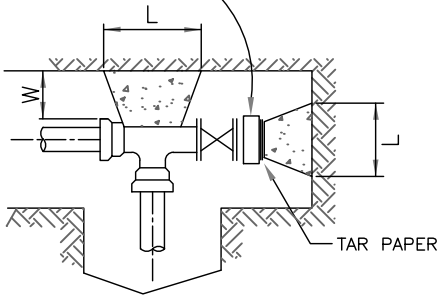


Note: WHERE GROUND CANNOT BE EXCAVATED TO FREE STANDING UNDISTURBED SOIL. SMALL PLANK SHEET PILING SHALL BE DRIVEN TO PROVIDE UNDISTURBED THRUST AREA. PILING TO BE DRIVEN PRIOR TO EXCAVATING FOR THRUST BLOCK. PILING SHOULD BE USED ONLY BELOW THE PERMANENT WATER TABLE.

BLOCK & PLING



CROSS WITH PLUG



TEE WITH VALVE

NOTES:

1. ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED.
2. CONCRETE TO HAVE A 28 DAY COMPRESSIVE STRENGTH OF 20MPa.
3. SEE DRAWING W102 FOR DIMENSION VALUES L,W,H & W_R FOR THE INDICATED GEOTECHNICAL CONDITIONS.

January 2025

TOWN OF COMOX

THRUST BLOCKING (PAGE 1 OF 2)

DRAWING NUMBER	W12
REVISION NUMBER	A
SCALE	N.T.S.

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	150 200 250 300	300 350 380 400		920 1070 1450 1650	460 610 760 920
45° BEND	150 200 250 300	300 350 380 400		460 610 760 920	460 610 760 920
22.5° BEND	150 200 250 300	300 350 380 400		460 610 840 920	230 300 460 460
TEE	150 200 250 300	300 350 380 400		610 760 990 1220	460 610 760 920
CROSS	150 200 250 300	300 350 380 400		610 760 990 1220	460 610 760 920
45° WYE	150 200 250 300	300 350 380 400	300 400 500 600	460 610 760 920	460 610 760 920
REDUCER	150 200 250 300	300 350 380 400	150 200 250 300	460 610 760 920	460 610 760 920
CAPS&PLUGS (if not bolted)	150 200 250 300	300 350 380 400		460 610 760 920	460 610 760 920

TOWN OF COMOX

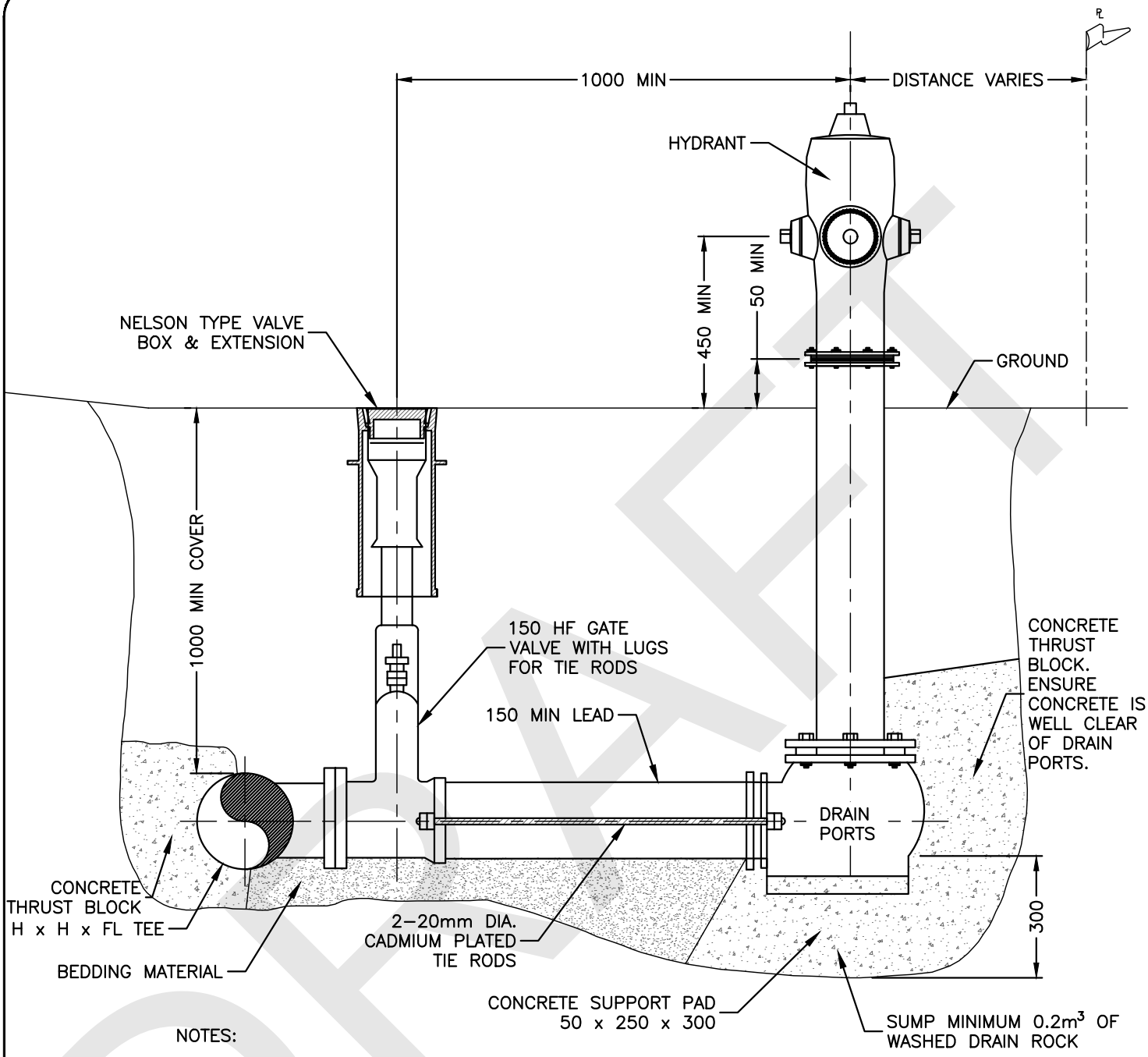
THRUST BLOCKING
(PAGE 2 OF 2)

DRAWING NUMBER
W13

REVISION NUMBER
A

SCALE
N.T.S.

January 2025



NOTES:

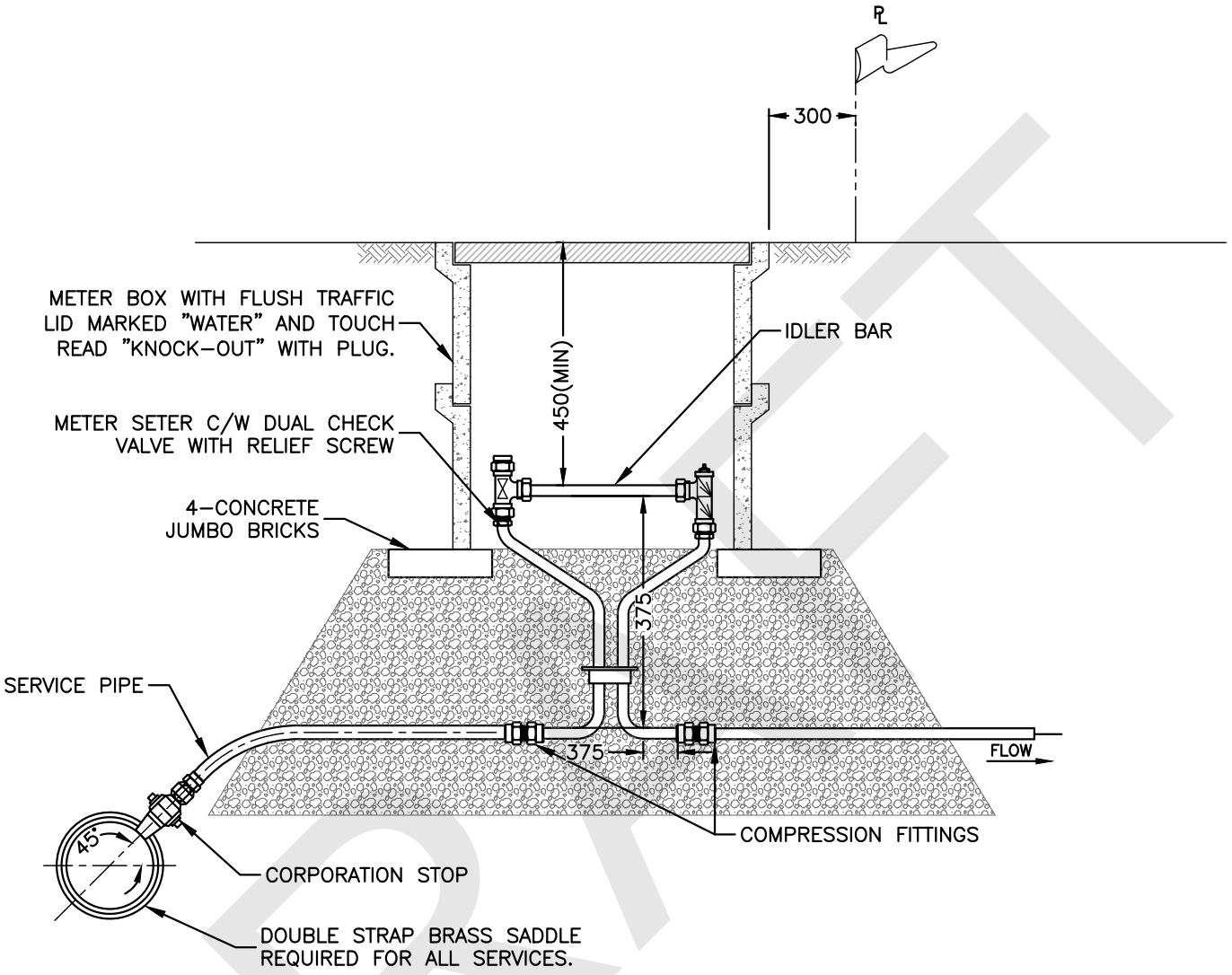
1. UNITS IN MILLIMETERS UNLESS OTHERWISE NOTED.
2. HYDRANTS SHALL BE COMPRESSION TYPE AND EACH SHALL CONTAIN:
   2.1. PUMPER PORT – 5.75 IN. OD, FOUR (4) THREADS PER INCH.
   2.2. 65mm STANDARD BC HYDRANT THREAD.
3. HOSE AND PUMPER NOZZLE MUST FACE ROADWAY.
4. HYDRANT BODY COLOUR – RED WITH WHITE NUTS AND CAP.
5. HYDRANT OPERATING NUTS AND NOZZLE CAP NUTS SHALL BE AWWA STANDARD PENTAGONAL. DIRECTION OF OPENING SHALL BE COUNTER–CLOCKWISE.

TOWN OF COMOX

HYDRANT

DRAWING NUMBER	REVISION NUMBER	SCALE
W14	A	N.T.S.

January 2025



NOTE:

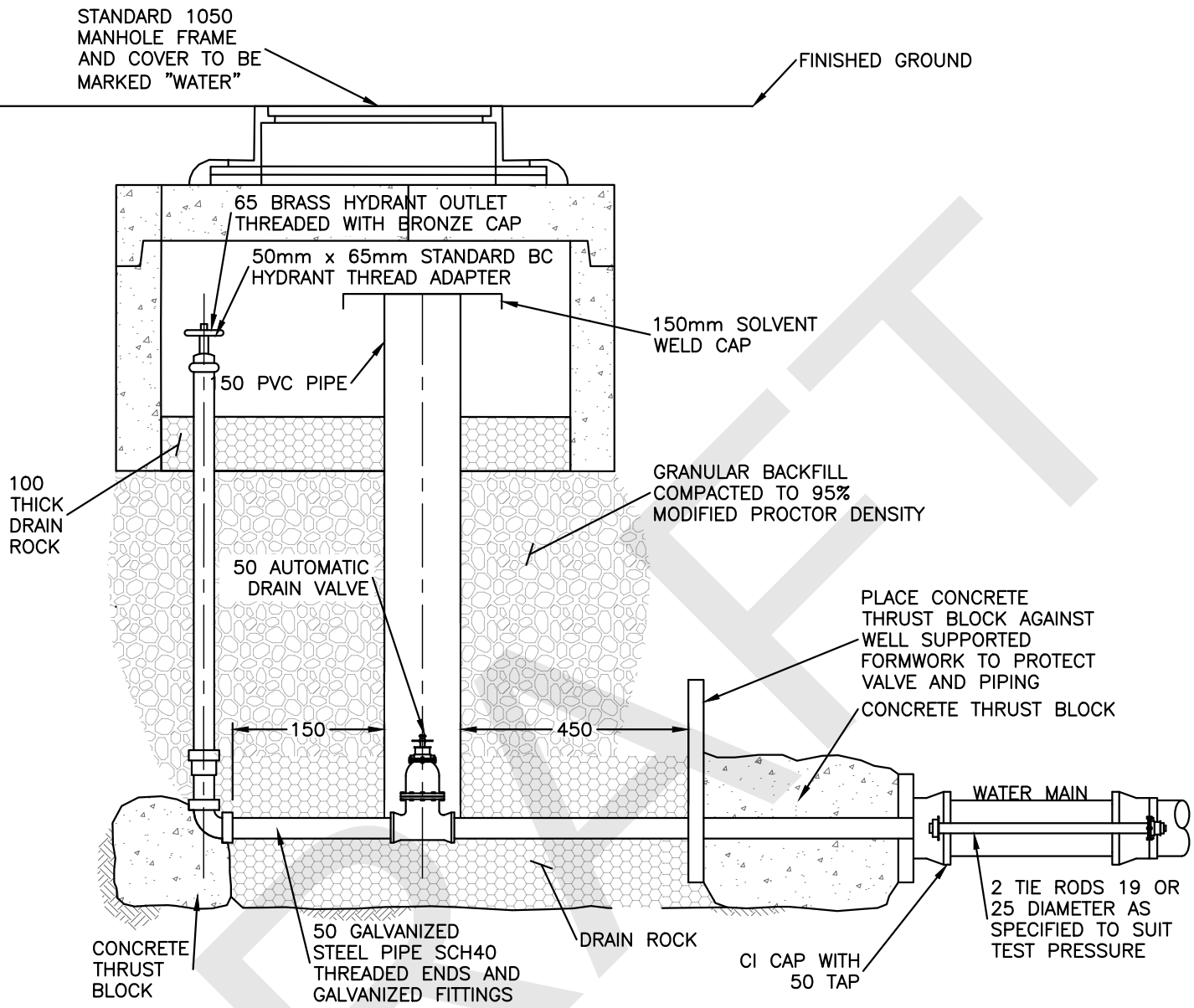
1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.
2. INSTALL SERVICE PIPE WITH "GOOSE NECK" IN HORIZONTAL POSITION.
3. ADDITIONAL METER "RISERS" SHALL BE EMPLOYED TO ACHIEVE A DEPTH OF COVER BETWEEN 450mm AND 60mm AS MEASURED BETWEEN THE FINISHED GRADE AND THE IDLER ARM.

TOWN OF COMOX

25 mm WATER SERVICE CONNECTION

DRAWING NUMBER	W15
REVISION NUMBER	A
SCALE	N.T.S.

January 2025



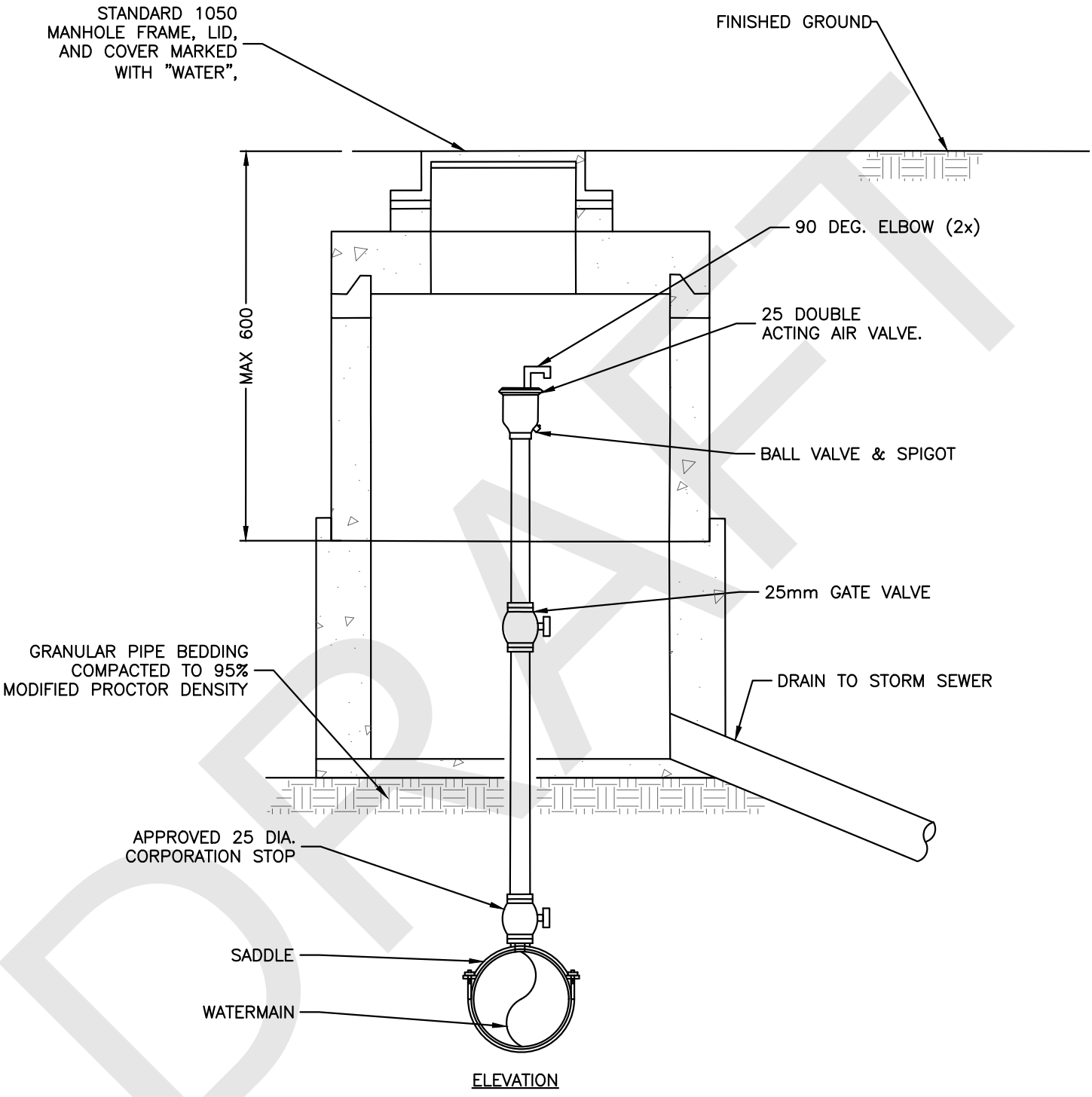
NOTES:
1. ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE SHOWN.

TOWN OF COMOX

BLOW OFF ASSEMBLY

DRAWING NUMBER	W16
REVISION NUMBER	A
SCALE	N.T.S.

January 2025



ELEVATION

NOTE:
1. ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED.
2. AIR VALVES TO BE LOCATED OUTSIDE OF THE TRAVELLED PORTION OF THE ROADWAY.

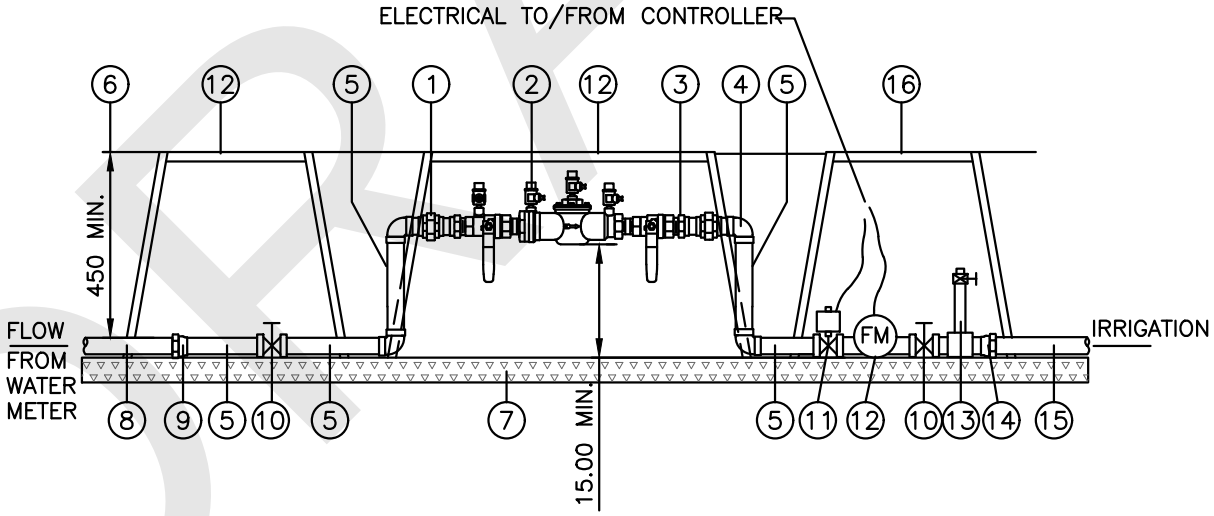
TOWN OF COMOX

AIR VALVE ASSEMBLY

DRAWING NUMBER	W17
REVISION NUMBER	A
SCALE	N.T.S.

January 2025

#	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



January 2025

TOWN OF COMOX

IRRIGATION BACKFLOW PREVENTION (PART 1 OF 2)

DRAWING NUMBER: L1

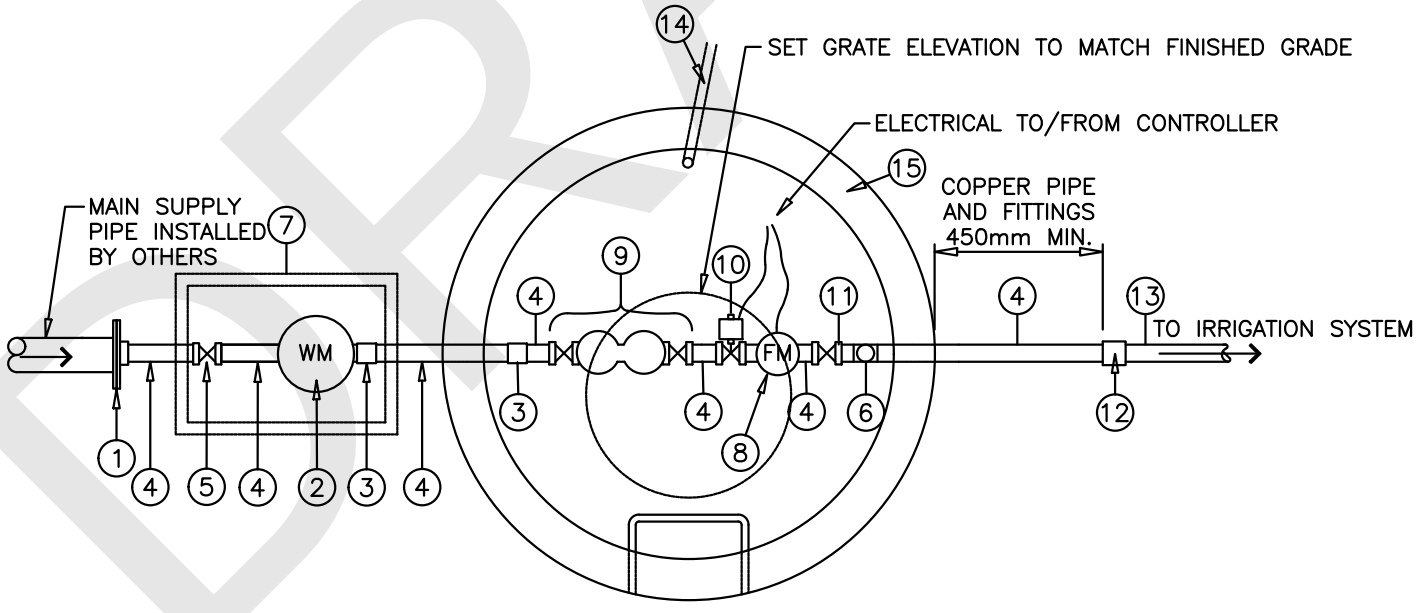
REVISION NUMBER: A

SCALE: N.T.S.

#	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 C\W 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 C\W 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:

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



PLAN

TOWN OF COMOX

IRRIGATION BACKFLOW PREVENTION (PART 2 OF 2)

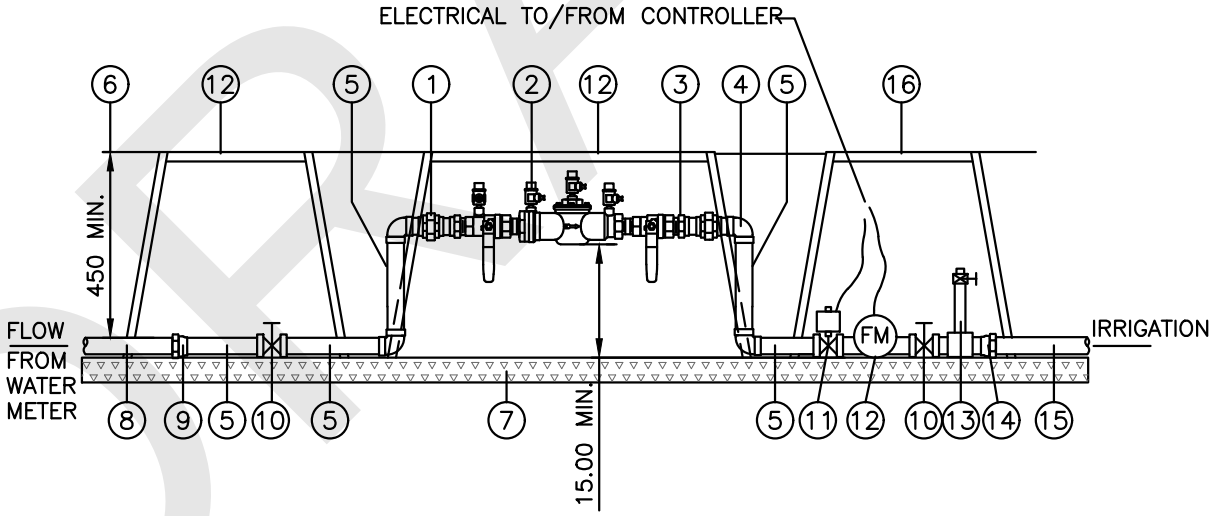
DRAWING NUMBER: L2

REVISION NUMBER: A

SCALE: N.T.S.

January 2025

#	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



January 2025

TOWN OF COMOX

IRRIGATION BACKFLOW PREVENTION (PART 1 OF 2)

DRAWING NUMBER: L1

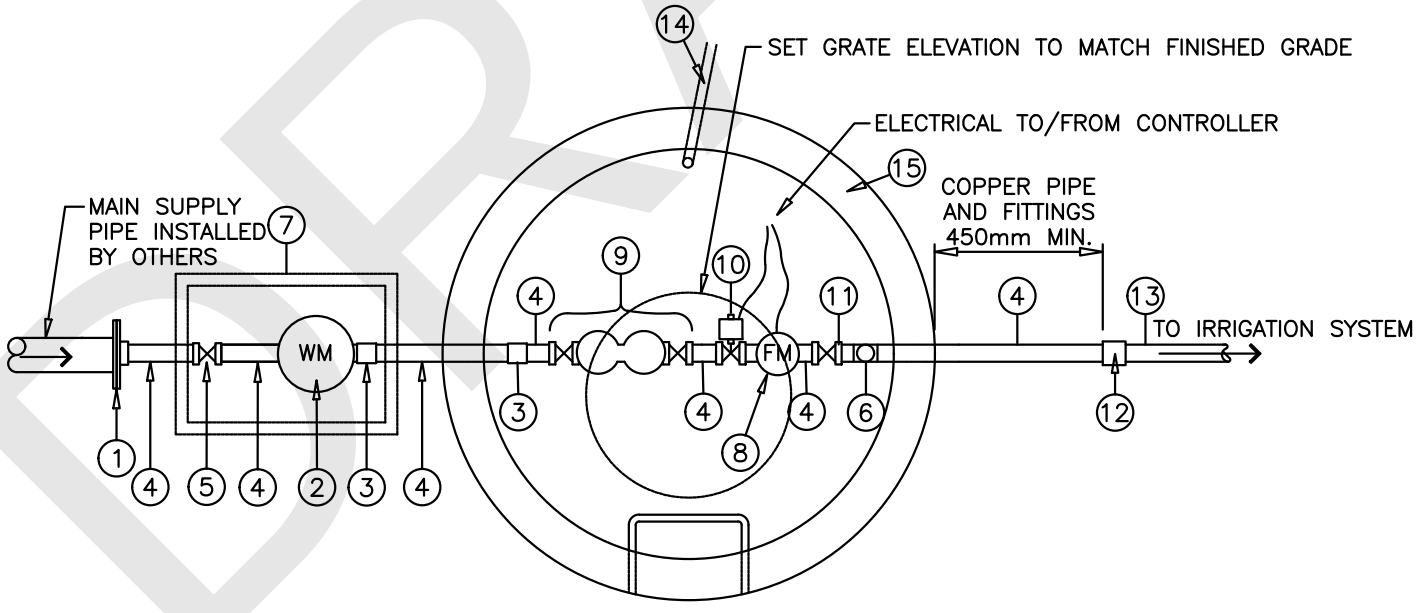
REVISION NUMBER: A

SCALE: N.T.S.

#	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 C\W 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 C\W 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:

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



PLAN

TOWN OF COMOX

IRRIGATION BACKFLOW PREVENTION (PART 2 OF 2)

DRAWING NUMBER: L2

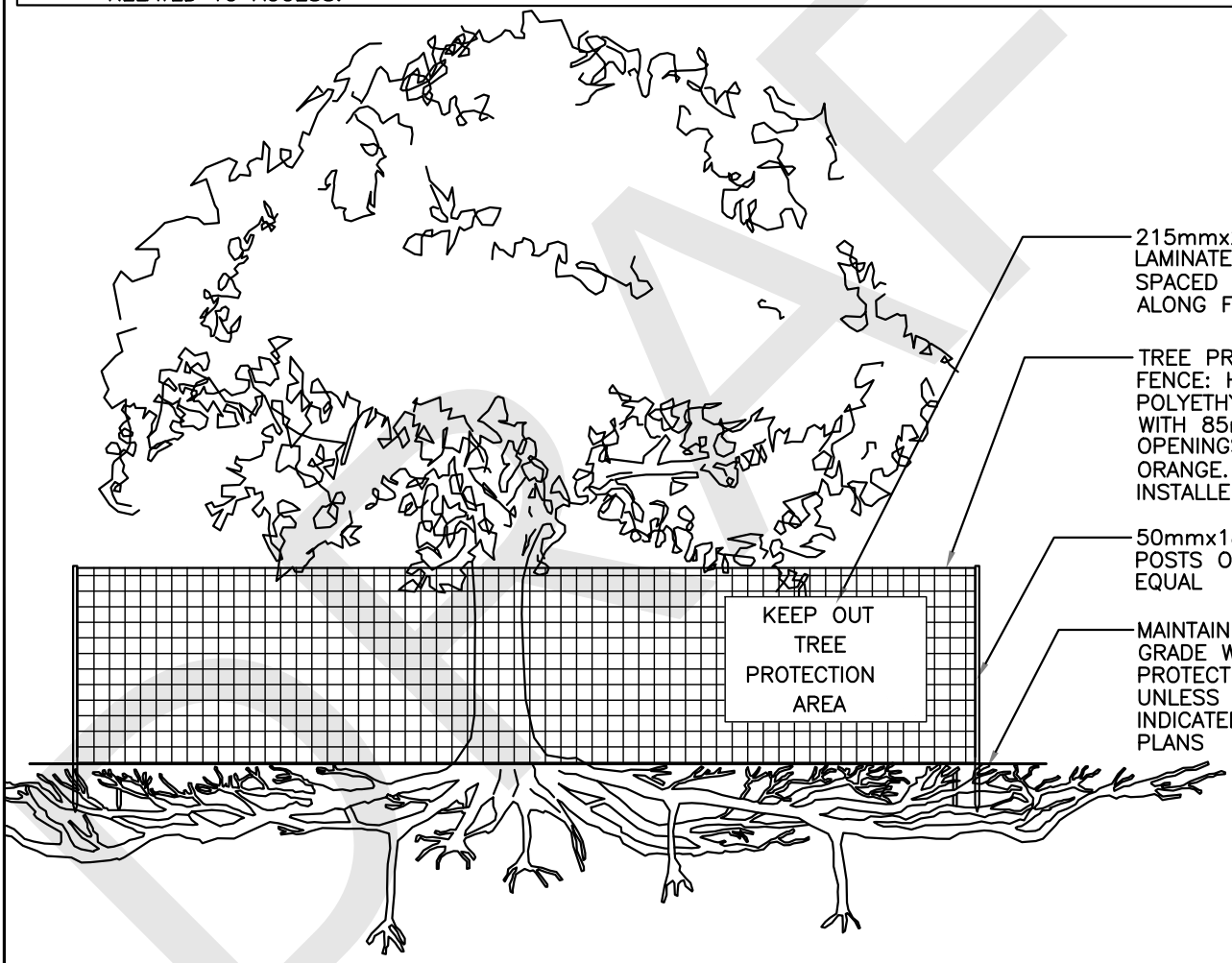
REVISION NUMBER: A

SCALE: N.T.S.

January 2025

NOTES:

1. LOCATION OF TREE PROTECTION FENCING AND LIMIT OF ACCESS FENCING TO BE VERIFIED WITH PROJECT MANAGER AND PROJECT ARBORIST PRIOR TO INSTALLATION.
2. TREE PROTECTION FENCING TO BE INSTALLED IN PRIOR TO ANY LAND DISTURBANCES ON SITE.
3. NO STORAGE OF BUILDING / CONSTRUCTION MATERIALS WITHIN PROTECTED AREAS OR AGAINST PROTECTION BARRIER.
4. ANY PRUNING OF BRANCHES OR ROOTS MUST BE DONE BY THE PROJECT ARBORIST.
5. HAND EXCAVATE ONLY WITHIN DRIPLINE OF TREES TO BE RETAINED SEVERING ROOTS IN EXCESS OF 50mm ø.
6. TREE PROTECTION FENCE IS NOT TO BE LIFTED OR REMOVED AT ANY TIME FOR VEHICULAR ACCESS. VEHICLES AND HEAVY EQUIPMENT CAN CAUSE SOIL COMPACTION IN THE ROOT ZONE DEPLETING THE AIR SPACE THAT IS ESSENTIAL TO THE TREE'S HEALTH.
7. BASED ON CONTRACTOR'S STAGING AND ACCESS REQUIREMENTS, ADDITIONAL TREE PROTECTION FENCING MAY BE REQUIRED.
8. THE TREE PROTECTION SHOWN SHALL BE TO THE EXTENT OF THE DRIP LINE OR AS IDENTIFIED IN THE CONTRACT DOCUMENTS;WHICHEVER IS MORE STRINGENT.
9. ALL EXCAVATION WORK WITHIN TWO METERS OF A TREE PROTECTION ZONE SHOULD BE CONDUCTED UNDER ARBORIST SUPERVISION.
10. TREES INDICATED FOR REMOVAL SHALL ALSO INCLUDE COMPLETE REMOVAL OF STUMPS AND ROOTS AND FILING IN DEPRESSIONS WITH SUITABLE SOIL FILL.
11. FENCING MUST REMAIN THROUGH THE DURATION OF ALL CONSTRUCTION ACTIVITIES. REMOVAL OR RELOCATION OF FENCING FOR TEMPORARY ACCESS MUST BE REPLACED DAILY AND IMMEDIATELY UPON COMPLETION OF WORK RELATED TO ACCESS.



TOWN OF COMOX

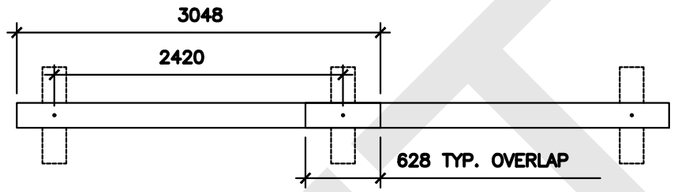
TREE PROTECTION

DRAWING NUMBER	L3
REVISION NUMBER	A
SCALE	N.T.S.

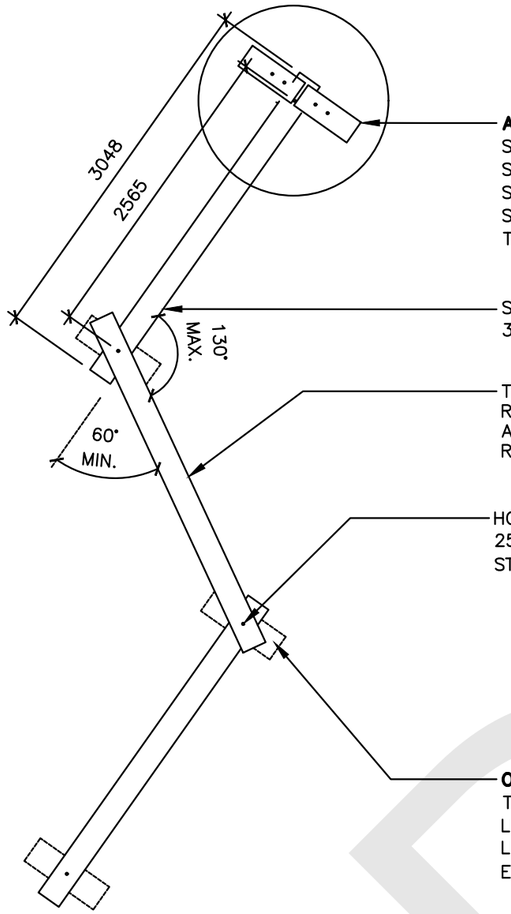
January 2025

NOTES:

1. ALL DIMENSIONS IN MILLIMETERS (mm), EXCEPT WHERE NOTED.
2. THE TOP RAIL IS TO BE LAGGED TO THE RAIL BELOW WITH ½" X 10" LAG SCREW.
3. ALL HARDWARE IS TO BE HOT DIPPED GALVANIZED.
4. WHERE THE ZIG–ZAG IS NOT POSSIBLE, AND THE 130 DEGREE ANGLE IS NOT POSSIBLE THE LAYOUT OF STACKED RAILS CAN BE IN–LINE, WHERE:
   - 4.1. THE OVERLAP OF RAIL ENDS IS 600mm
   - 4.2. THE CONNECTING REBAR IS DRIVEN 900mm INTO THE GROUND OR BORED INTO ROCK 150mm BELOW
   - 4.3. THE FENCE END SHOULD BE FINISHED WITH THE A–FRAME OPTION OR PINNED TO SOLID ROCK;
   - 4.4. THE REBAR DIAMETER SHOULD BE INCREASED TO 25mm (1").



PLAN (IN–LINE/STRAIGHT)



A–FRAME END OPTION
SHORT RAIL LENGTHS LAID UPON END SPACERS AND LAGGED TOGETHER TO SECURE FENCE.
SPACER LENGTHS FLARED BOTTOM TO TOP TO FORM A–FRAME.

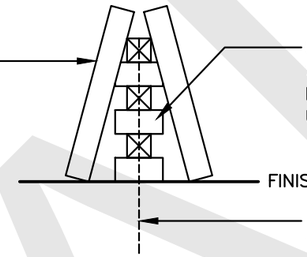
SPLIT RED CEDAR RAILS
3m (10' length), 200mm Ø

THREE (3) OR FOUR (4) STACKED CEDAR RAILS PLUS SPACER RAILS. NOTE THAT A 2–TIER RAIL AND POST DETAIL ONLY REQUIRES THE TOP AND BOTTOM PIECES.

HOLE FOR REBAR
25mm (1") HOLE DRILLED THROUGH STACKED RAILS.

OPTION
THE BASE OF THE FENCE CAN BE FULL LENGTH RAIL OR A SHORT SPACER TYPE LENGTH, THE BASE IS LAID UPON THE EXISTING NATIVE GROUND CONDITION.

PLAN (ZIG–ZAG)



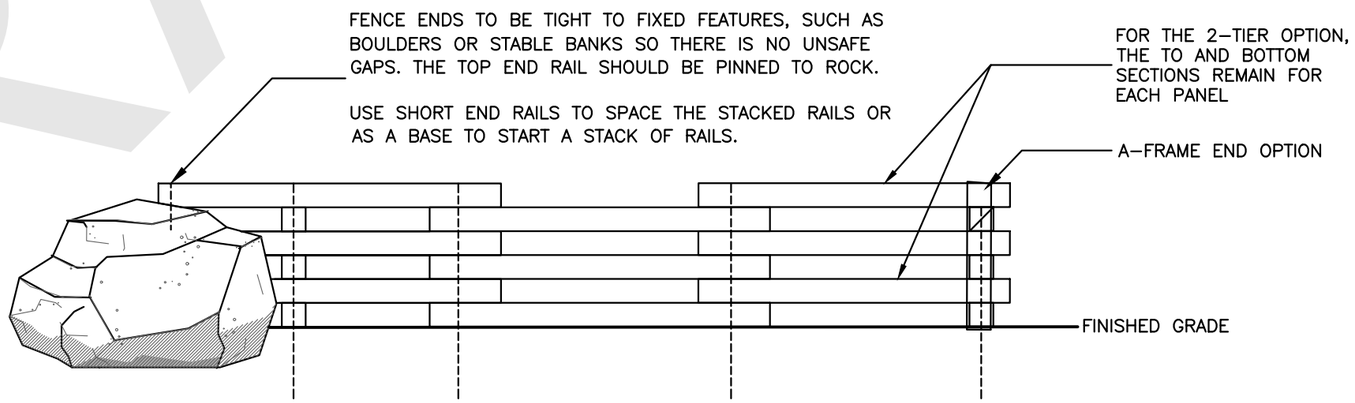
SPACER RAILS
SHORT RAIL LENGTHS USED AS SPACERS IN STACKING FENCE RAILS AND MAY BE USED AS A BASE FOR STACKING RAILS.

FINISHED GRADE

REBAR HAMMERED THROUGH RAILS PLUS 600mm INTO THE GROUND BELOW TO SECURE FENCE.

IF GROUND IS ROCK, BORE 150mm TO TIGHTLY SECURE REBAR TO GROUND.

END ELEVATION (A–FRAME)



FENCE ENDS TO BE TIGHT TO FIXED FEATURES, SUCH AS BOULDERS OR STABLE BANKS SO THERE IS NO UNSAFE GAPS. THE TOP END RAIL SHOULD BE PINNED TO ROCK.

USE SHORT END RAILS TO SPACE THE STACKED RAILS OR AS A BASE TO START A STACK OF RAILS.

FOR THE 2–TIER OPTION, THE TO AND BOTTOM SECTIONS REMAIN FOR EACH PANEL

A–FRAME END OPTION

FINISHED GRADE

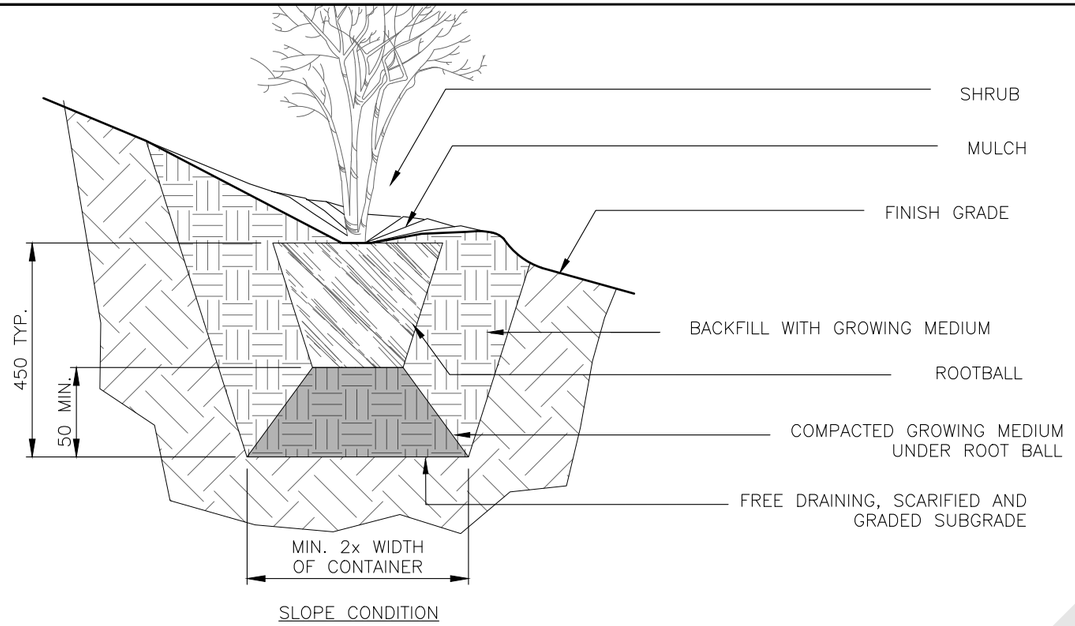
ELEVATION (ZIG–ZAG)

TOWN OF COMOX

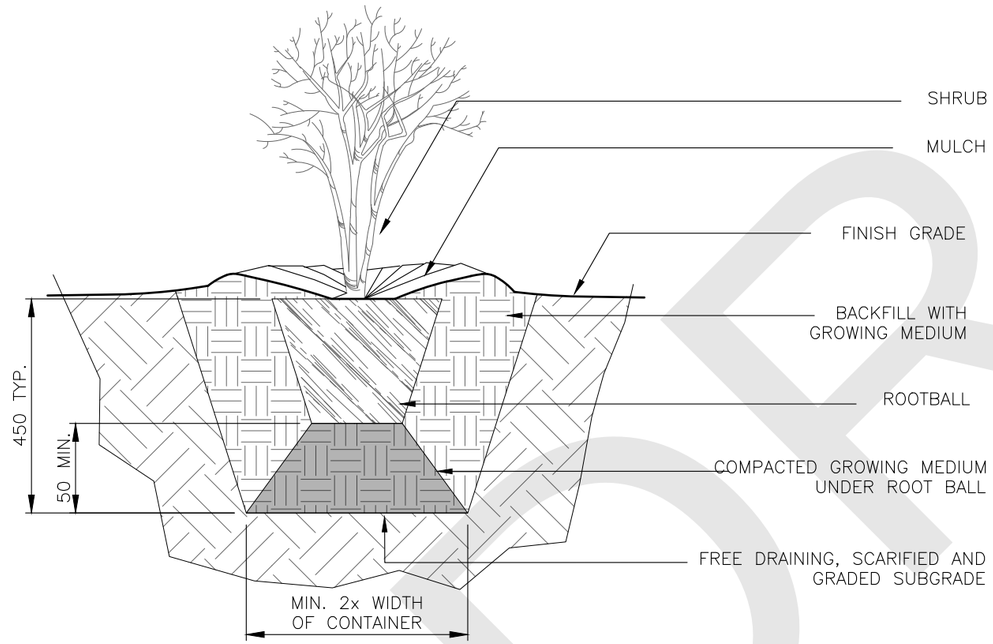
SPLIT RAIL CEDAR FENCE

DRAWING NUMBER	L4
REVISION NUMBER	A
SCALE	N.T.S.

January 2025



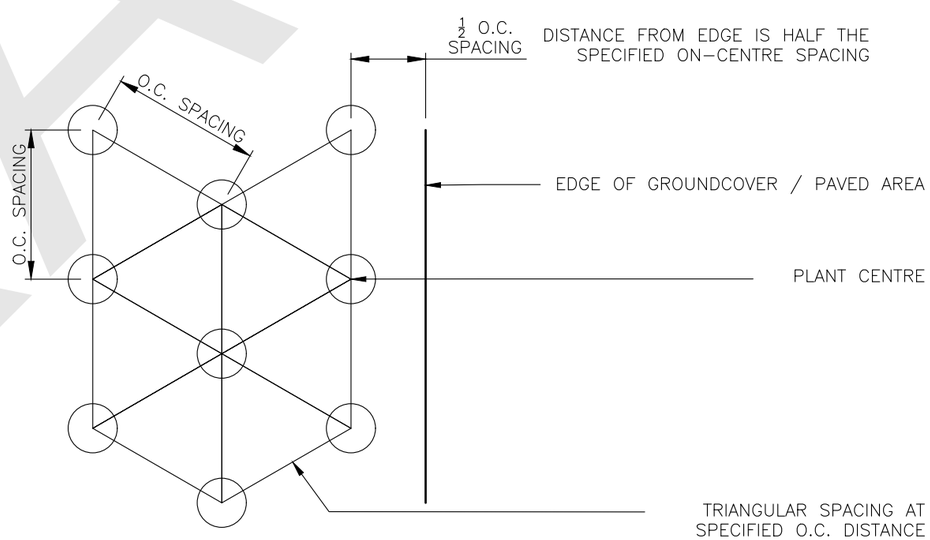
SLOPE CONDITION



FLAT CONDITION

NOTES

1. SHRUBS SHOWN IN INDIVIDUAL PLANTING PITS FOR CLARITY ONLY. ALL SHRUBS TO BE INSTALLED IN SHRUB PLANTING BED TO DEPTHS SHOWN UNLESS OTHERWISE INDICATED.
2. SET CROWN OF ROOTBALL 25mm ABOVE FINISHED GRADE AND REMOVE ALL ORGANIC POTS PRIOR TO PLANTING.
3. COMPOSTED MULCH:
   3.1. KEEP BACK 50mm FROM STEM
   3.2. DEPTH TO BE 75mm UNDER IRRIGATION CONDITION, 100mm UNDER DRYLAND CONDITION AFTER SETTLING
4. ALL UNITS IN mm UNLESS OTHERWISE NOTED.

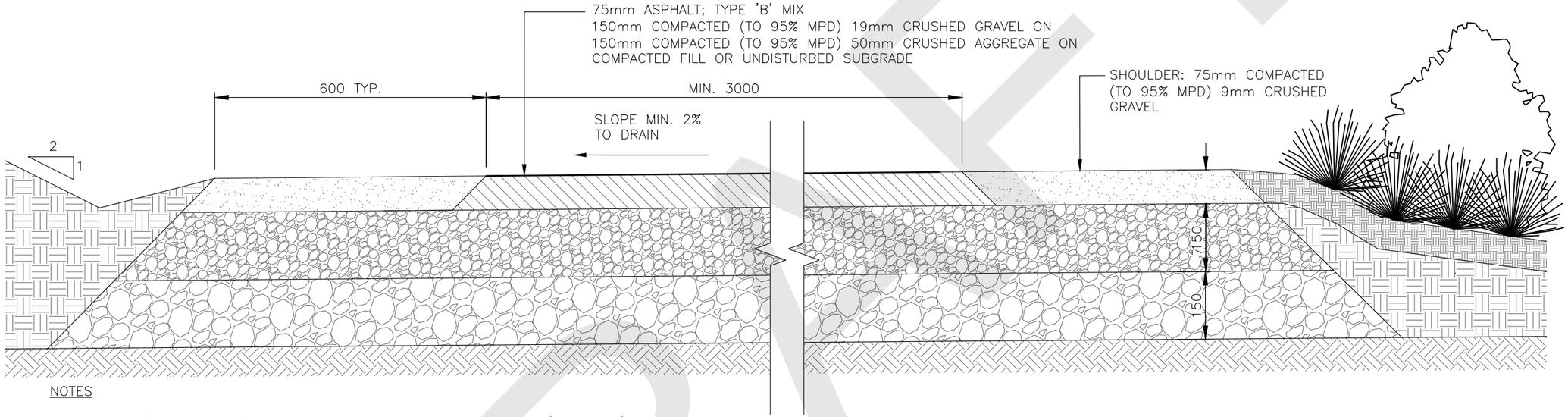


TOWN OF COMOX

SHRUB PLANTING

DRAWING NUMBER	L5
REVISION NUMBER	A
SCALE	N.T.S.

January 2025



NOTES

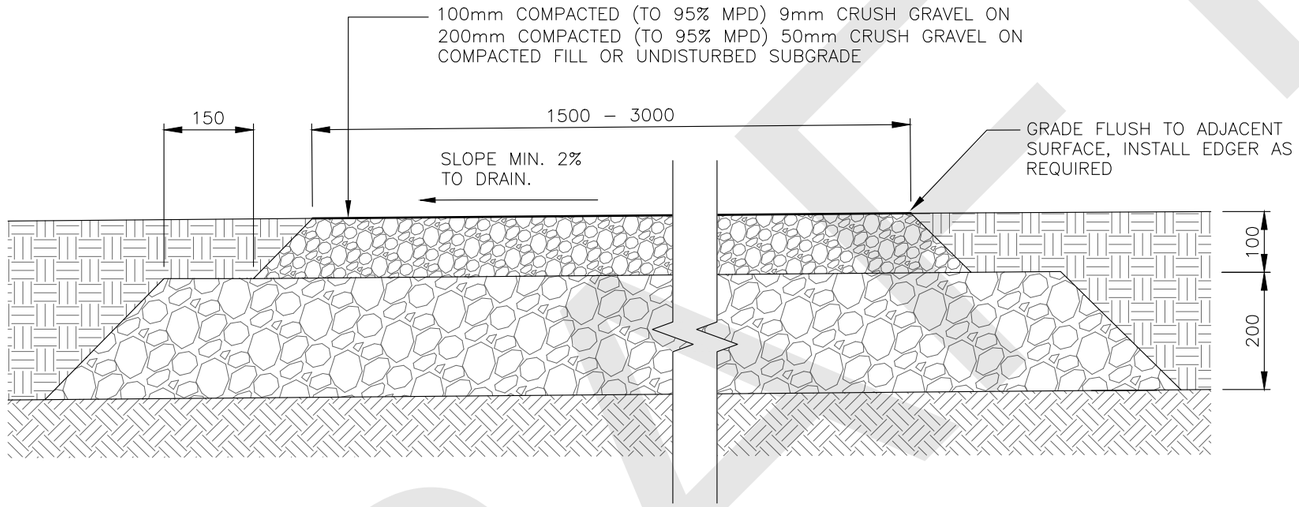
1. COMPACTED BASE MATERIAL TO BE 50mm CRUSHED AGGREGATE (AS NOTED) OR APPROVED ENGINEERED FILL.
2. PROVIDE 2% CROSSFALL IN THE DIRECTION OF DRAINAGE.
3. CONTRACTOR'S RESPONSIBILITY TO REHABILITATE ALL DISTURBED AREAS ALONG TRAIL EDGE.
4. THICKNESS OF EACH LAYER SHOWN AS MINIMUM REQUIREMENTS.
5. ALL UNITS IN MILLIMETERS UNLESS OTHERWISE NOTED.

TOWN OF COMOX

COMMUNITY PATHWAY

DRAWING NUMBER	L6
REVISION NUMBER	A
SCALE	N.T.S.

January 2025



NOTES

1. COMPACTED BASE MATERIAL TO BE 50mm CRUSH GRAVEL (AS NOTED) OR APPROVED ENGINEERED FILL.
2. THICKNESSES OF EACH LAYER SHOWN AS MINIMUM REQUIREMENTS.
3. ALL UNITS IN MILLIMETERS UNLESS OTHERWISE NOTED.

January 2025

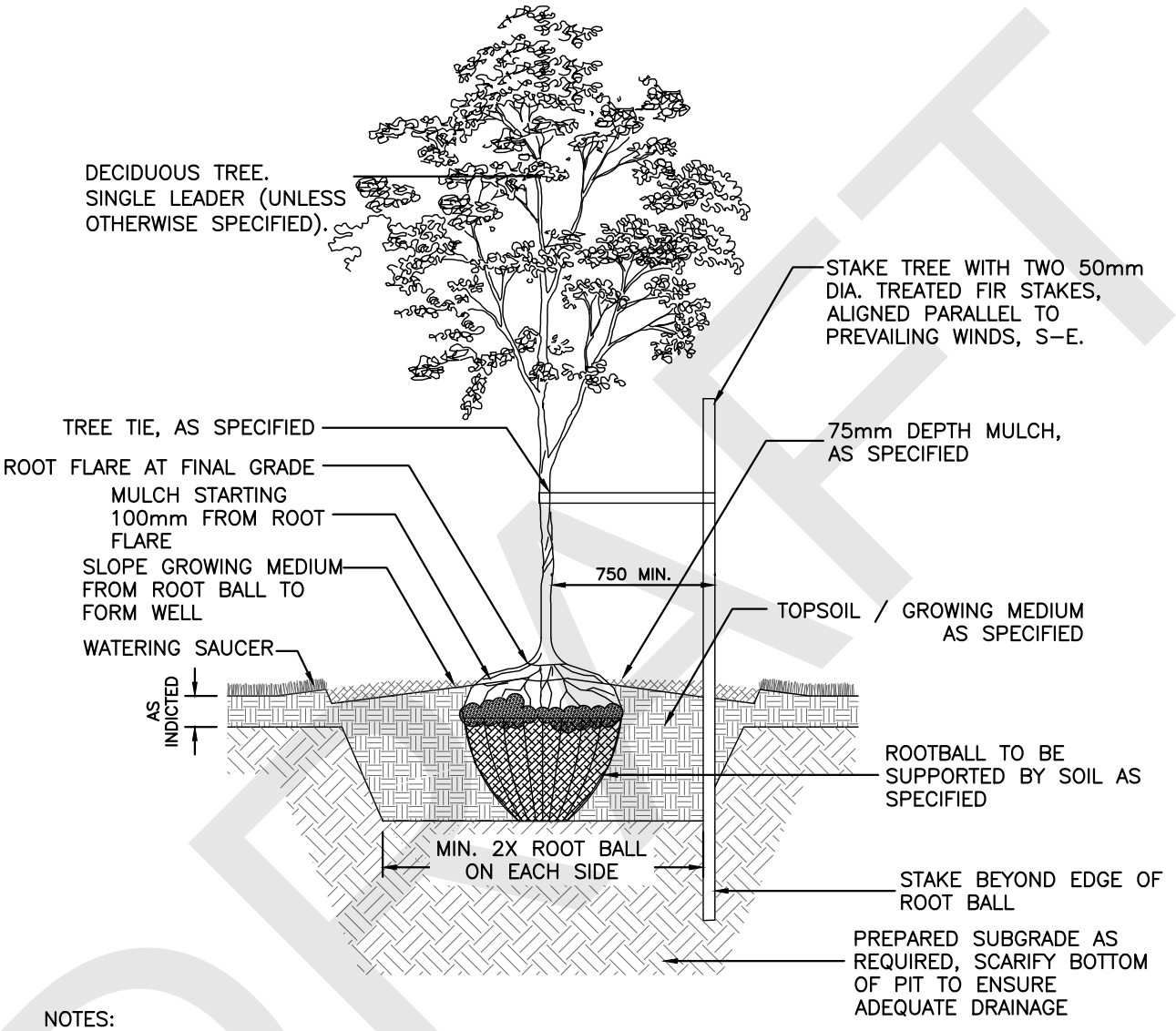
TOWN OF COMOX

NATURE TRAIL

DRAWING NUMBER
L7

REVISION NUMBER
A

SCALE
N.T.S.



NOTES:

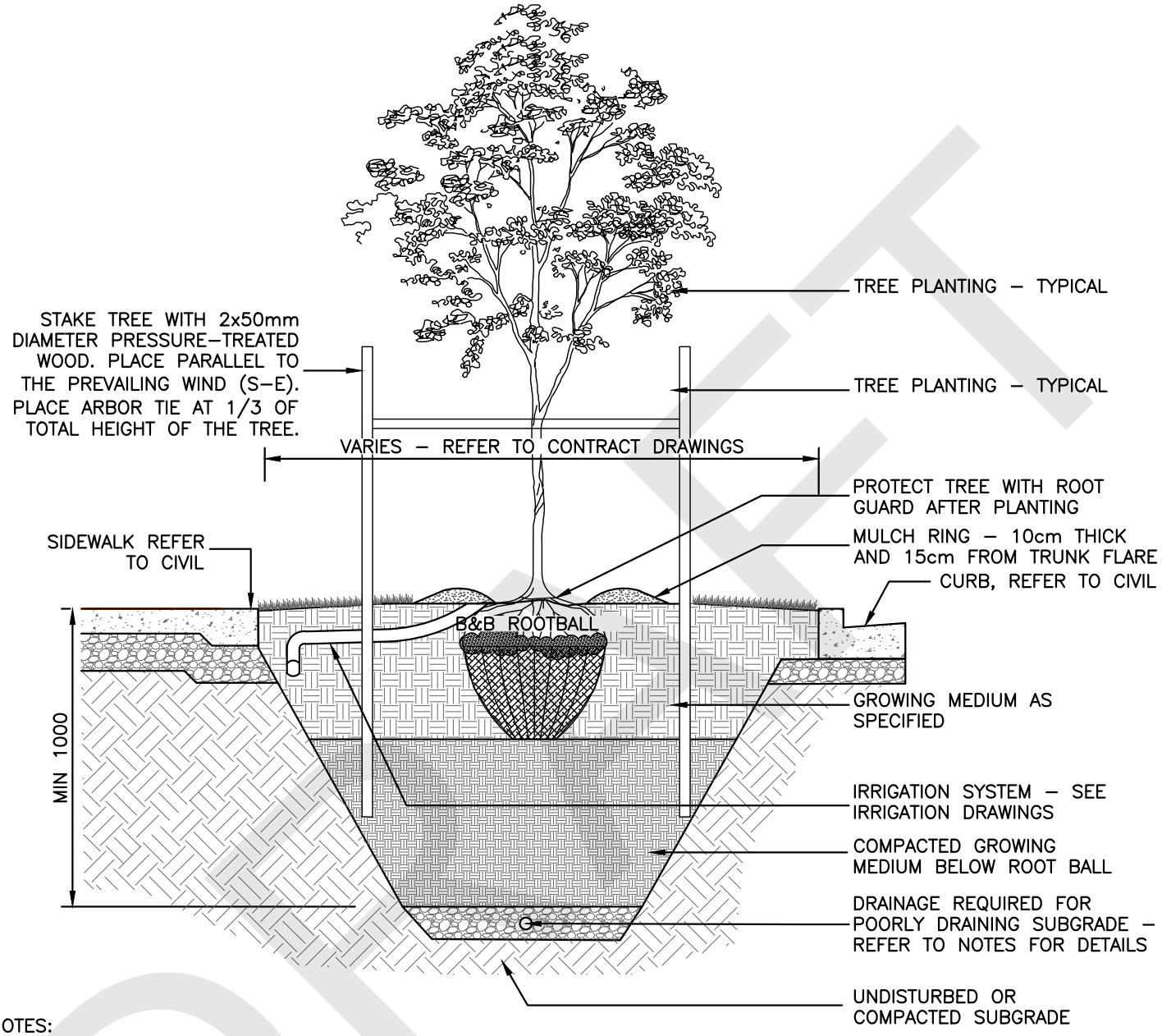
1. FOR B&B, LOOSEN AND CUT AWAY TOP 1/3 OF WRAPPING, TWINE, AND WIRE BASKET ONCE THE ROOTBALL HAS BEEN SET IN THE HOLE.
2. GROWING MEDIUM SHALL BE MIN. 1000mm DEPTH UNLESS NOTED OTHERWISE.
3. MIX 150mm DEPTH GROWING MEDIUM WITH SCARIFIED SUBGRADE PRIOR TO BACKFILLING REMAINING GROWING MEDIUM .
4. INSTALL TREE TIE AT APPROX. 100mm BELOW LOWEST BRANCH FOR DECIDUOUS LESS THAN 100mm CAL. DO NOT REMOVE OR CONSTRAIN ANY BRANCHES.
5. IF POOR DRAINAGE CONDITIONS EXIST, PROVIDE POSITIVE SUB–SURFACE DRAINAGE AWAY FROM PLANTING EXCAVATION.
6. IRRIGATION REQUIRED TO TOWN STANDARDS WHERE INDICATED BY MUNICIPAL ENGINEER.
7. ALL UNITS IN MILLIMETERS UNLESS OTHERWISE NOTED.
8. ROOTS MUST BE TEASED OUT TO ENCOURAGE LATERAL GROWTH AND REDUCE GIRDING, ESPECIALLY ION CONTAINER GROWN PLANTS.

TOWN OF COMOX

TREE PLANTING

DRAWING NUMBER	REVISION NUMBER	SCALE
L8	A	N.T.S.

January 2025



NOTES:

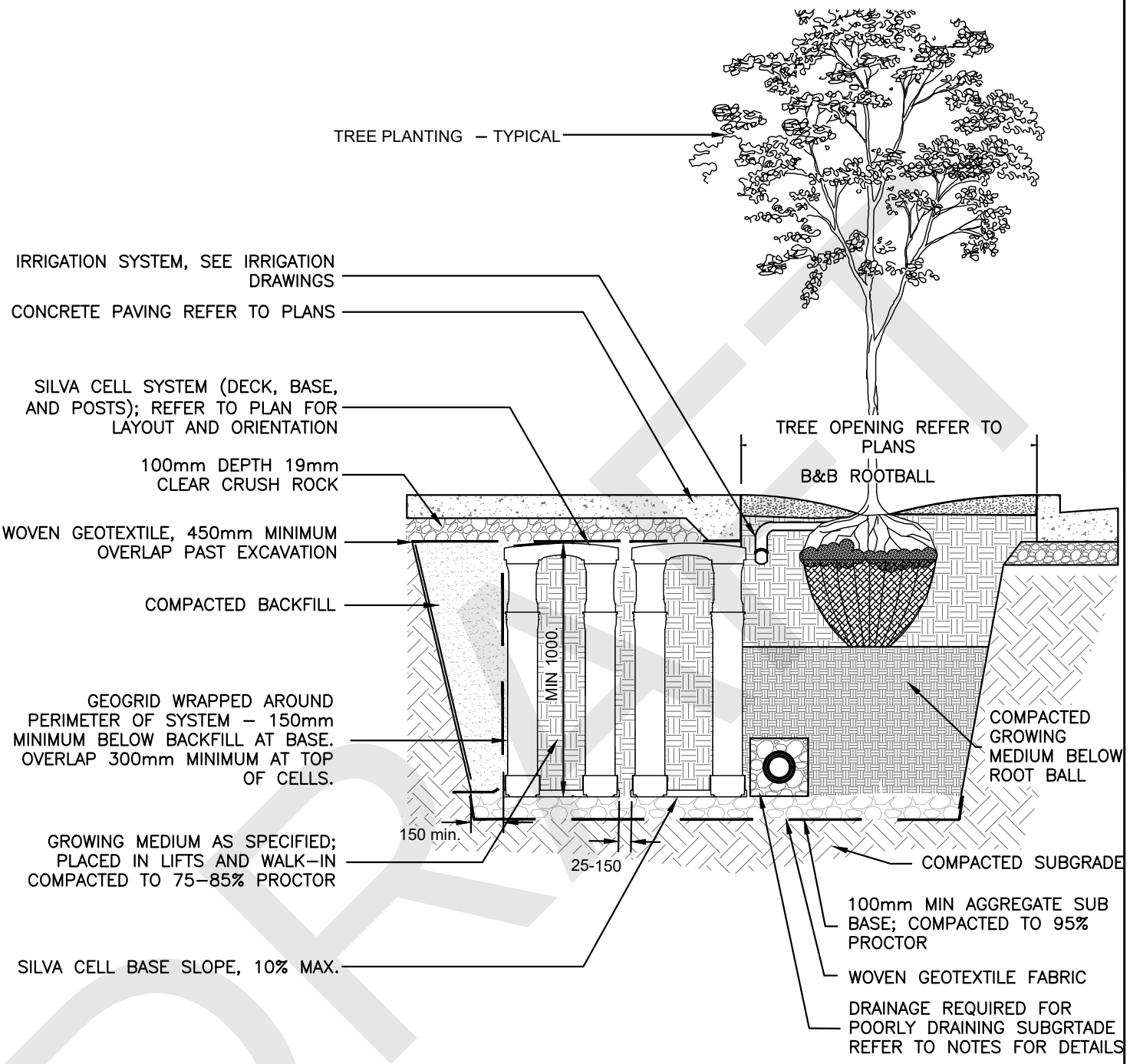
1. FOR B&B, LOOSEN AND CUT AWAY TOP 1/3 OF WRAPPING, TWINE, AND WIRE BASKET ONCE THE ROOTBALL HAS BEEN SET IN THE HOLE.
2. GROWING MEDIUM SHALL BE MIN. 1000mm DEPTH UNLESS NOTED OTHERWISE.
3. MIX 150MM DEPTH GROWING MEDIUM WITH SCARIFIED SUBGRADE PRIOR TO BACKFILLING REMAINING GROWING MEDIUM.
4. INSTALL TREE TIE AT APPROX. 100mm BELOW LOWEST BRANCH FOR DECIDUOUS LESS THAN 100mm CAL. DO NOT REMOVE OR CONSTRAIN ANY BRANCHES.
5. IRRIGATION REQUIRED TO TOWN STANDARDS WHERE INDICATED BY MUNICIPAL ENGINEER.
6. LOCATE AND FLAG ALL BURIED UTILITIES IN TREE PLANTING SITE PRIOR TO DIGGING TREE PITS.
7. DRAINAGE: 100mm PERFORATED PVC DRAIN COVERED WITH MIN. 150mm DRAIN ROCK WRAPPED WITH FILTER CLOTH (NILEX 4535 NON–WOVEN GEOTEXTILE OR EQUIVALENT), PIPE CONNECTED TO STORM DRAIN.
8. ALL UNITS IN MILLIMETERS UNLESS OTHERWISE NOTED.
9. EACH TREE REQUIRES 24.6m^3 OF GROWING MEDIUM/SOIL. IF ADEQUATE VOLUME CANNOT BE ACHIEVED, STRUCTURAL SOIL OR SOIL CELLS TO BE ADDED. REFER TO SUPPLEMENTAL DETAIL L10 AND L11 FOR OPTIONS.

TOWN OF COMOX

TREE PLANTING ADJACENT TO SIDEWALK

DRAWING NUMBER	REVISION NUMBER	SCALE
L9	A	N.T.S.

January 2025



NOTES:

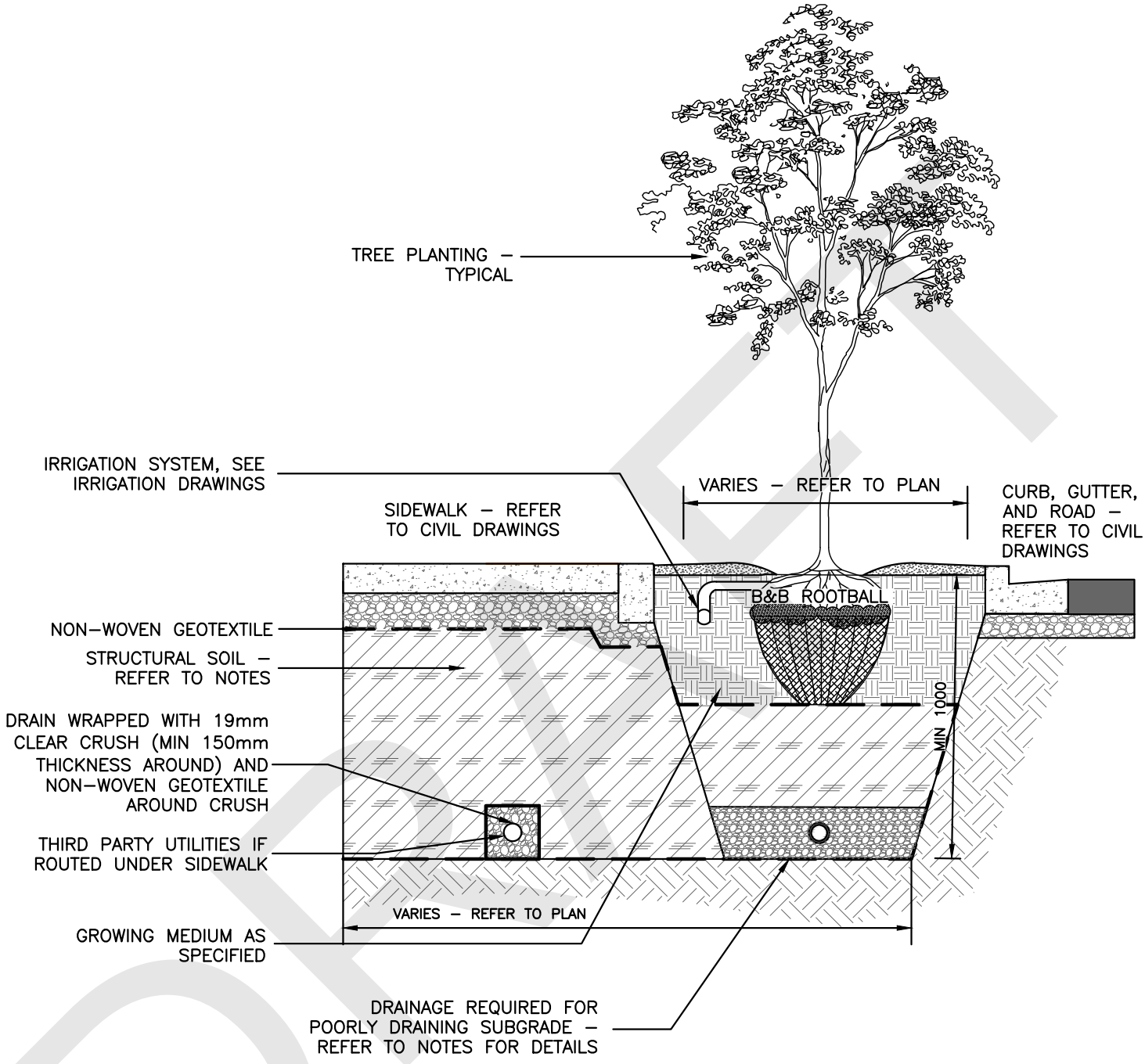
1. SOIL CELLS TO BE DEEPROOT SILVA CELL 3X SYSTEM OR APPROVED EQUIVALENT.
2. SOIL CELLS TO BE INSTALLED AS PER MANUFACTURER'S SPECIFICATIONS.
3. LOCATE AND FLAG ALL BURIED UTILITIES IN TREE PLANTING SITE PRIOR TO DIGGING TREE PITS.
4. DRAINAGE: 100mm PERFORATED PVC DRAIN COVERED WITH MIN. 150mm DRAIN ROCK WRAPPED WITH FILTER CLOTH (NILEX 4535 NON–WOVEN GEOTEXTILE OR EQUIVALENT), PIPE CONNECTED TO STORM DRAIN.
4. ALL UNITS IN MILLIMETERS UNLESS OTHERWISE NOTED.

TOWN OF COMOX

TREE PLANTING WITH SOIL CELL

DRAWING NUMBER	L10
REVISION NUMBER	A
SCALE	N.T.S.

January 2025



NOTES:

1. LOCATE AND FLAG ALL BURIED UTILITIES IN TREE PLANTING SITE PRIOR TO DIGGING TREE PITS.
2. DRAINAGE: 100mm PERFORATED PVC DRAIN COVERED WITH MIN. 150mm DRAIN ROCK WRAPPED WITH FILTER CLOTH (NILEX 4535 NON–WOVEN GEOTEXTILE OR EQUIVALENT), PIPE CONNECTED TO STORM DRAIN.
3. STRUCTURAL SOIL: CALCULATE VOLUME ACHIEVED AS 20% ACTUAL SOIL – FINAL MATERIAL TO BE APPROVED BY TOWN OF COMOX.
4. ALL UNITS IN MILLIMETERS UNLESS OTHERWISE NOTED.

TOWN OF COMOX

TREE PLANTING WITH STRUCTURAL SOIL

DRAWING NUMBER	L11
REVISION NUMBER	A
SCALE	N.T.S.

January 2025

SCHEDULE 4

STANDARDS FOR SANITARY LIFT STATIONS

TABLE OF CONTENTS

TABLE OF CONTENTS 2
INTRODUCTION 1
INTENT OF THE STANDARDS 1
SANITARY LIFT STATION DESIGN CRITERIA 2
1.0 GENERAL SPECIFICATIONS 2
1.1 PUMPS 2
1.2 KIOSK 2
1.3 PIPING/VALVE CHAMBER 3
1.4 VENTILATION 4
1.5 LIFT STATION TANK 4
1.6 EQUIPMENT 5
1.7 EMERGENCY BACKUP GENERATOR 5
1.8 WARRANTY 6
1.9 WATER CONNECTION 6
1.10 SITE FENCING 6
2.0 LIFT STATION ELECTRICAL DESIGN STANDARDS 7
2.1 STANDARD LIFT STATION ELECTRICAL SPECIFICATION 7
2.2 USER INTERFACE 8
2.3 VFD STATION SUPPLEMENTARY SPECIFICATION 9
2.4 ENTRY AND ALARM TEST MODE 9
3.0 TOWN SCADA SYSTEM 10
4.0 COMMUNICATIONS BETWEEN SCADA AND LIFT STATION 10
CONSTRUCTION SUPPLEMENTARY SPECIFICATIONS 11
1.0 GENERAL 11
1.1 RELATED WORK 11
1.2 SHOP DRAWING AND DATA SHEETS 11
1.3 REQUESTS FOR APPROVED EQUALS 11
1.4 COMMISSIONING PLAN 12
2.0 PRODUCTS 12
2.1 STRUCTURE 12
2.2 SUBMERSIBLE SEWAGE PUMPS 14
2.3 FIXED DISCHARGE CONNECTION 15
2.4 LIFTING CHAINS 16
2.5 GUIDE RAIL ASSEMBLY 16
2.6 VENTILATION DUCT WORK & FAN 16
2.7 LIGHTING FIXTURE 16
2.8 EXTERNAL PIPING 16

2.9 INTERNAL PIPING 16
2.10 PLUG VALVES 16
2.11 CHECK VALVES 16
2.12 LEVEL REGULATORS 16
2.13 BOLTS 16
2.14 ACCESS COVERS 16
2.15 AIR RELEASE VALVE 17
2.16 FLOOR GRATINGS 17
2.17 MISCELLANEOUS 17
2.18 PRESSURE GAUGE 17
2.19 HYDROSTATIC TESTS 17
2.20 CONCRETE BASE AND ANCHORING SYSTEM 18
2.21 POWER SUPPLY AND CONTROLS 18

3.0 EXECUTION **18**

3.1 EXCAVATION AND BACKFILLING 18
3.2 EXTERNAL PIPING 19
3.3 CONCRETE WORK 19
3.4 ELECTRICAL 19
3.5 PIPING INSTALLATION 19
3.6 **PUMPS AND ACCESSORIES** 20
3.7 START-UP 20
3.8 PROTECTION 22
3.9 CLEANING 22
3.10 MAINTENANCE MANUALS 22

INTRODUCTION

The use of sanitary lift stations is generally discouraged and the Town must approve any proposal for a lift station prior to submission of any engineered drawings for a lift station. Lift stations are considered a "special case" and are to be designed by a qualified professional. The following will form the general design requirements for duplex lift stations categorized as small to mid-sized lift stations. For stations larger than 50 l/s, or that require more than two pumps, authorization must be obtained from the Town on a case-by-case basis, and the following standards may not fully apply.

Unless documentation provided by the Town of Comox along with a specific request for tender or request for proposal states specifically that a provision set forth has been waived, all provisions are to be satisfied.

The requirements set forth in these standards are minimum requirements that shall be applied universally by all parties performing services for and/or providing equipment to the Town of Comox. This includes, but is not limited to, all component parts that may form part of package systems.

This document is part of a series of standards and as such should not be viewed in isolation of all other Town of Comox associated standards which may modify and/or clarify the requirements set forth within this document.

The Town of Comox may, on a case-by-case basis, and at the Town's sole discretion, approve deviations from these standards.

INTENT OF THE STANDARDS

The Design Criteria are intended to provide direction to the Applicant and their Engineer on the elements required to be considered in the design of sanitary lift stations. It is intended to be used in conjunction with the MMCD Design Guideline Manual and the Town of Comox Subdivision and Development Servicing Bylaw Schedule 1.

The Supplementary Specifications are intended to provide direction to the Applicant and their Engineer on the specifications that must be incorporated into building servicing contracts for the installation of new sanitary lift stations. The Supplementary Specifications are to be used in conjunction with the Town of Comox Subdivision and Development Services Bylaw Schedule 2 and the Master Municipal Construction Document (MMCD).

SANITARY LIFT STATION DESIGN CRITERIA

1.0 GENERAL SPECIFICATIONS

1.1 Pumps

(a) All sanitary lift stations shall be designed with a minimum of two pumps, each capable of handling the Peak Wet Weather Flows independent of the other. The pump that is furthest away from the inlet shall be supplied with a 4901 flush valve.

(b) Each pump must be:

- capable of passing solids up to 75 mm in size;
- equipped with hour meters with units in decimals;
- easily removed for maintenance;
- constructed to operate on a voltage based on HP rating as shown on the table below:

Pump Size	Approved Voltages
Less than 5HP	Single phase 240V / Three phase 208V
5HP – 10HP	Three phase 208V / Three phase 600V
Larger than 10 HP	Three phase 600V

(c) Motor cables, power cables, etc. shall be continuous from the lift station to the kiosk. Cables are not to be spliced. Only one power cable is allowed in one conduit. Minimum conduit size to be 3” for pumps, and 2” for controls.

1.2 Kiosk

All auxiliary equipment and control panels shall be mounted in a secure lockable kiosk adjacent to the station. The kiosk shall be located not less than 1.2 metres and not more than 3 metres from the station lid, with the controls section of the kiosk facing the wet well and facing north (where practical to do so.). The kiosk shall be founded on a concrete foundation, and should be made from powder coated aluminum, with a standard green finish. All kiosks shall be supplied with a rubber gasket between the aluminum kiosk and the concrete to prevent water leakage into the kiosk.

The electrical Kiosk shall be CSA Type 3R rated and fabricated from marine grade aluminum in accordance with the following Ministry of Transportation and Infrastructure Kiosk Specifications:

- General Material Requirements: 402.3.1
- Connecting Hardware 402.3.2
- Fabrication Mechanical Requirements, General Requirements 402.4.1
- Welding 402.4.2
- Door Gaskets 402.4.4
- Kiosk Environmental Requirements, General 402.4.8.1
- Kiosk Fan and Heater Thermostat 402.4.8.5
- Kiosk Finish 402.6

- Electrical Kiosk shall be powder coated “Fence Post Green”.
- Plan Pouch 402.9

The kiosk shall be fabricated with sufficient bracing to form a structure capable of withstanding transportation, wind, snow and ice loading. The kiosk manufacturer is responsible for obtaining structural and seismic certification from a professional engineer registered with Engineers and Geoscientists BC. Structural certification shall include recommendations for fastening methods.

The kiosk shall contain separate compartments for:

- pump control;
- service entrance and distribution; and
- fan and duct section, complete with isolated cable junction chamber vented to the atmosphere.

The kiosk shall be designed to contain:

- all control and telemetry equipment within the pump control compartment;
- an electrical service entrance that is complete with required appurtenances and components shall be arranged in a manner acceptable to B.C. Hydro;
- all power distribution equipment in the service entrance and distribution section, with exception to a 120/240 or 120/208V electrical panel which shall be mounted within the pump control compartment;
- an extra 120 volt receptacle within the pump control and service entrance/distribution sections;
- an automatic transfer switch in the service entrance and distribution section;
- a manual transfer switch in the service entrance and distribution section;
- a receptacle for mobile backup generator on the exterior of the kiosk, standard with all the other receptacles on Town lift stations;
- exterior lighting mounted to an overhead pole capable of illuminating the area around the tank lid to WorksafeBC required standards; and
- a heater within each of the pump control and service entrance/distribution sections.

The fan and duct section shall be isolated from the pump control and service entrance/distribution sections by means of a continuous weld.

1.3 Piping/Valve Chamber

All piping within the wet well shall be stainless steel or approved equivalent, and all stations shall feature an external separate valve chamber for valves and flow measurement equipment. The valve chamber can be either fiberglass or pre-cast concrete with suitable lockable lids with lift assist mechanisms as required. The chamber will have a 4” drain fitted with a flushable P-Trap and Backwater Valve. See Figures 1 and 2, or equivalent function.

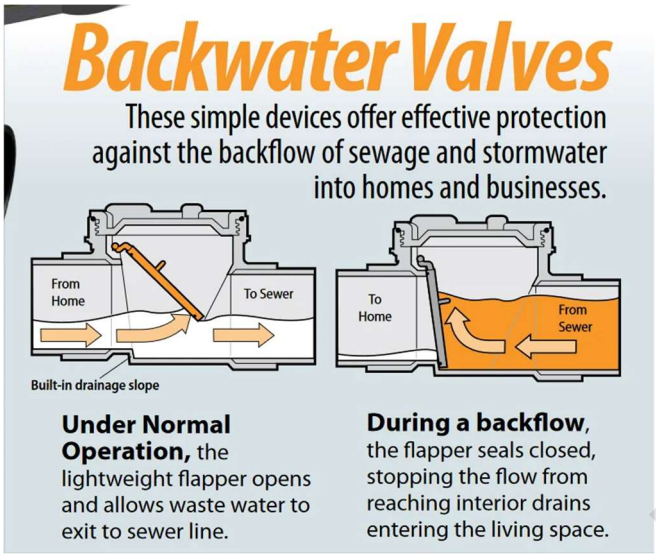


Figure 1 – Backwater Valve Schematic

Figure 2 – P-Trap

Each pump discharge shall have a ball check valve or lever type swing check valve.

Each pump discharge shall have a plug valve installed downstream of the check valves.

Drain to be provided at floor elevation and floor to be sloped to convey inflow of water or sewage toward drain inlet. The drain shall include a backwater valve and p-trap to prevent sewage and gas from entering the piping/valve chamber.

1.4 Ventilation

Ventilation at each station is to be by forced air using a fixed speed fan that runs continuously. The minimum ventilation rate is to be 12 air changes per hour or higher if required for safety considerations. The fan shall be located in the kiosk and be sealed to the inlet blower line. The blower shall indicate failure on the control panel.

Each station shall have a minimum of one vent stack, and shall have odour control installed. As a minimum, the vent stack shall be equipped with an activated carbon filter capable of conveying the required air flow rate without excessive pressure loss: Calgon SweetVent or equal.

1.5 Lift Station Tank

The lift station tank to be of fiberglass construction.

Wet wells shall be designed with the following features:

- Include a benched bottom to direct all solids into the pump suction;
- Include surface access with a lockable, waterproof fiberglass or aluminum cover. Access hatches must include hydraulic assist and safe hatch;

- Provide bollards around the wet well to prevent vehicles from riding overtop of the structure. Bollards to be as per MMCD Detail C12;
- Contain aluminum (or fiberglass) ladder mounted so it does not interfere with the removal and installation of the pumps, etc. The ladder shall be designed to extend and lock least 1.0 metre above the tank access. Ladders mounts to be structurally sufficient to prevent puncturing of the tank wall, where mechanical fasteners are to be used, the wall shall be reinforced to provide sufficient capacity for the type and size of fastener. Integrated fiberglass ladders shall be fixed mounted to the fiberglass wall with appropriate reinforcing of the fiberglass as specified by the manufacturer;
- Contain a platform above the high-level float to permit wet well access wherever the total depth from ground level to wet well floor exceeds 2.4 metres;
- Include 1 base and davit for confined space entry.
- Contain explosion proof lighting capable of illuminating the interior of the tank.

1.6 Equipment

All equipment must be CSA Approved and Work Safe BC compliant.

1.7 Emergency Backup Generator

All sewage lift stations shall be equipped with and emergency backup generator unless otherwise approved by the Town. The generator transfer switch shall be of the automatic type. The generator shall be diesel fueled unless otherwise approved by the Town. Diesel fuel tanks shall be base tanks integrated into generator unit by OEM, shall include double wall containment, and shall be sized to run the generator for at least 24 hrs continuously at 100% load. Fuel tank for generator shall have double walls, spill containment, and leakage alarm system. The generator shall have a 1.2m clearance all around, and it shall be provided with a noise control package. Noise Control Package Specification for Generator shall be residential rated. Sound attenuation includes enclosure and exhaust muffler package. Sound attenuation system performance shall result in measured sound levels not to exceed 65 dB @ 10.7 metres. Design Engineer shall perform a load analysis with the sequence of motor starting in order to know the motor starting loads and the motor running loads. Such electric load calculations must be done in kVA units to account additional loads due to low power factor. The generator shall have a motor starting kVA capacity to limit the voltage dip to no more than 15% for any motor starting conditions. Such generator load analysis must be included in the engineering report. The generator manufacturer must be pre-approved by the Town prior to design of the backup system.

The generator shall also come equipped with a permanently-mounted resistive load bank, with a full load that equals +/- 80% of the generator unit's full load capacity. The load bank shall also include the following specifications:

- Duty Cycle: Rated for continuous operation.
- Load Steps: 5, 10, 10, 25, 50, 100 KW
- Cooling System: integral with generator cooling system
- Sound dampening: integral with generator muffling system
- Operator Controls: Control Panel housed in a NEMA-type wall mount enclosure including:

  - Main Power ON/OFF Switch, Power ON Indicator, and Master Load ON/OFF Switch.
  - Load selection shall be provided by individual industrial lever-type toggle switches for on/off application of resistive load segments, one provided for each load step.
  - Auto Load Dump Circuit: A remote load dump circuit is provided as part of the load bank control circuit.
- Provisions shall be provided to trip the load bank off-line from a normally closed set of auxiliary contacts from an automatic transfer switch or other device. In the event of a utility failure, all load is removed.

Automatic Load Controller: Automatic Load step controller that maintains a minimum load on the generator set. The controller shall monitors the connected downstream loads and will automatically add or subtract load steps in response to overall load changes as to maintain a minimum load level on the generator set.

1.8 Warranty

All lift station components shall be warranted in accordance with the manufacturer's warranty, and such warranty shall be explicitly stated in a warranty statement (section) provided with the Operations and Maintenance Manuals submitted upon acceptance of the Lift Station by the Town.

1.9 Water Connection

A 50 mm water service connection for cleaning purposes must be provided at the site. The service must include a dry standpipe and appropriate cross-connection control devices located in an above ground heated lockable cabinet. The connection shall also include an on/off ball valve and a 38mm quick connect cam-lock fitting. Cross-connection control devices must designed to be compliant with CSA standard B64.10-11 (Selection and Installation of Backflow Preventers/Maintenance and Field Testing of Backflow Preventers). RP backflow device shall be located in an above ground kiosk.

1.10 Site Fencing

1.8m black epoxy coated perimeter fencing is to be provided.

2.0 LIFT STATION ELECTRICAL DESIGN STANDARDS

2.1 Standard Lift Station Electrical Specification

All lift stations shall include at a minimum the following features and capabilities:

Manual pump controls	It shall be possible to set each pump into manual (Hand) mode. When in the manual mode the control of the pump shall be independent of (and unaffected by) the actions (or absence) of the controller or fail-safe pump control relays.
Motor type and starting	All pumps 10hp or larger require soft starting devices or are to be speed controlled via Variable Frequency Drives.
Controller	The station controller shall conform to the Town of Comox Approved Products List.
Float Switches	Each station shall be supplied with a high level and low level float switch. Guides must be used for all float levels. The low level float is to be set at a level just above the pump intake. The high level float is to be set at a level no higher than the obvert of the lowest inlet pipe. Refer to the section below for details regarding redundancy.
Fail Safe Operation	A redundant float switch setup shall be installed alongside the main switch operation. Pump start and shut-off switches should be wired in and set to “ready” mode but removed from the lift station surface to preserve the floats. A parallel contactor should be installed to an automated control system for redundancy.
Level monitoring	Wet well levels shall be monitored using an ultrasonic or radar sensor connected as an analog input to the control unit. This level is to be used for pump control and shall be reported to the central monitoring station.
Programmable operation	Pump start and stop levels are to be programmable and set through the local pump controller HMI.
Pump supervision	Pumps shall be monitored, as a minimum, for stator over temperature faults, seal leakage and over current condition.
Flow rate	Flow rate data is to be reported by flow monitoring device.
Intrusion alarm for kiosk or building	Access to the electrical controls is to be monitored by a contact switch, and an alarm condition shall be generated when the contact is broken.

Receptacle for plug in of standby generator	Each station, including those which include local generator, shall be equipped with a receptacle for plug-in of Town standby generator, mounted on the exterior of the building or kiosk within a lockable NEMA-4X enclosure (padlock provided by the Town). Manual disconnect switch required parallel to the automatic transfer switch.
Alarms	The following alarms shall be generated and reported by the alarm system by way of a dedicated telephone connection. • Intrusion Alarm • Loss of Power • High level alarm • Low level alarm • Pump monitoring alarms (leakage, high temperature) • Generator Faults (if generator installed) • Breaker tripped • Float switch failure
UPS backup for controller and communications system	A UPS standby power system is required. The UPS must provide power to the controller for at least one hour in the event of a power outage.

2.2 User Interface

The user interface in a typical lift system consists of manual controls for emergency and maintenance purposes, and an electronic interface directly to the controller.

Manual Controls

The operator interface at this level shall be kept to a minimum. Auto/Off/Manual selectors for each pump are to be provided. These controls shall function independently of the controller. When in placed in manual mode the appropriate pump shall start. When placed in the Off condition the pump shall not start regardless of input from the controller. In Auto mode the pump is controlled by the controller. Pump run time meters shall be installed for each pump.

Status lamps are required as follows:

- One lamp indicating kiosk power
- One status lamp for each pump indicating pump run condition
- One status lamp for each pump indicating a failure condition

Controller Interface

Each station shall also include a station control Human-Machine-Interface (HMI), mounted in the door of the control cabinet. This control keypad is used to view and reset alarm status, and to configure the operation of the station. The mounting position should be at a comfortable viewing height for the average person, with the screen being big enough to read any graphics and words comfortably.

2.3 VFD Station Supplementary Specification

All lift stations involving VFDs shall include the features and capabilities outlined above plus the following features and capabilities:

VFD	A solid state variable frequency drive, sized for the motors associated with the project, with inline load filters. Xylem ACS550 or similar.
VFD Manual Mode	The VFD shall be programmed to run the pump at an appropriate default speed in manual mode (when started).
VFD controller connection	Connection to the VFD is by analog output from the controller.
VFD output monitoring	The controller shall monitor and make use of the speed output, and current outputs of each VFD. These shall be made available to the monitoring system.

2.4 Entry and Alarm Test Mode

Each pumping station panel will have a key lock access to the control cabinet. A momentary spring-to-centre rotary selector switch shall be provided to switch to select between Test & Normal mode of operation. In Test mode the system shall behave as follows:

When momentarily switched to the “Test” position all normal alarms from the station will be acknowledged and disabled for 30 minutes, and a local “Test Mode” pilot light will illuminate.

In addition, a test alarm shall be triggered which will be treated as a low priority alarm at the SCADA system.

The station controller begins a phased monitoring of the situation, as described in the following table.

Phase	Description	
1	The input is activated by the test mode selector switch. Result: Work time begins (25 minutes).	
2	The input has been activated longer than the Work time. Result: Common alarm outputs are activated. Warning time begins. (5 minutes)	
3	Personnel acknowledge their presence within the Warning time. Result: Work time is restarted. Common alarm outputs are set to passive.	No acknowledge is received within the Warning time. Result: Personnel alarm is generated.

4	The selector switch is momentarily placed in the “Normal” position, or the kiosk/station door is closed. Result: “Test Mode” pilot light extinguishes and station alarming returns to normal.

3.0 TOWN SCADA SYSTEM

Sewage pumping stations are to be compatible with a central monitoring system, planned for some future date. This section is provided to explain the requirements on all new lift stations in order to ensure compatibility with the planned SCADA system.

Key features of the planned SCADA system are planned to include:

- Real-time information regarding the status of stations throughout the municipality in order to efficiently respond to faults and other issues as they arise.
- Limited remote-control capability of the stations, which in certain cases may avoid the need for a site visit.
- Historical information and other data that will assist with proactive maintenance activities; and
- Historical information and other data that can be used to make informed decisions
- guiding future infrastructure development.

4.0 COMMUNICATIONS BETWEEN SCADA AND LIFT STATION

Stations constructed pre SCADA system shall support the future installation of communications equipment. Sufficient space is to be provided in the kiosk for a lockable louvred/ventilated box that will contain transmitter/receiver and networking equipment. In addition, a 100mm underground communications conduit shall be stubbed out from the kiosk/building foundation to allow for a future installation of antenna.

CONSTRUCTION SUPPLEMENTARY SPECIFICATIONS

1.0 GENERAL

.1 This section refers to those portions of the Work that are unique to the supply and installation of prefabricated submersible sewage lift stations. This section must be referenced to and interpreted simultaneously with all other sections pertinent to the works described herein.

1.1 Related Work

.1	Electrical	Division 26
.2	Concrete Reinforcement	Section 03 20 01
.3	Cast-in-Place Concrete	Section 03 30 53
.4	Aggregates and Granular Materials	Section 31 05 17
.5	Excavating, Trenching, and Backfilling	Section 31 23 01
.6	Sanitary Sewers	Section 33 30 01
.7	Sewage Forcemains	Section 33 34 01

1.2 Shop Drawing and Data Sheets

.1 Before fabrication, the supplier shall submit shop drawings to the Town for review. The submission shall include data sheets for all equipment to be ordered, along with a full drawing package for the electrical kiosk (external kiosk, internal layouts, wiring and controls diagrams)

.2 Lift station structural drawings, stamped by a Professional Engineer registered in British Columbia, shall be provided for the fibreglass wet well, the reinforced concrete base, the electrical kiosk enclosure and the anchoring systems for the generator, electrical kiosk and wet well.

1.3 Requests for Approved Equals

.1 Any requests for approved equal shall contain sufficient documentation regarding the service organization which is available to back up the tendered pumping units. In particular, the service organization shall:

- have been in existence a sufficient length of time to have established a reputation which can be backed up with references;
- have a number of qualified employees whose major commitment is to carry out service calls; and
- have a well-equipped local maintenance shop.

.2 The Contractor shall also be prepared to demonstrate the availability of commonly required spare parts. If these are not kept in stock locally, the anticipated delivery period must be clearly indicated in the Form of Tender.

1.4 Commissioning Plan .1 A commissioning plan should be provided to the Town for review 2 weeks in advance of the scheduled commissioning.

2.0 PRODUCTS

2.1 Structure .1 Chamber:

.1 The main chamber shall contain the pumps and associated equipment and shall be a vertical cylinder.

.2 The shell shall be constructed of Fibreglass Reinforced Plastic (FRP) and shall provide sufficient rigidity to resist deflection during installation and to resist pump loads and vibrations.

.3 The main chamber shall be reinforced with external reinforcing rings.

.4 Four (4) lifting "eyes" adequate for the entire weight of the completed station, including all installed equipment, shall be provided.

.5 Where inflow, discharge and ventilation lines, pass through the tank wall, the wall shall be reinforced.

.6 The connecting flanges shall be ANSI B-16.1, Class 125, unless shown otherwise on drawings.

.7 Color of the fibreglass interior shall be sanitary white. The exterior shall be dark green.

.8 Hold down lugs, complete with hold down bolts, shall be provided with sufficient strength to anchor the lift station to the reinforced concrete base, preventing flotation.

.9 The wet well shall be smooth and free of projections and pockets which could impede flow and collect sediment.

.10 An aluminum access ladder shall be provided as per Work Safe BC requirements. After installation of the complete lift station, all equipment shall be capable of servicing from the upper chamber.

.11 Electrical connection points shall be provided for the pump motors, light, and float conduits.

.2 **Physical Properties of FRP Fabrication:**

.1 The material of all tanks shipped shall meet the following minimum requirements:

Property at 73° F.	ASTM Test	Value
Tensile Strength	D638	8,000 - 16,000 psi
Compressive Strength	D695	14,000 - 27,000 psi
Flexural Strength	D790	16,000 - 30,000 psi
Flexural Modulus	D790	1.0×10^6 psi
Hardness (average)	D790	Barcol 40

.2 Fiberglass tank to be helically filament wound utilizing chemically inert ISO resins. The laminate shall contain at least 60% and not over 70% glass by weight. All FRP work shall meet or exceed the following standards:

C.G.S.B.	41-GP-22
A.S.T.M.	3299 and 2563-2.4
A.S.T.M.	D883-69

.3 The maximum load rating permitted on the top of the tank must be posted on a plaque on the inside of the lid. The plaque must clearly visible when the lid is open.

.3 **Construction**

.1 Laminates shall be dense, without voids, dry spots, foreign inclusions, air bubbles, pinholes, or delamination and shall not be cracked or crazed. Such deficiencies shall be removed by grinding and replaced with hand laid matt and roving exceeding the amount removed. The fabricated unit shall have a smooth white inner surface and shall have a dimensional tolerance of plus or minus 6mm from design dimensions.

.2 Bonded joints shall be made by wrapping with strips of fibreglass mat soaked in resin. The wrap material shall be at least as thick as the heaviest plastic section joined, and it shall extend to either side of the joint a sufficient distance to make the joint at least as strong as the pieces joined. Interior joints shall be coloured white to match the interior surfaces; exterior joints shall be of the same colour as the exterior surface.

.3 The inside surfaces of bonded joints shall be sealed with one layer of mat and then coated with resin to a minimum of 2.5mm thick.

.4 All exposed interior and exterior surfaces shall have sufficient resin coating 0.51mm minimum thickness, to avoid exposure of glass fibres.

.5 To prevent "flowing" of the final resin coat, it shall be bonded by using "Veil" glass fibre.

.6 All cut edges and drilled holes shall be coated with resin so that no glass fibres are exposed and voids filled.

.7 Structural elements having edges exposed shall be reinforced with chopped strand glass mat.

.8 The minimum tank wall thickness shall be 16mm and shall be externally reinforced to resist soil, bearing, hydraulic, and handling loads, both internal and external. Wall thickness to be increased as required to resist loading.

.9 The resin used shall be a commercial grade and shall be evaluated by test of previous service to be acceptable for use in domestic sewage applications and suitable for installation underground throughout Canada.

.10 Ultraviolet light inhibitors to be used on all external surface in accordance with resin manufacturer's instructions.

2.2 Submersible Sewage Pumps

.1 Pumps to be equipped with ANSI discharge flange. Pumps shall be a centrifugal, submersible, non-clog, bottom suction, capable of passing a 76mm solid. Pumps and motors shall incorporate the following:

Impeller: Cast iron.

Volute/Motor Frame: Cast iron, close coupled to seal chamber. Volute to be equipped with quick discharge nozzle to provide an automatic rapid and leakproof gravity lock type connection or disconnection from the fixed elbow. Sliding guide brackets to slide along guide rails.

Shaft: Stainless Steel.

Seals: Double mechanical seals (tungsten carbide to carbide upper and tungsten carbide to tungsten carbide lower).

Bearings: Anti-friction suitable for a minimum bearing life of 50,000 hours B10 life under operating conditions.

Fluid Operating Temp.: 0°C to 20°C.

Fluid Specific Gravity: 1.0

Fluid Type: Domestic Sewage

Fasteners: Stainless Steel (ASTM TYPE 316).

.2 Motors shall be CSA approved submersible squirrel cage induction type with Class F insulation and non-hydroscopic windings. Service factor shall be 1.0. Use EEMAC Design B. If higher starting torque is required for the equipment loading, use EEMAC Design C.

Pump motors shall come equipped with means of communicating seal leaks and over-temperature conditions.

.3 Power cables shall be factory-sealed into the motors and flush valve. They shall be of a type of construction acceptable to the electrical inspector. Cables shall be of sufficient length to reach the Control Kiosk without splices.

Power cables shall be equipped with a disconnect switch located inside the wet well, complete with lockout. Disconnect switches to be Meltric Decontactors or approved equal.

.4 The pump motor nameplates shall be mounted in the Kiosk or Panel.

.5 Pumps shall be painted with epoxy and equipped with sacrificial zinc anodes to provide corrosion protection.

.6 Pump P2 to be equipped with Flygt Model 4901 Mix Flush Valve or approved equal.

.7 Contractor shall supply the following spare equipment:

- one (1) impeller
- one (1) spare pump

2.3 Fixed Discharge Connection

.1 Fixed discharge elbow, quick disconnect type, with steel soleplate, lower guide rail holder and drilled for anchor bolts.

2.4	**Lifting Chains**	.1	Lifting chains to be Grade 80 Accoloy A8 material, rated with a working load of 1900 kg and shall be NAR approved for overhead lifting, finish to be galvanized. Chain length to be sufficient to connect between pump and chain hoist.
2.5	**Guide Rail Assembly**	.1	Schedule 40 galvanized steel pipe c/w upper guide bar holder.
		.2	All fittings and connectors to be galvanized.
2.6	**Ventilation Duct Work & Fan**	.1	Inlet duct shall be provided for air blown into the lift station and a vent shall release exhaust air.
2.7	**Lighting Fixture**	.1	The wet well light shall be an explosion-proof, wall-mounted, LED fixture suitable for Class 1 locations, complete with globe and guard, RAB Type EB 123 or equal. Switch by General Contractor.
2.8	**External Piping**	.1	As per the Contract Drawings.
2.9	**Internal Piping**	.1	Sewage piping shall be stainless steel.
2.10	**Plug Valves**	.1	Plug Valve, c/w lever. Flanges to ANSI B-16.1, Class 125.
2.11	**Check Valves**	.1	Ball check valve. Flanges to ANSI B-16.1, Class 125.
2.12	**Level Regulators**	.1	Provide five ENM-10 Flygt level regulators to stop both pumps, start lead pump, start standby pump, high level alarm, low level alarm for 24 volt operation, each with sufficient cable suitable for the installation.
		.2	Provide one aluminum liquid level hanger, with wall bracket mount and flat switch conductor hooks for excess cable. Hanger shall also provide threaded strain-relief squeeze connectors for each level regulator.
2.13	**Bolts**	.1	All bolts, including those for the check valve and plug valve, shall be ASTM Type 316 Stainless Steel.
2.14	**Access Covers**	.1	Access covers shall be designed to allow removal of the pumps from the stations without removing or damaging other equipment.
		.2	Each cover shall be hinged and include hydraulic assist for easy opening with less than 225 N lifting force and shall be provided with a padlock hasp with a box enclosure to prevent vandalizing of the lock.

.3 A brass padlock shall will be installed by the Town at the developer's cost.

.4 Each cover shall be provided with a positive means of locking open.

.5 Safe-Hatch (or approved equal) shall be included to provide fall through protection.

2.15 Air Release Valve

.1 Air release valve to be 50mm diameter NPT inlet, cast iron body, bronze mechanism and seat, stainless steel lever pins and float, designed for sewage, rated at 1MPa. Provide shut-off valve and back flushing facilities including blow-off valves and 3 metre long back flush hose. Equip valve and hose with quick disconnect couplings.

2.16 Floor Gratings

.1 Fibreglass or Borden Type B aluminium Size No. 6 suitable for a bearing load of 5 kN/m², or 200 kg plus dead weight of one pump whichever is greater.

2.17 Miscellaneous Metals

.1 Aluminium: to ASTM 655.

.2 conforming to CSA G40.2-M1977; Type W with yield strength of 300 MPa, shop primed.

.3 stainless steel ASTM Type A316 Stainless Steel unless otherwise noted.

.4 Miscellaneous metalwork, including brackets, nuts and bolts, cables, turnbuckles, and eye bolts shall be stainless steel or aluminium. Sharp edges and weld splatter shall be removed prior to installation.

2.18 Pressure Gauge

.1 GIC #6211, liquid 100 mm diameter pressure gauge c/w snubber and isolating valve.

2.19 Hydrostatic Tests

.1 Pressure piping within the FRP wet well and valve chamber shall be hydrostatically tested to a pressure no less than 1.5 x the shut off pressure of the lift station pumps. The test pressure shall be held for a period of not less than two (2) hours, with no leakage permitted.

Sewage forcemains external to the lift station shall be tested in accordance with Section 33 34 01 – Sewage Forcemains.

Should any test disclose leakage greater than that specified above, the Supplier shall locate and repair the defect and retest

the section to ensure that the leakage is within the allowable limits.

2.20 Concrete Base and Anchoring System

.1 The reinforced concrete wet well base and anchoring system shall be designed to prevent uplift of the fibreglass lift station assuming that the surrounding soil is flooded to finished ground elevation and that the station is empty. A minimum safety factor of 1.5 against uplift shall be used in the design of the base and anchoring system.

2.21 Power Supply and Controls

.1 As per Division 26.

3.0 EXECUTION

3.1 Excavation and Backfilling

.1 To requirements of Section 31 23 01 Excavation, Trenching and Backfilling.

.2 Start backfilling only after the concrete has acquired a suitable degree of strength and only after obtaining written permission from the Contract Administrator. No backfilling of walls shall take place before the slabs have been cast and have reached a minimum of 75% design strength.

.3 Use only the approved portion of the excavated material and other approved imported granular fill.

.4 Deposit backfill in layers not exceeding 150mm thickness, and compact to obtain 95% of Standard Proctor Density or otherwise indicated on the Contract Documents.

.5 Keep heavy compacting equipment away from structure by at least 1.5 metres. This portion shall be compacted using hand operated tampers.

.6 Make all fills and embankments to elevations, contours, and slopes shown on the drawings.

.7 Grade top layer carefully to smooth regular surface, with a minimum thickness of 100mm of topsoil, when indicated on the drawings.

.8 Allow for any settlement which may occur in order that the finished fills or embankments will be to the final grades as shown on the drawings.

.9 Excavate and remove all materials whatever their nature and condition to depths and dimensions necessary for the construction of the structure and piping to the limits shown on the drawings.

.10 Furnish all equipment for construction, temporary supports including shoring, bracing, cribs, coffer dams, etc. and for de-watering.

.11 Install and operate an adequate de-watering system for construction of the structures in the dry.

.12 All equipment used for de-watering and excavation shall be of a suitable and rugged type to assure continuous operation.

.13 Make special provisions to relieve the water pressure and prevent flotation or damage to parts of the works in case of accidental stoppage of de-watering equipment.

.14 Where over excavation is required, fill with specified sub-base or lean concrete unless otherwise indicated in the Contract Documents.

.15 Stockpile excavated granular material meeting backfill specification designated by the Contract Administrator. Save for re-use.

.16 Notify the Contract Administrator for inspection and approval after the excavation is completed.

.17 Do not place any concrete until the Contract Administrator has approved the depth of excavation and the character of the foundation material.

3.2 External Piping

.1 To requirements of Sections 31 23 01 - Excavating, Trenching and Backfilling, Section 33 30 01 - Sanitary Sewers, and Section 33 34 01 - Sewage Forcemains.

3.3 Concrete Work

.1 To Section 03 30 53 - Cast-in-Place Concrete and Section 03 20 01 - Concrete Reinforcement.

3.4 Electrical

.1 To Division 26.

3.5 Piping Installation

.1 Pipe shall be adequately supported on adjustable pipe saddle supports or from pie hangers or brackets during construction and completion to prevent abnormal stresses being imposed on items of equipment such as pump flanges.

.2 Valves shall be installed in accordance with the manufacturer's recommendations.

.3 Before installing bolted connections, pipe ends, and gaskets shall be absolutely clean. Gaskets shall be lubricated with soapy water and bolts with thread lubricant. Bolts shall be tightened progressively by the crossover method and not in rotation around the joint. Bolts shall be torqued to the manufacturer's requirements. Wrenches used for tightening bolts shall be in good condition and properly sized to prevent rounding of nuts and bolt heads.

.4 During all stages of construction, piping shall be protected from damage from any cause. Openings in the piping system shall be securely covered, capped, or plugged to prevent collection of dirt, debris, or other extraneous matter during the entire construction.

.5 Damaged work shall be removed and replaced with new material to the satisfaction of the Town.

3.6 Pumps and Accessories

.1 Locate discharge elbows on the sump floor at exact locations required so that guide rails which connect from them to the access frame will be in perfect alignment.

.2 Firmly anchor discharge elbows to the floor at their proper location.

.3 Install guide rails.

.4 Lower pumps on guide rail system until contact is made with discharge elbows. Ensure that system functions to give leaktight connection.

3.7 Start-Up

.1 Lift station shall be completed, including work of other sections, before start-up.

.2 Start-up of equipment to take place in the presence of a trained representative of the Equipment Supplier and Town. Copies of final operating and maintenance manuals shall be provided to the Town at least two (2) weeks in advance of start-up.

.3 Set level and align all equipment to the complete satisfaction of the Town.

.4 Carefully check the operation and controls of the equipment.

.5 Notify the Town when the operation and controls of the equipment are satisfactory.

.6 Provide the necessary facilities for the Town to check the operation of the equipment.

.7 The Contractor shall make provisions for adequate supply of water to the wet well and forcemain for testing purposes. Testing will include checking performance of all pumps, floats, and controls. At minimum the following tests will be conducted.

.1 Pump Condition - i.e. pump body, impeller running free, quick disconnect connection, cable connections, gaskets and oil level.

.2 Wet Well Condition - i.e. pump sliding free on guide rails, pump cable with sufficient slack, floats suitably positioned and will not snarl, no cable splices or junction box in the wet well, well clean.

.3 Control Panel Condition - i.e. components including motor overloads correctly rated for the pumps. Record over-load settings on schematic, date and sign.

.4 Start-Up Operation - i.e. supply voltage suitable, pump rotation correct, operation of pumps - by float switches - HOA selectors - lead pump selector - overloads isolate associated control, alarm float.

.5 Pump Load Checks - ie. load current on all phases for single and parallel pump operation, supply voltage under load. Confirm pumping rate and operating head.

.6 Alarm panel test to confirm all zones are correctly configured and operational.

.8 Liaise with the Contract Administrator to ensure that the Design Engineer, the Town, the Contractor, and the Equipment Supplier are present for the start-up and testing program.

.9 The Town will not take over operation and maintenance of any equipment until the work of all related sections has been completed in the area in which the equipment is located and all equipment has operated in its intended manner to the satisfaction of the Town.

.10 Cost of any temporary power costs for the start-up procedure shall be the responsibility of the Contractor.

3.8 Protection

.1 Protect the work and material of all other sections from damage and make good all damage thus caused, to the satisfaction of the Town.

.2 Be responsible for work and equipment until finally inspected, tested, and accepted, protect work against theft, injury, or damage, and carefully store material and equipment received on site which are not immediately installed. Close open ends of work with temporary covers and plugs during construction to prevent entry of obstructing materials.

3.9 Cleaning

.1 Any dirt rubbish, or grease on walls, floors, or fixtures for which the Contractor is responsible must be removed and the premises left in first class condition in every respect.

.2 De-water station wet well and remove all dirt and grit from bottom of station.

3.10 Maintenance Manuals

.1 Supply three copies of hard backed bound manuals with all the information required for maintenance, operation, parts catalogue and lubrication.

The following information shall be included in the manual:

.1 Table of contents.
.2 As constructed shop drawings.
.3 Equipment, layout drawings.
.4 Electrical, control, and alarm wiring diagrams.
.5 Normal and emergency operating instructions for all equipment.
.6 Maintenance instructions for all equipment.
.7 Safe work procedure for confined space entry into the wet well and valve chamber (to be prepared by a Qualified Professional).
.8 Equipment data sheets.
.9 Certified head/capacity curves for pumps.
.10 Equipment part lists.

.2 Each section shall be separated from the preceding section with a plasticized divider with a tab denoting contents of the section.

.3 Review all of these instructions with the Town representatives before the commencement of the maintenance period.

General catalogues will not be accepted and bulletins must deal specifically with the equipment provided.

SCHEDULE 5

LANDSCAPE STANDARDS

INTRODUCTION

The following landscape standards include design criteria and specifications pertaining to all required landscaping requirements under the Town's Subdivision Development and Servicing Bylaw.

Unless documentation provided by the Town of Comox along with a specific request for tender or request for proposal states specifically that a provision set forth has been waived, all provisions are to be satisfied.

The requirements set forth in these standards are minimum requirements that shall be applied universally by all parties performing services for the Town of Comox.

This document is part of a series of standards and as such should not be viewed in isolation of all other Town of Comox associated standards which may modify and/or clarify the requirements set forth within this document.

The Town of Comox may, on a case-by-case basis, and at the Town's sole discretion, approve deviations from these standards.

INTENT OF THE STANDARDS

This schedule is intended to provide direction to the Applicant and their Engineer on the elements required to be considered in the design landscaped areas. It is intended to be used in conjunction with the MMCD Design Guideline Manual and the Town of Comox Subdivision and Development Servicing Bylaw Schedules and the Master Municipal Construction Document (MMCD).

LANDSCAPE STANDARDS

1. GENERAL

(a) Landscape design shall comply with the Canadian Landscape Standard (CLS), published by the Canadian Society of Landscape Architects and by the Canadian Nursery Landscape Association, current edition. A Consulting Landscape Architect shall prepare drawings and planting specifications for street trees, boulevard*s*, medians, curb extensions, and any other landscape screening in locations as directed by the Parks Manager or designate.

(b) The Landscape design shall comply with the Town of Comox Climate Resilient Landscaping Standards, current edition. Should any conflict arise this Bylaw shall take precedence.

(c) Tree Preservations and new tree planting shall be considered at the early stages of development design and structure(s), driveways, rock pits, drainage features, retaining walls, street design etc. being arranged, sized and oriented to accommodate existing trees and new trees, including street trees.

(d) A Landscape Plan and details shall be prepared by a Consulting Landscape Architect and submitted to the Parks Manager or designate for approval prior to any Works and Services being done.

(e) The Landscape Plan shall be prepared in conformance with the Engineering Design Drawings requirements contained in this Bylaw.

(f) The Consulting Landscape Architect shall submit a BCSLA Schedule L (Assurance of Professional Design and Commitment for Field Review) prior to the commencement of construction and a Schedule C-L (Assurance of Professional Field Review and Compliance) at the time of Final Acceptance.

2. STANDARDS & SPECIFICATIONS

(a) All construction within the scope of this Schedule shall conform to the Canadian Landscape Standard and the requirements, standards and specifications prescribed by this Bylaw.

(b) Should any conflict exist or arise between these documents, this Bylaw shall take precedence.

3. PLANTING REQUIREMENTS

(a) Boulevard*s*

(i) All softscape Boulevards without street trees, as approved shall be finished with 300mm Growing Medium and seeding or sod at the discretion of the Parks Manager or designate. Seed mix shall be as specified by the Consulting Landscape

Architect and approved by the Parks Manager or designate.

(ii) All softscape Boulevards to be planted with street trees shall be finished with 1000mm Growing Medium in a continuous trench followed by seeding or sod as applicable in (i) Above

(iii) All hardscape Boulevards shall use soil cells to obtain the applicable soil volume as required in Section 13.

(iv) The Developer shall be responsible for maintaining the Boulevards until the end of the Warranty Period.

(v) Additional Landscaping may be required in certain areas at the discretion of the Parks Manager or designate.

(b) Medians

(i) Medians shall be Landscaped according to a plan prepared by a Consulting Landscape Architect and approved by the Parks Manager or designate.

(c) Curb Extensions

(i) Curb Extensions shall be Landscaped at the discretion of the Parks Manager or designate.

(d) Plant Material

(i) All plant material shall conform to the Canadian Landscape Standard and the Canadian Nursery Stock Standard, current edition. The plant size at time of planting shall be #1 pot size for ground covers and #2 pot size or greater for shrubs.

(ii) All plant material shall be selected based on the premise of the right plant for the right location. Plant selection shall be appropriate for the site's light and moisture availability, as well as context and aesthetic.

(iii) All plant material shall be located such that their mature height does not conflict with sight line requirements.

(e) Street Trees

All street tree plantings shall:

(i) Conform to the Canadian Landscape Standard and the Canadian Standard for

Nursery Stock, current edition;

(ii) Be nursery field grown unless approved otherwise by the Parks Manager or designate;

(iii) Be locally hardened and acclimatized;

(iv) Be 6cm caliper or greater if deciduous;

(v) Be 3.0 metres height or greater if coniferous.

All exceptions to the above must be pre-approved by the Engineer.

(f) Single Family Residential Parcels

A "yard" tree shall be provided for each newly created Residential parcel in a Development.

Yard trees shall be a minimum height of 2.0m for conifers and a minimum truck diameter of 6.0 cm measured at 1.2m above the root crown for deciduous.

4. PLANT SPACING AND LOCATION

(a) Street tree spacing shall be varied to accommodate species diversity, maximize the number of trees to achieve crown closure, allow for full crown Development, and accommodate site lines, utilities, and other site features.

(b) Species selection shall be guided by the Town of Comox Climate Resilient Landscaping Standards, current edition.

(c) The following are recommended tree spacing based on the described size classes and required soil volume, for reference:

Tree Type	Mature Height	Spacing on Centre (o/c)*	Soil Volume
Large	> 15 m	9.0 m – 12.0 m	35 m3
Medium	10 m to 15 m	9.0 m – 12.0 m	20 m3
Small	< 10 m	6.0 m – 9.0 m	15 m3
Columnar Trees	Narrow habitat & < 8 m	6.0 m – 9.0 m	15 m3

*Final tree spacing and location shall be approved by the Town.

(d) Tree spacing should be consistent with existing tree spacing within the same block, on both sides of the street. Individual cases are subject to offsets due to constraints shall be as directed by the Parks Manager or designate.

(e) Tree spacing shall be adjusted to accommodate clearances set out in this Section.

(f) Landscape shrub and groundcover plantings shall be designed to fill in, such that there is no exposed soil, within three (3) years of installation.

(g) Street tree planting shall not be required within the cul-de-sac bulb area.

5. MINIMUM TREE PLANTING CLEARANCES

(a) Listed below are the minimum distance that trees should be planted from street feature or furniture:

Street Feature/Furniture	**Minimum Separation to Tree**
Lamp Standards	5.0m
Steel/wooden poles, posts & bollards	3.0m
Hydrants	3.0m
Catch Basins	3.0m
Manholes, Valve Boxes, Service Boxes	3.0m
Water, Drainage & Sewer Service and Connection locations	2.0m
Driveways	2.0m
Intersection sight lines	8.0m
Overhead lines	5.0m from pole – Max. height of tree, 5.0m 10.0m from pole – Max. height of tree, 12.0m

6. DRAINAGE

(a) Drainage systems connected to the municipal storm sewer system shall be provided under hard surfaced street tree planting areas with soil cells, where subsoils are poorly draining and where tree pits and planting beds are at risk of holding water, at the discretion of the Engineer and Parks Manager.

7. IRRIGATION

(a) Drip irrigation and controllers meeting Town standards shall be provided for street trees in medians, curb extensions, and where street trees are planted in hard surfaced planting areas.

(b) All irrigation systems shall be metered.

8. LANDSCAPE LIGHTING

(a) At the discretion of the Engineer and Parks Manager, conduit from the nearest Town

electrical outlet to each tree pit shall be provided for all trees planted in hard surfaced street tree planting areas on Comox Avenue and Beaufort Avenue between Stewart Street and Church Street. Lighting systems acceptable to the Engineer may be required. Conduit and outlet shall be located to avoid conflict with the growing tree trunk and root collar and not pose a hazard to pedestrian traffic.

9. GROWING MEDIUM

(a) Growing Medium as defined in this Bylaw shall be installed at the following minimum depths prior to planting in non-hard surfaced areas:

(i) sod and grass areas 300mm (measured from top of sod thatch)

(ii) groundcover and shrub areas 450mm

(iii) street tree areas 1000mm

(b) Each tree planting location shall be provided with a volume of Growing Medium per subsection 4. (b) of this section. The Consulting Landscape Architect shall provide the planting plan showing the planting bed, and soil cell areas and associated Growing Medium volume calculations for each tree to the Town for approval.

(i) The Growing Medium volume calculations shall account for the functional volume of Growing Medium achievable using planting beds and soil cells.

(c) In areas where the required Growing Medium volume per tree is not achievable due to specific site or project constraints, such as the presence of surface bedrock, the volume of Growing Medium may be adjusted in coordination with tree species selection and at the discretion of the Parks Manager or designate.

(d) On-site topsoil or amended topsoil shall only be used if it meets the requirements for the specified Growing Medium and is approved by the Parks Manager or designate.

(e) For each Growing Medium source and type used, soil tests confirming that the texture, organic matter, and nutrient levels meet the specifications shall be conducted conforming to the CLS (section 6.1.6) and provided to the Consulting Landscape Architect for approval prior to delivery and use.

10. SEEDING (GRASS & WILDFLOWERS) AND SODDING

(a) Seeding and Sodding shall:

(i) Conform to the Canadian Landscape Standard, current edition;

(ii) Sod must be suitable for high-traffic areas, offer good wear tolerance, shall be grown on sand or sandy loam-based soil and shall be un-netted.

(iii) Seed mixtures and sod shall be suited to the climate, growing medium condition and type, site orientation, sun exposure, terrain, purpose of use, establishment and lawn class designation under which they are to be grown, and/or to the Consulting Landscape Architect or Parks Manager or designate specification;

(iv) All seeded and sodded areas shall be inspected and accepted by the Parks Manager or designate after warranty period has ended.

11. SPLIT RAIL FENCING

(a) Split rail fencing to be used in areas with environmental sensitivity, in seeded areas with pollinator seed mixes, or to delineate or separate trails.

(b) All split rail fencing shall be designed and constructed in accordance with Supplementary Detail Drawing L4.

12. MULCH

(c) Non-composted bark mulch shall be used in all Boulevard, median, and curb extension planting beds and street tree plantings unless otherwise specified by the Consulting Landscape Architect and approved by the Parks Manager or designate.

(d) Non-composted bark mulch shall be placed at a minimum 75mm settled depth unless otherwise specified by the Consulting Landscape Architect and approved by the Parks Manager or designate.

13. SOIL CELLS

(a) Soil cells shall be used in areas of hard surface planting where tree grates are used. Or where the softscape boulevard width is less than 1.65 m from face of curb to sidewalk or 1.5m of clear width of growing medium to supplement the minimum volume of growing medium.

(b) Irrigation and drainage systems shall be installed in all soil cell areas.

(c) Refer to Supplementary Detail Drawing L10.

(d) Soil cells shall be filled with Growing Medium as specified by the Consulting Landscape Architect and approved by the Parks Manager or designate.

(e) Soil cells shall be installed according to the manufacturer's specifications and recommendations.

14. STRUCTURAL SOIL

(a) Structural Soil shall be used only under hard surfaces to connect two areas of softscape (e.g. under a Sidewalk to connect a Boulevard to a planting bed) where trees are installed in the soft Boulevard. **DO NOT** place Structural Soil in planting beds or planting pits.

(b) Structural Soil shall be installed as per Supplementary Detail Drawing L11.

15. MAINTENANCE

(f) During the Warranty Period maintenance and watering activities shall be specified by the Consulting Landscape Architect, approved by the Parks Manager or designate, and carried out by the Developer.

(g) After the expiry of the Warranty Period the Town will be responsible for the maintenance of street trees.

16. TRAILS

(a) Community Pathways
Multi-Use Trails are 3 – 5 metres wide with a smoothly paved surface to accommodate high usage and wherever possible universal accessibility with a maximum grade of 5%. They shall be designed and constructed in accordance with Supplemental Detail Drawing L6.

(b) Nature Trails
Gravel Trails are 1.5 – 3 metres wide with a compacted granular surface for moderate use and an intermediate level of accessibility. They shall be designed and constructed in accordance with Standard Detail #. Where the gradient exceeds 25% a stairway shall be constructed with materials and design that are approved by the Engineer and Parks Manager. They shall be designed and constructed in accordance with Supplemental Detail Drawing L7.

(c) Planning, Design and Construction of all Trails:

(i) Trees, other plantings and landscaping should be included along the trail corridor to improve the local climate and environment and to make trails more inviting for daily activity.

(ii) Trail types and widths are at the discretion and approval of the Parks Manager or designate.

(iii) Associated works may be required such as, but not limited to: trail-head amenities, parking, creek crossings, slope stabilization measures, boardwalks,

fencing, signage, viewpoints, drinking fountain, seating areas, stairs and access controls.

(iv) Where trails are to be included in a development, they must be shown on all associated plans, such as grading, servicing, landscape, tree preservation, and storm water management plans.

(v) For narrow trails, maintenance and emergency access must be considered and only small-sized specialized construction equipment will be allowed.

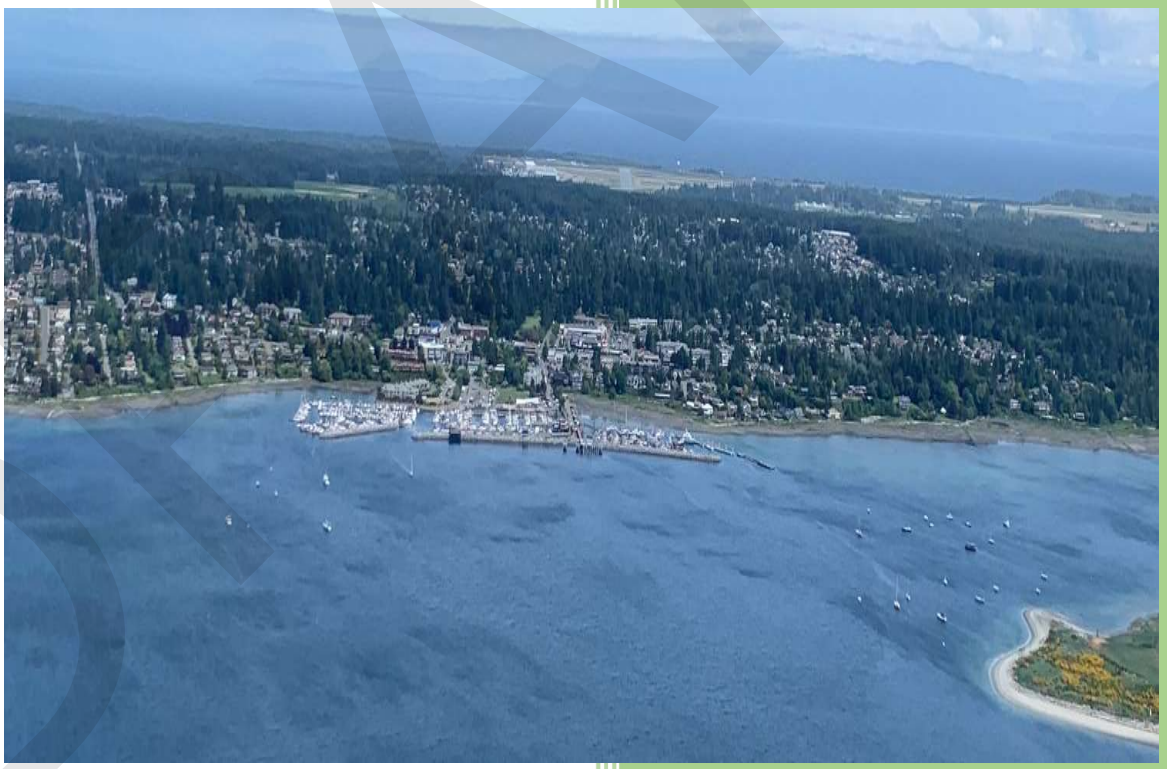
(vi) Layout plans must be confirmed with Town staff, with on-site confirmation prior to any tree pruning or removals or other works occurring on site.

SCHEDULE 6

FIBRE OPTIC CONSTRUCTION STANDARDS

TOWN OF COMOX

Fibre Optic Construction Standards



Town of Comox – Public Works Dept

Contact : 250-339-5410

Table of Contents

1.0 – Introduction 4
2.0 – Fibre Optic Network Installation Planning
2.1 – Option A – Back of Curb 5
2.2 – Option B – Boulevard – Paved or Softscape 5
2.3 – Option C - Back of Sidewalk – Softscape 5
2.4 – Option D – Asphalt Road – Hardscape 5
2.0.a – Microduct Route Planning Options Cross Section 6
2.0.b – Typical Road Cross Section Diagram (Option A) 7
2.0.c – Fibre Optic Back of Curb Installation (Option A) 8
3.0 – Civil Construction – Fibre Optic Networks
3.1 – Underground Construction – Contractor Requirements
3.1.1 – General 9
3.1.2 – Civil Drawings, As-Built Drawings and GIS Spatial Data 9
3.1.3 – Daily Progress Reports 10
3.1.4 – Construction Schedule 10
3.1.5 – General Contractors Notes 10
3.2 – MicroTrenching and Construction Sequence
3.2.1 – Trench Detail 13
3.2.2 – Trench Backfill 13
3.2.3 – Microtrench Construction Sequence 14
3.2.a – Softscape trench Diagram 15
3.2.b – Hardscape (Asphalt) Trench Diagram 15
3.2.c – Hardscape (Concrete) Trench Diagram 16
3.3 – Standard Horizontal Direction Boring 17
3.3.1 – Directional Drilling Contractor Notes 17
3.4 – Microduct Installation Requirements 19
3.4.1 – Tracer Wire 19
3.4.2 – Surface Warnings Markers and Signage 19
3.4.3 – Microduct Depth Recording 20
3.4.4 – Fibre Cable Install 20
3.4.5 – Pull Strings 20
3.4.6 – Labeling 20
3.4.7 – Fibre Optic Cable Installation Contractor Notes 20
3.5 – Standard Vaults/Service Boxes
3.5.1 – Accepted Vault Types 22
3.5.2 – Vault/Service Box Detail 22
3.5.3 – Vault Installation Detail 22
3.5.a – Oldcastle Vault Installation Diagram 23
3.5.b – Synertech Vault Installation and Grounding Plate Diagram 23
3.5.c – Microduct Bundle Entry in Vault Diagram 24
3.5.d – Microduct Stub Caple Example Diagram 24
3.5.e – Town of Comox Vault Label Standard Diagram 24

Table of Contents

4.0 – Aerial Fibre Optic Cable Installation Guideline (TOC Owned Poles) 25

4.1 – Standard Riser Pole 27

5.0 – Alternative Fibre Optic Cable Installation Options 27

5.1 – Existing and Abandoned Conduits 28

5.2 - Streetlight Conduits 28

5.0.a - Streetlight Fibre Optic Install Diagram 29

6.0 - Building Entry – General Guidelines

6.1 – Civil Work 29

6.2 – Building Entry Service/Pull Box 30

6.3 – Bend Radius 30

6.4 – Private party 30

7.0 – Safety Specifications

7.1 – General Guidelines 31

7.2 – Traffic Management Plan (TMP) 32

7.3 – Confined Space 32

8.0 – Definitions and Abbreviations 33

1.0 – Introduction

Fibre optic networks are the global standard for high-speed data connectivity. Progressive municipalities understand the importance of advancing their communities to a "Fibre Ready" status and are preparing for this technology progression through the development of municipal fibre optic installation standards and guidelines.

The purpose of the Town of Comox's Fibre Optic Construction Standard is to provide a guideline to assist municipal contractors and corporate telecommunication incumbents as they continue to develop fibre optic networks within the Town of Comox's municipal boundary. It is anticipated that adherence to the Town of Comox's Fibre Optic Construction Standard will support effective fibre optic network deployment and reduce required permitting requirements and wait time. This document focuses on three current technologies for fibre optic network deployment, Directional Drilling, Micro Trenching and Aerial Pole Access. This document does not address fibre optic cable deployment through traditional civil construction methods, as these principles have been identified in the Town of Comox's current bylaws and construction standards.

DISCLAIMER:
The following material represents a preferred construction standard for the Town of Comox and should be considered a guideline. Any user of this document should always refer to the bylaws and construction standards established by the Town of Comox as a basis for making any business, legal, engineering, or other decisions. This document is only intended to be a guide and is not intended to be a substitute for sound engineering knowledge, judgment, or experience and does not attempt to duplicate material already covered in relevant engineering documentation, such as the Canadian Electrical Code. Any action taken should be under the advisement of the Town of Comox's engineering and corporate staff. The authors and contributors of this guide are not responsible for any false or incomplete information presented in this guide.

Contact Information

Town of Comox Public Works - 250-339-5410 **BC1 Call – 1-800-474-6886**

Revision History

Date	Pages Affected	Description of Revision

2.0 – Fibre Optic Network Installation Route Planning Options

The Town of Comox has identified four options for the installation of fibre optic microducts in subsurface environments within the town's municipal boundary. Contractors are encouraged to choose routes for Microtrenching or Directional Drilling based on the following priority sequence when planning subsurface installation of fibre optic networks.

Due to the invasive nature of Directional Drilling and Micro-trenching, care should be taken that subsurface utilities and infrastructure are exposed through rigorous pothole, daylighting procedures and certified Engineering Surveys. Directional Drill depth must not impact existing subsurface utilities. Microtrench cut width should not exceed 10 cm and trench depth must not be less than 60cm minimum.

The following route options are provided in priority sequence:

2.1 – Option A – Back of Curb

- Microducts to be installed along back of curb and follow curbline.
- See Diagram 2.0.a, 2.0b and 2.0.c for further detail
- Best protection for microduct

2.2 – Option B – Boulevard – Paved or Softscape

- Microduct installed in boulevard located between curbline and sidewalk
- See Diagram 2.0.a for further detail
- Good protection at 60+ cm depth and best cost value for Trenching and Directional Drill

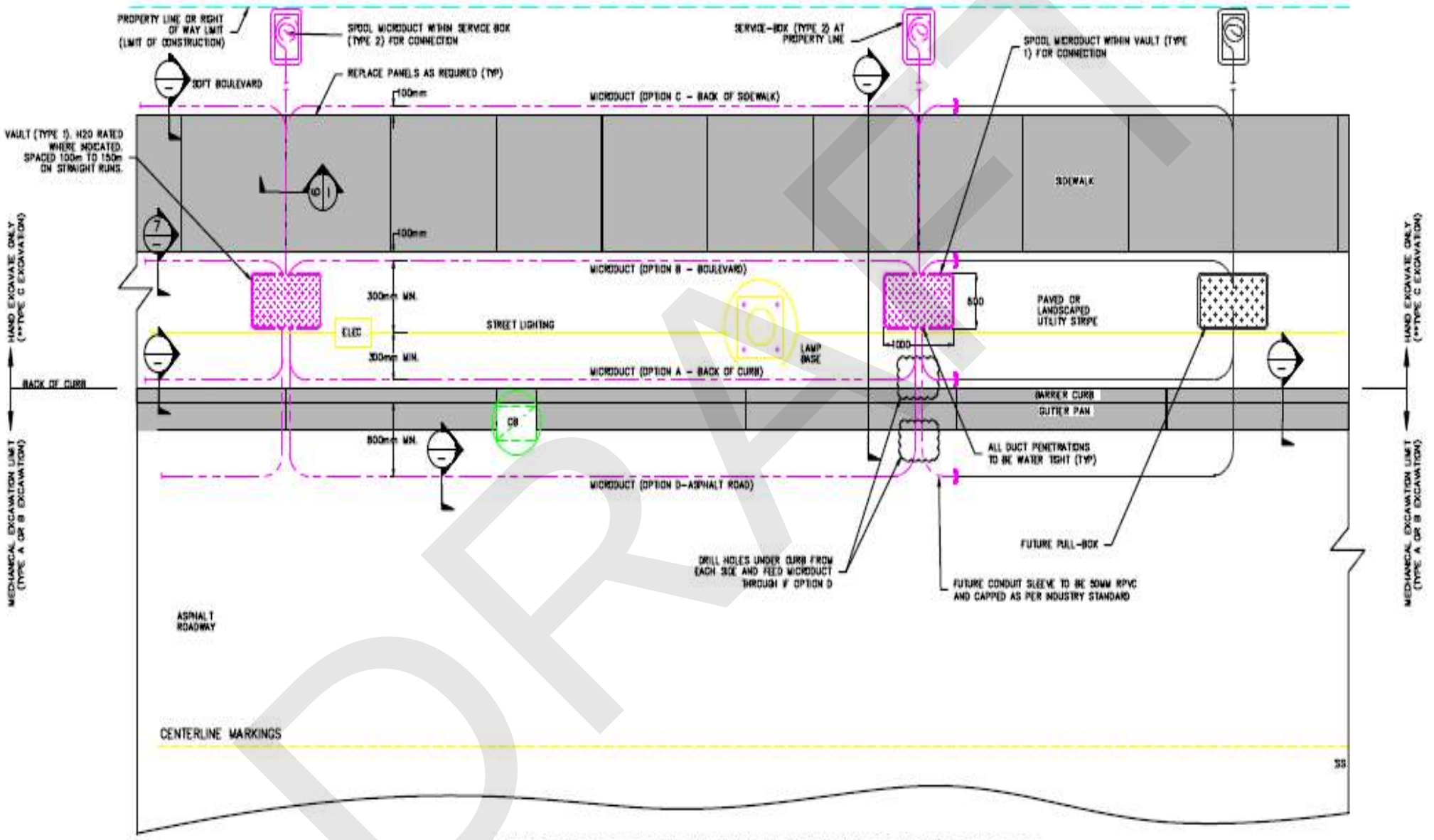
2.3 – Option C - Back of Sidewalk - Softscape

- Microduct installed in softscape area or back of sidewalk
- See Diagram 2.0.a for further detail
- Good protection at 60+ cm depth and best cost value for Trenching and Directional Drill

2.4 – Option D - Asphalt Road - Hardscape

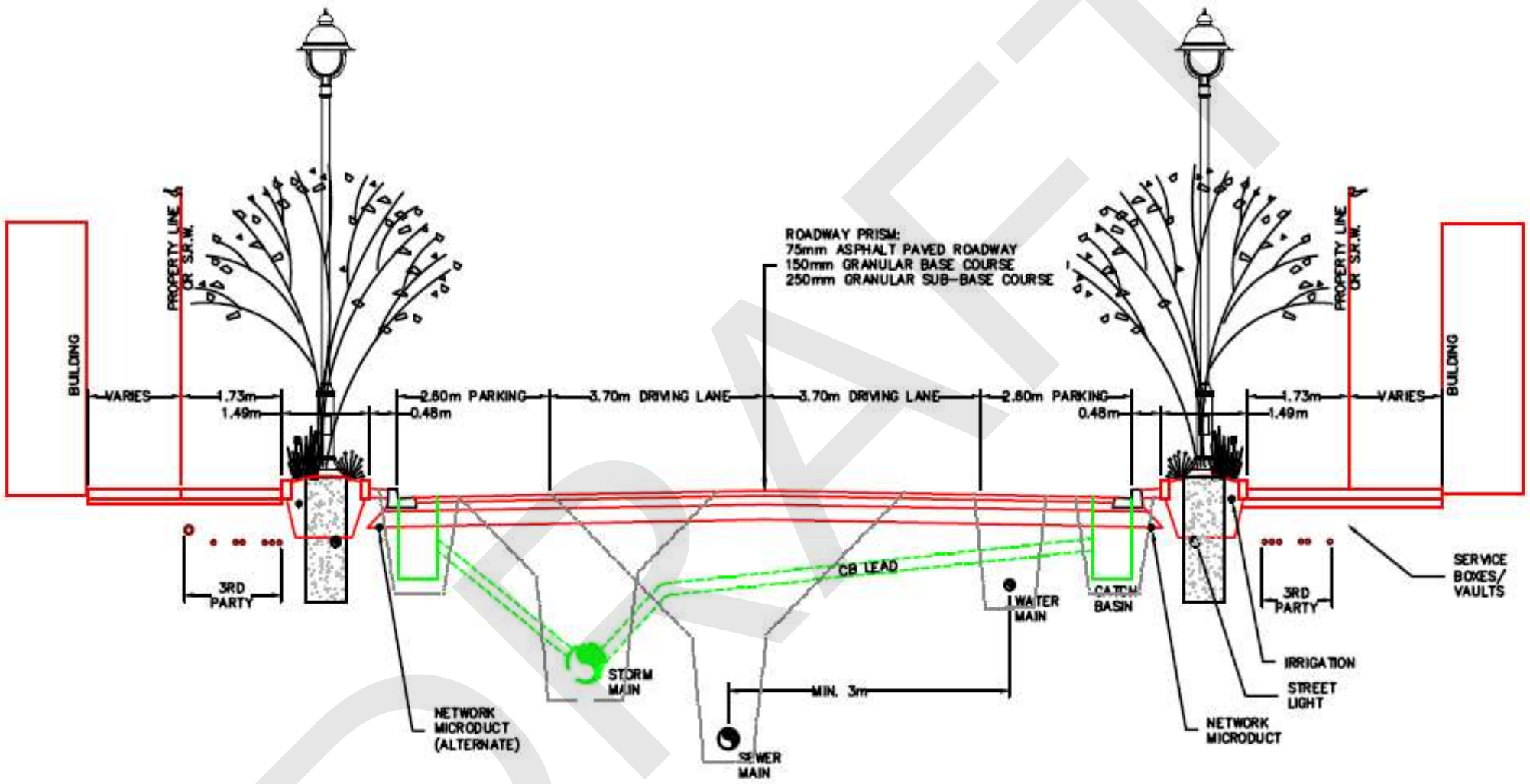
- Microduct installed in asphalt roadway as indicated by the TOC.
- See diagram 2.0.a for additional detail
- Good protection, most expensive for remediation and repair

2.0.a – Microduct Route Planning Options Cross Section



TYPICAL MICRODUCT SYSTEM LAYOUT IN EXISTING ROADWAY CORRIDOR

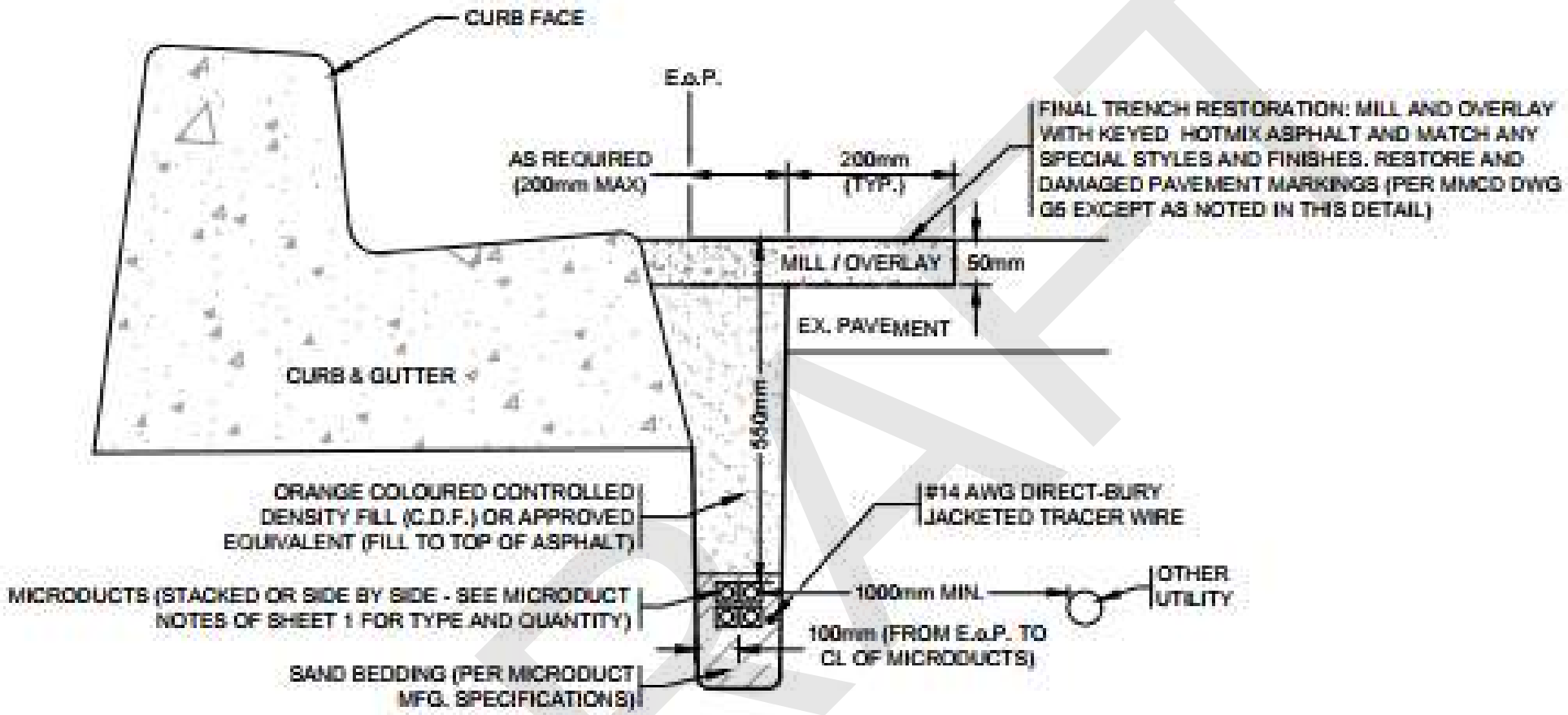
2.0.b – Typical Road Cross Section Diagram (Option A)



TYPICAL ROAD CROSS SECTION FOR NEW OR REHABILITATED CORRIDORS

NOT TO SCALE

2.0.c – Fibre Optic Back of Curb Installation (Option A)



NOTES:

1. TRACER WIRE MAY BE OMITTED WHEN MICRODUCT BUNDLE IS TRACEABLE WITH METALLIC SHEATH.

CAUTION:

CONTRACTOR SHALL TAKE ALL NECESSARY MEASURES REQUIRED TO PREVENT ANY MATERIALS FROM ENTERING CATCHBASINS OR FISH-BEARING WATERWAYS (PER D.F.O. AND BC ENVIRONMENTAL REGULATIONS).

MICRO-TRENCHING AT EDGE OF CURB/GUTTER

N.T.S.

3.0 - Civil Construction- Fibre Optics Networks

3.1 - Underground Construction – Contractor Requirements

3.1.1 - General

- Contractor shall provide the labour, tools, materials, equipment, project coordination, permits coordination/application, safety and traffic planning, travel and transportation for Outside Plant (OSP) underground, Inside Plant (ISP) building core, EMT and plenum duct installation, pulling or jetting cable and terminating and testing fibre in existing, new, or third-party structures, FOSCs, FECs, FPPs, and other housings within vaults, and rooms as required.
- All workmanship, materials and/or installation practices and activity shall be equal to or better than the standards established by the CAN/CSA T529/T530 Standards and the Canadian Electrical Code.
- Prior to any trenching, microtrenching, excavation, or boring, the contractor performing the work is responsible to notify the Town of Comox (**TOC**).
- In addition, TOC must be notified to locate private services, such as: water, sewer, storm, traffic control, fire alarm, Fortis Gas, BC Hydro, and street/traffic lighting.
- The contractor is responsible for maintaining all marks as detailed in the by-laws set up by the TOC. Copies of the by-laws can be requested by contacting the TOC or accessing the town's website www.comox.ca.
- All established waiting periods must be met before any trenching or excavating can be performed.
- To reduce errors, the contractor must conduct an engineering certified preliminary survey prior to start of work and has requested infrastructure data through BC 1 Call (www.bc1c.ca). Proof of BC 1 Call will be provided to the TOC.
- The proposed trench path or work should be "white-lined" with paint as visible representation of the proposed route.

3.1.2 – Civil Drawings, As-Built Drawings and GIS Spatial Data

- The contractor will keep a log of all Utility Locates. This will be kept for review if needed for utility damage reports and turned in with project As-built drawings as requested by the TOC.
- The contractor shall ensure that fiber optic cable is installed as specified on the drawings and that the Contractor installs fiber optic cable in accordance with the manufacturer's recommendations
- On a daily basis, the contractor shall red-line drawings during the course of construction to show the actual alignment or other variances of all installations required by the construction drawings.
- The drawings shall be available for review by the TOC when requested on the job site. Additionally, the contractor shall submit all redline drawings to the TOC on a weekly basis.
- Under no circumstances shall the contractor proceed with work until acceptable redline drawings are received by the TOC for previous week's work.

- Work shutdowns incurred by the contractor due to the failure to provide acceptable redline drawings per this section shall not become the basis for an extension of time or additional compensation to complete the contract.
- The contractor shall not submit any application for payment prior to submitting the associated redline "as-built" drawings.
- The TOC shall not make payment for work prior to receiving the associated redline "as-built" drawings. Such drawings shall indicate the location of the installed fibre, cable, conduit, or equipment referenced from permanent landmarks such as mileposts, edge of pavement, bridges, underpasses, vaults, service boxes, manholes or other permanent markers.
- All updated Civil and As-Built drawings must be provided to the Town of Comox as a final deliverable at the end of project completion.
- A GIS spatial data representation (compatible with ESRI mapping software) of the project must be provided to the Town of Comox as a final deliverable at the end of the project.

3.1.3 - Daily Progress Report

- The contractor's progress shall be tracked by utilizing Daily Progress Reports.
- Progress Reports shall be completed by a contractor's field representative and signed by the contractor's site supervisor with a copy made available to the TOC.
- The contractor shall note on these forms any discrepancies in progress.

3.1.4 – Construction Schedule

- If required by the TOC, the contractor shall submit a revised detailed Microsoft project resource-loaded construction schedule within five (5) business days of contract execution for TOC's approval on an 'as-needed' basis determined solely by the TOC.
- For small jobs Microsoft project resource-loaded construction schedules may not be required, which will be based upon the TOC's sole discretion.
- The resource-loaded construction schedule shall include the method(s) by location with the associated quantities, manpower, equipment and production to complete the work.
- The contractor shall provide TOC with this schedule in soft and hard copy form. The schedule shall contain sufficient detail to ensure that the TOC can measure Contractor's progress on a weekly basis throughout the project duration.
- The TOC shall utilize the Daily Progress Report to measure the contractor's progress.
- The TOC must be notified of any unscheduled delays or recovery plans as necessary.

3.1.5 – General Contractor Notes:

1. The contractor will provide all required equipment, tools, materials, and labour, including all associated mounting, pulling, jetting, testing, and other installation hardware to perform all work described within this document.

2. When installing cable in ducts, concrete vaults, and junction boxes, the contractor shall ensure the duct does not exceed the minimum bend radius as per manufacturer.

3. All work will be performed under strict accordance with all applicable federal, provincial, and municipal laws and regulations to safety and environmental rules.

4. The contractor will inform the Town's representative of their arrival and departure at the worksite daily. The representative must be contacted prior to starting, suspending, or completing work.

5. Unused excavation material and abandoned equipment shall be disposed of at the contractor' expense.

6. The contractor shall provide and install all necessary bends, couplings, reducers, bell end fittings, plugs, heat-shrink wrap, caps and adaptors of the same product material as the duct to ensure a complete installation.

7. Top of vault/junction box covers to be flush with existing grade, unless noted otherwise.

8. The contractor shall not disturb or destroy existing plants, bushes, trees, or roots while installing the equipment. manually dig through hedges within tree drip lines.

9. All junction box and pull pit symbols are not to scale.

10. Individual ducts shall enter and exit concrete vaults and junction boxes in the same position at each location for ease of identification and continuity.

11. The contractor shall not use factory bends in conduit runs unless shown on the drawings or approved by the engineer in the field. All communication conduits shall utilize large radius sweep bends.

12. All ducts shall be verified and cleaned using the following procedure:

- Terminate ducts ends in the junction box as per standards drawings
- Send rubber cone projectile through duct with a string to prove the integrity of the duct. (opti-com. inc. rubber cone projectile or approved equal)
- Clean duct by pulling a wire brush mandrel through with a heavy pull rope connected to both ends of the mandrel
- Use a swab after mandrilling (existing ducts only)
- Install pull line and cap ends of duct using rubber or rpvc duct plugs
- Clean and vacuum boxes

13. Where minimum clearances from utilities cannot be maintained, notify the TOC representative.

14. All materials and aspect of the work shall be as per the most recent applicable:

- MOTI standards
- MMCD platinum edition
- All relevant contract documents and all specifications refereed to therein Worksafe B.C.
- The contractor must retain copies of the above documents on-site and shall ensure that all sub-contractors are familiar with the relevant sections of the above documents.

15. All municipal, provincial and private roadways affected by these construction works shall be maintained in a clean and dust-free state, and shall be kept free of equipment and materials when construction activity is not occurring.

16. The contractor shall supply and install security hardware on all existing and new communication concrete junctions and concrete vaults.

17. The contractor shall obtain all permits and licenses prior to construction.

18. The contractor is to notify the city representative of any discrepancies found within these drawings or the contract documents a minimum of 72 hours before starting construction.

19. The contractor shall supply and place permanent hot mix asphalt patching to the satisfaction of the TOC and engineer at all locations required. The use of cold mix asphalt as a permanent remediation is not acceptable.

20. The contractor must repair or replace all existing signs, services, roads, vegetation, driveways and their letdowns, private properties, and private improvements that become damaged due to construction. Repair to surface features may be completed by the contractor at the direction of the city's representative while repairs to underground works and lighting will be completed by the Town of Comox at cost to the contractor.

21. The contractor is responsible for all utility permit applications.

22. All work in areas with trees shall be completed in accordance with Town of Comox urban forestry oversight. The contractor shall confirm all locations requiring oversight with Town of Comox prior to commencing work.

23. As soon as the contract is awarded, and at least 72 hours prior to beginning any construction activities, the contractor shall consult local authorities and contact BC One-Call (1-800-474-6886) to verify existing utility location and to ensure all related parties are informed of the proposed works ahead of the time.

24. Provide daily progress by electronic notification and include the following:

- Highlighted drawing that shows progress. Highlighted drawing shall identify measured distances between vaults and junction points and any changes to offsets.
- As-Built notes on drawings.
- Photographs, of the vaults and the micro trenches prior to backfilling

3.2– MicroTrenching and Construction Sequence -Refer to detail diagram 3.2.a, 3.2.b, 3.2.c

3.2.1 - Trench Detail:

- Trench walls to be uniform and straight.
- Bottom of trench to be flat and free of stray stones etc.
- The trench path should be straight as possible to ease the placement of conduits(s) and cable pulls.
- Cover depth to be 600mm minimum or where otherwise required and approved by Town of Comox.
- Sod cutting equipment shall be used prior to trenching areas that have established lawns. The removal and replacement of existing grass will speed the restoration process and reduce potential complaints.
- It is the contractor's responsibility to ensure exposed/open areas are properly barricaded and temporally covered to reduce safety hazards.
- Trenching near tree root systems should be avoided. Main tree routes should never be cut, without the approval of the TOC.
- Final trench inspection is required after two, but not more than four weeks to check for trench settlement.

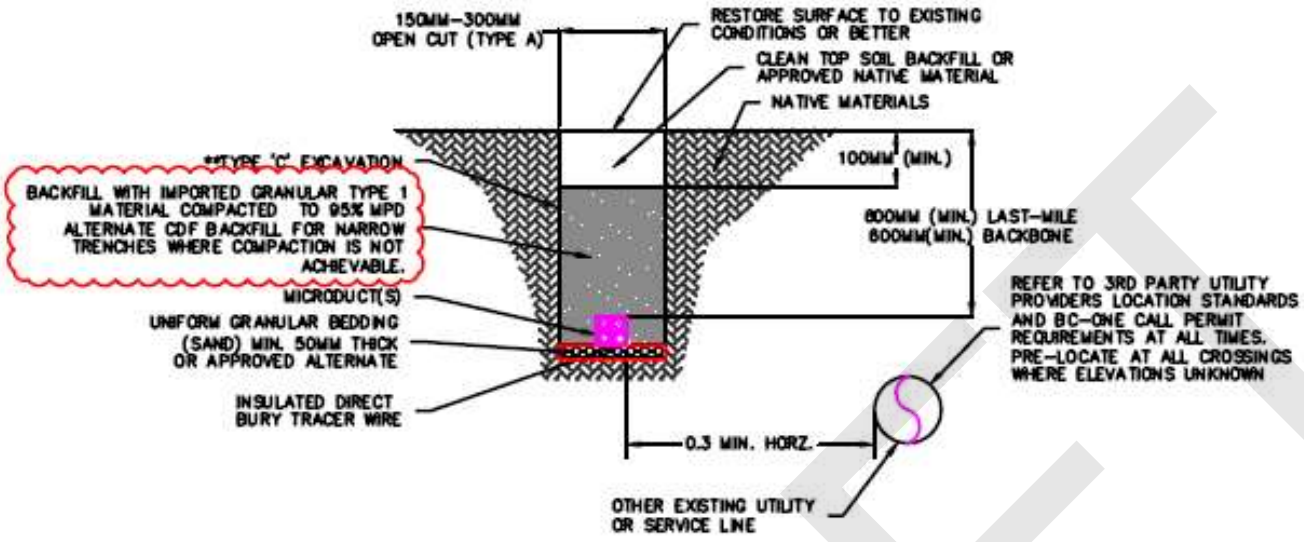
3.2.2 - Trench Backfill:

- Where applicable in open trench use 19mm minus granular material compacted to 95% mpd.
- Where compaction equipment is not suitable use flowable controlled density fill (c.d.f.) or non-shrink grout.
- TOC contract administrator to approve duct installation in writing prior to any backfilling.
- C.D.F. or grout to be coloured orange to denote communications utility. Colouring to be liquid iron oxide - solomon colorflo-orange or approved equivalent.
- C.D.F. and grout to have 1-5 mpa mix design that will set within 2 hours to strength suitable for traffic and to be non-shrinking following initial set.
- Restoration should return the area to pre-construction conditions. This may include the placement of new top soil or loam, seed, and fertilizer. The TOC must be notified to ensure restoration requirements are met. See TOC subdivision bylaw for further detail on softscape restoration
- All trenches and/or excavations will be back-filled the same day.

3.2.3 – MicroTrench Construction Sequence

1. Cut trench and remove sod or asphalt
2. Excavate to required depth.
3. Inspect bottom of trench and remove any stray rocks etc. that will prevent microduct(s) from laying flat on trench bottom.
4. Place tracer wire in bottom of trench.
5. Place microduct(s) in bottom of trench.
6. Seek TOC approval prior to backfill. 24 hr notice required.
7. Place flowable c.d.f. or non-shrink grout in trench to level as indicated on applicable detail (see diagram 3.2.b).
8. For restoration of concrete sidewalk or concrete roadway refer to diagram 3.2.c and TOC construction standards – Subdivision Bylaw
9. Allow c.d.f./non-shrink grout to set before opening for use. (mix specification to allow for setting in 2 hours or less where required).
10. Mill asphalt keyed patch strip along trench, sweep road clean and dry in limits/areas as indicated in diagram 3.2.b, centered on trench (does not apply to concrete surfaces).
11. Coordinate in advance, the delivery and placement of the TOC paving contractor.
12. Prep all trench and edges for asphalt.
13. Place fiber optic trench surface warning markers and signage along trench-line and as indicated in section 3.4.2.
14. Roll markers into warm asphalt during final finish rolling
15. Allow patch/fill to cool/set before opening to traffic.
    - Compaction - completed using a steel roller of sufficient weight to establish a uniform density comparable to the adjacent surface within the work area.
    - Industry standard compaction test is required and will be provided by the contractor to the TOC.
    - Finished surface shall be level with no depression retaining. Note: Cold patch mixes are temporary and must be replaced when hot-mix plants reopen.
    - Pavement restoration should be re-inspected after a period of a month for settlement.
16. The contractor is responsible for quick correction to any trip or fall hazards.
17. Remediation - replace concrete panels and misc. restoration to landscaped or paver surfaces as required by the TOC subdivision bylaw and as indicated in diagrams 3.2.a, 3.2.b and 3.2.c below.
18. **The TOC will require one (1) spare microduct or innerduct installed along all fibre back bone installations, and at all road crossings for TOC proprietary use and fibre optic cable installation.**
19. Refer to the TOC subdivision Bylaw for further information on:
    - Settlement time period and inspection procedures
    - Pavement and concrete restoration
    - Traffic control planning and requirements

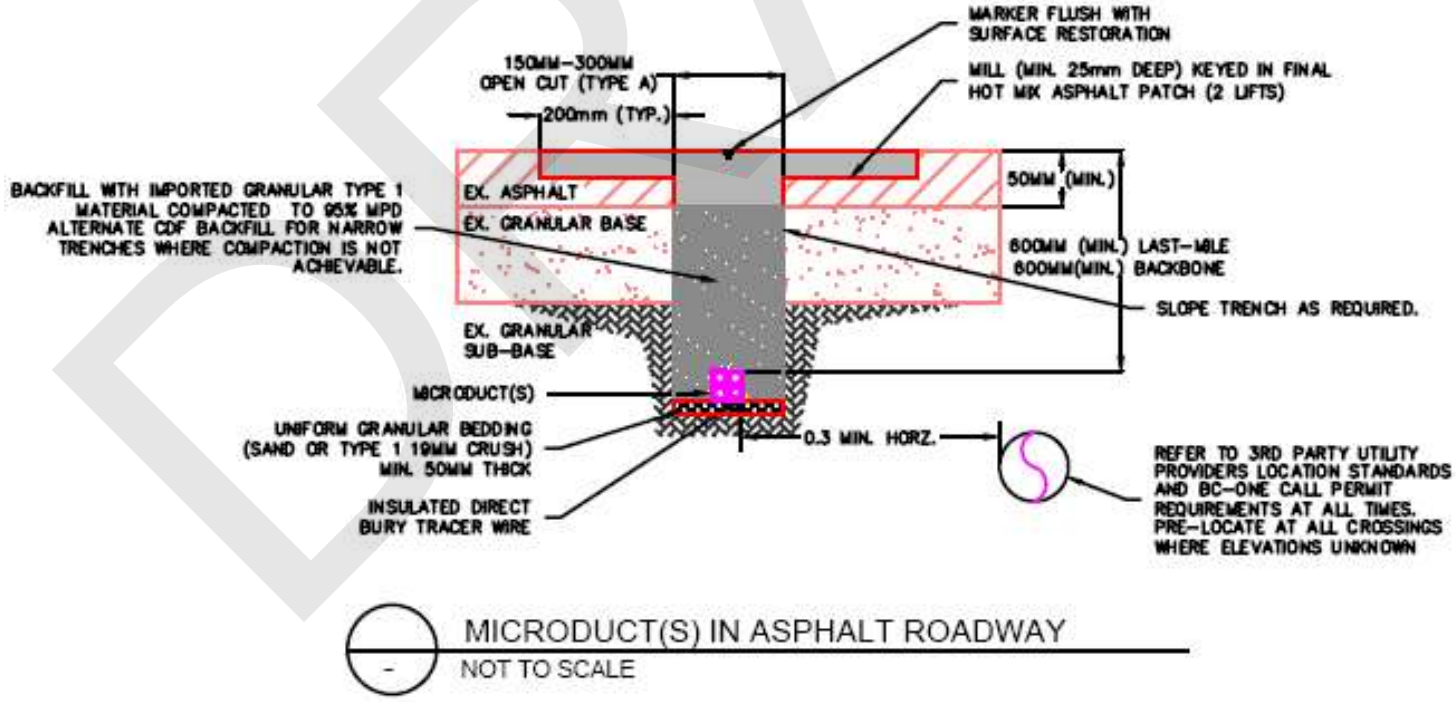
3.2.a – Softscape Trench Diagram



TYPICAL MICRODUCT(S) LAYOUT FOR NON- TRAFFIC AREAS
TYPE C EXCAVATION

NOT TO SCALE

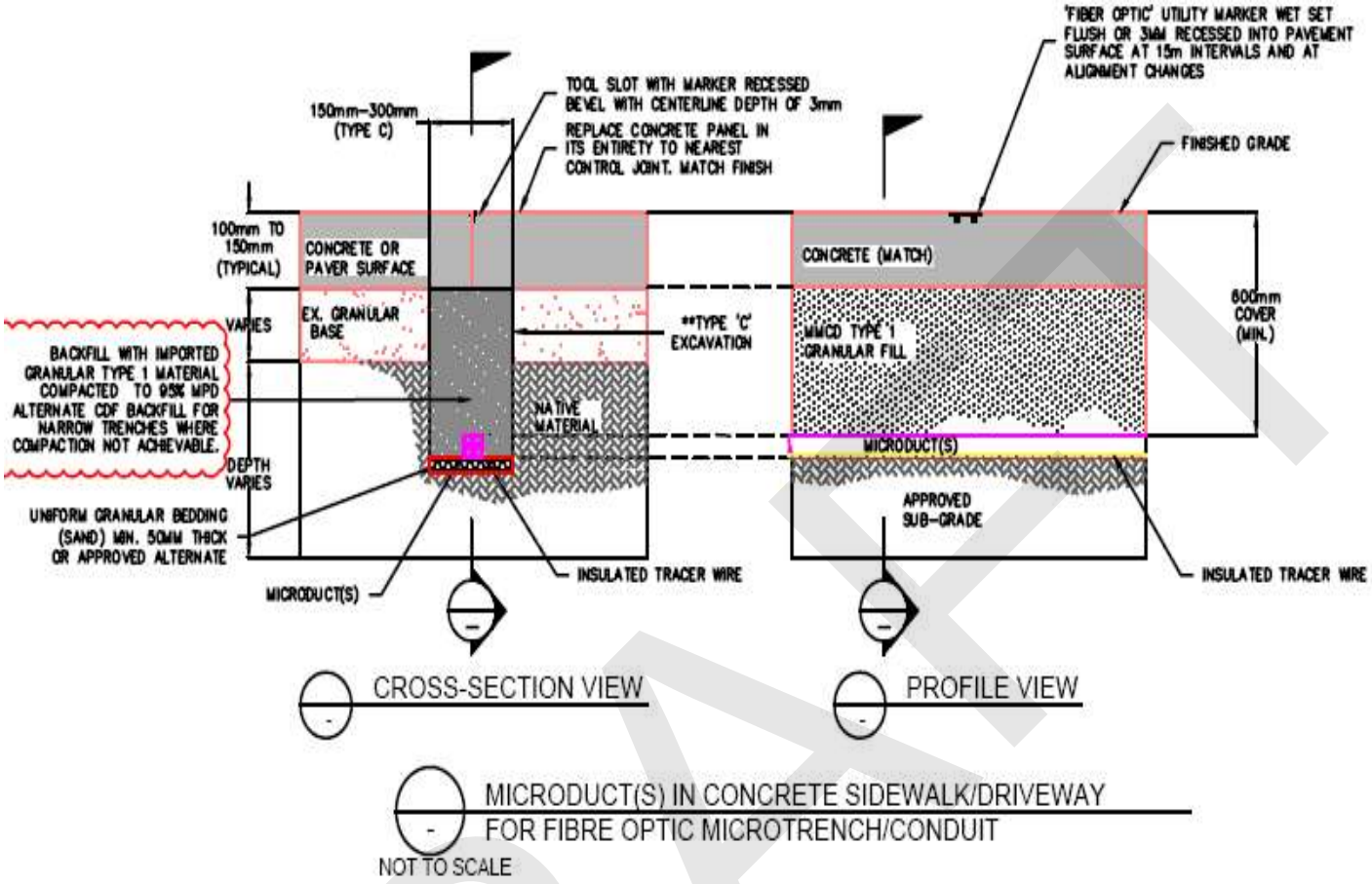
3.2.b – Hardscape (Asphalt) Trench Diagram



MICRODUCT(S) IN ASPHALT ROADWAY

NOT TO SCALE

3.2.c – Hardscape (Concrete) Trench Diagram



MICRODUCT(S) IN CONCRETE SIDEWALK/DRIVEWAY
FOR FIBRE OPTIC MICROTRENCH/CONDUIT

NOT TO SCALE

3.3 - Standard Horizontal Directional Boring

A cost effective and popular alternative to micro-trenching can be accomplished through the use of a directional drill. This trenchless technology allows micro-duct(s) to be installed in subsurface environments, at depths that exceed the limitation of micro-trenching, without the substantial expense associated with hardscape/softscape remediation. Directional Boring may be accomplished by a mechanical boring machine that drills / pushes a drill stem the length of a crossing or a pneumatically driven piston (if approved) which basically does the same task. In either case, TOC standards should be checked for accepted practices.

- Road crossing bores should be made perpendicular to the roadway centerline to minimize bore distance.
- All conduits will be provisioned with a tone-able “Mule-Tape” for locating purposes.
- The tunnel of the crossing can be enlarged by using reamers or cones.
- Conduit size should be placed to support the tunnel wall and to minimize settlement.
- Boring pits are to be a minimum of 90cm below grade to ensure the bore depth maintains 60cm cover minimum.
- All bores are to be drilled prior to the start of trenching.
- Utilities crossing the bore path are to be located using local "BC 1 Call" procedures.
- Utilities to be visibly located through the use of vacuum trucks or digging test pits or pot holes to daylight existing utilities
- A directional Bore Log of the Running Line and Depth will be provided to the TOC in electronic and GIS spatial formats. This requirement also includes Flowing Water Crossings that cannot be completed by aerial.
- Directional Bore Reamer Size shall not be over 5cm larger than the pipe being pulled back for the FOC to be placed in.
- Pneumatically driven piston may be used with depth being a minimum of 120cm to top of pipe.
- All Directional bore casing shall be HPDE Poly pipe unless authorized by the TOC in writing.

3.3.1 – Directional Drilling Contractor Notes

1. Prior to beginning work, locate, mark and confirm depths of all utilities identified through an engineer certified survey, to be crossed (or that run parallel within 4.0m) by using ground penetrating radar and other reliable means.

2. Daylight all utilities that are to be crossed and all utilities identified that locate within 2m (horizontal) of proposed directional drilled installation to confirm utility location and depth. Daylighting to be done by hand-digging or hydrovac excavator.

3. Proposed microduct must have a minimum vertical separation of 3oo mm and horizontal separation of 1000 mm from all utilities except where noted otherwise.

4. Advise engineer at time of layout if it is not possible to achieve the required clearances and do not proceed with installation until all utility conflicts are resolved by the engineer.

5 Minimum microduct cover shall be 600 mm and depth to be as uniform as possible within municipal boundary. Utility policy manual shall be followed for MOTI jurisdiction.

6. Depth may be increased as required in areas where it is necessary to pass safely below existing utilities and structures or, to accommodate difficult soil conditions. Prior approval is required (it is the TOC's or ministry's discretion as to whether increased depth is permitted).

7. When entering pull boxes/vaults , microduct or conduit must run horizontally through the end of pull boxes (microduct/conduit will not be installed through the floor of boxes)

8. Microduct or conduit will enter through the short ends of pull boxes and at a cover depth between 600 mm and 700 mm. Entering boxes from the side requires prior approval from the inspector unless noted otherwise.

9. Microduct/conduit terminations at opposite ends of the pull box/vaults are to be aligned with each other.

10. Microducts entering pull boxes will extend to a minimum of one pull box length into the box to allow for future coupling. Microduct extensions are to be securely fastened to the vault wall and not left loose within box.

11. If any portion (or all portions) of the installation is found to be impractical or impossible via directional drilling the contractor must utilize narrow trenching methods or conventional trenching methods,

12. Drilling mud must be controlled and fully contained within drill pits and shall never be allowed to enter any waterways (ditches, catch basins, lawn, basins).

13. Following the completion of installation of all directional drilled microducts or conduits, contractor must verify depths at 15m intervals by radio-locating (or daylighting) and must record the depths readings on the as-built plans at the corresponding locations, the contractor must arrange for the inspector to be on-site for the depth verification and, if requested by the inspector, the contractor must daylight (up to 1 location per' 50 meters of installed microduct/conduit) to confirm the radio-location depth readings are accurate and the equipment is properly calibrated.

14. Proposed drill pit locations will be identified on the drawings for locations requiring drilling. Pit locations shall be confirmed by the contractor prior to drilling and new or additional locations may be proposed by the contractor as needed. Receiving pits are at the discretion of the contractor but are generally intended to be located at or near

vault/pull box locations. Where possible all pits should be in boulevard areas to avoid pavement damage.

3.4 - Microduct Installation Requirements

- Microduct to be HDPE capable of accommodating a minimum of 24 fibre optic strands.
- TOC prefers innerduct solutions with minimum strand counts of 144 strands per duct or as indicated.
- Multiple microducts should be installed in one trench or bore hole, stacked or side by side.
- Duct to have a temperature rating of inst. 30°c to +70°c and operating range of -40°c to +70°c
- Crush rating of 16 kilo-newtons /per 100mm, min.
- Bending radius of 400mm
- Tensile rating of 2.5 kilo-newtons.
- Acceptable microduct products are EMTELLE or DURALINE or approved equal.
- Microduct(s) to be laid straight and flat in trench or pulled without wrapping during directional drill process as per plans
- As microduct has coiled memory, pea gravel may be placed at regular intervals to hold microduct down if required. Hold down is not required for directional drill process.
- Alternate equally effective conduit/microduct hold-down methods may be used upon prior approval from TOC.
- Microduct/Innerduct and Fibre Optic Cable will be secured/clamped around the inside walls of the manhole/vault/service box (~30 cm).
- If available, use the center racks as an attachment location for cable and FOSC.
- Do not wrap or box in other cables.
- At the splice and slack locations, fibre must be accessible, and must be able to be brought out of the vault for splicing, then returned to the vault, and reattached.
- All conduit commissioned by mandrel size for microduct product
- The ends of the microduct conduits must be capped or sealed, through the use of industry standard rubber caps or heat shrinking.

3.4.1 – Tracer Wire

- Tracer wire to be placed in the trench, or pulled alongside microduct when not integrated.
- Use (#10 gauge wire a.w.g.) rwu90 with xlpe insulation and connected to grounding points in pull boxes.

3.4.2 - Surface Warning markers and Signage

- Install inlay surface mounted trench warning markers every 15m and 1m on either side of each change in alignment.
- Surface warning signage to be provided every 150m or at vault locations

3.4.3 – Microduct Depth Recording:

- Record microduct(s) depth from finished surface on the as-built drawings at 5m intervals
- Clearly indicate all points where depth changes, and lengths of the depth transition areas, where the duct is sloping from one depth to a new depth.
- Submit mark ups to TOC.

3.4.4 - Fibre Cable Install

- The Fibre Optic Cable (**FOC**) will be protected with innerduct and properly identified with owner ID, tubes ID and tags.
- Fibre cables to be installed (blown, pulled, etc.) after microduct installation
- There must be 30m of coiled and tagged slack fiber cable at each vault location.
- Excess FOC inside concrete vaults and service boxes shall be coiled and mechanically secured in place with hook and pile fastener (e.g. Velcro™) ties such that the minimum bend radius is not exceeded and the cable is suspended above the concrete vault or junction box bottom. The hook and pile fastener straps are to provide 'breakaway' protection in the event of an accidental dig up between pull boxes.

3.4.5 - Pull Strings

- For each section between pull boxes complete with blown nylon pull string.
- Nylon pull string to remain in duct and tied off in each pull box.

3.4.6 – Labeling

- All cables, conductors, ports and terminals shall be labeled as defined on drawings or following the TOC naming standards.
- Cable labels are required at each duct mouth.
- Each cable shall be labeled within 10cm of the terminated ends with a tag and text stating the fibre optic cable identifier and destination name.
- All labels must be machine generated. cables shall be tagged in the concrete vaults, junction boxes and all other access points with the fibre optic cable identifier and with "Caution: Fibre Optic Cable" tags and identify From-To locations targets (if extended).

3.4.7 - Fibre Optic Cable Installation Contractor Notes

1. The contractor shall supply and install indicated cables with exact fibre count noted.

2. The contractor shall install fibre optic cables as per manufacturer's recommendation and shall not exceed the recommended pulling and bending specifications.

3. Mini/micro cables installed in existing conduit shall be u/g rated or appropriately protected.

4. Excess cable inside concrete vaults and junction boxes shall be coiled, protected and mechanically secured in place with hook and pile fastener or weather resistant ties such that the minimum bend radius is not exceeded, and the cable is suspended above the concrete vault or junction box bottom. The hook and pile fastener straps are to provide "breakaway" protection in the event of an accidental dig up between pull boxes.

5. The contractor shall supply and install all fibre optic cable, including the supply and installation of termination and OTDR testing as required.

6. Fibre optic cable shall be installed in a continuous run in conduit between the splice closures (i.e. no splices are allowed except within the splice closures). 20-30m of fibre optic cable coil shall be installed inside each concrete vault or junction box and 10m service loops shall be provided in each pull box except where otherwise noted on the drawings.

7. The fibre optic cable shall be installed after the installation of the micro-duct is in the ground. The fibre optic cable shall be installed in the longest continuous run possible in conduit segments between the vaults or boxes that will still allow the cable to be efficiently pulled back in case of rupture.

8. Fibre Optic Splice Closure (FOSC) –

a. The contractor shall review the splice details and ensure configuration is consistent with design drawings and existing configuration. The contractor must contact the Town of Comox immediately for any discrepancies or inaccuracies. Any splice work should be suspended until discussed with a representative from the Town of Comox.

b. All splice closures shall be installed to the manufacturer's specifications and installation instructions.

c. Splicing shall start on the bottom tray and will be assigned as tray #1. Buffer tubes are assigned as defined in drawings.

d. All FOSC trays shall be labeled on the side of tray. Splice details shall be labeled on splice protector of the tray.

e. All FOSC transport tubes shall be labeled and identified as feed or distribution per tray. Spare buffer tubes shall be neatly coiled and stored in the storage basket.

f. The FOSC shall be pressure tested prior to storage

g. Formal Splice Diagrams must be provided to the Town of Comox at project completion.

3.5- Standard Vaults/Service Boxes – refer to diagrams 3.5.a to 3.5.e for further detail

3.5.1 – Accepted Vault Types

- **Type 1 - H20 Road Rated Vault** - Oldcastle enclosure solutions. Synertech Duomold composite 2436-36 or approved alternate.
- **Type 2 - Service Box** - Oldcastle enclosure solutions. Synertech Duomold composite 1118-18 or approved alternate.
- **Type 3 - Pull Box** - Armtech t266 service box complete or approved alternate. Synertech 'duo-mold' poly-concrete pull boxes are recommended for non-traffic areas

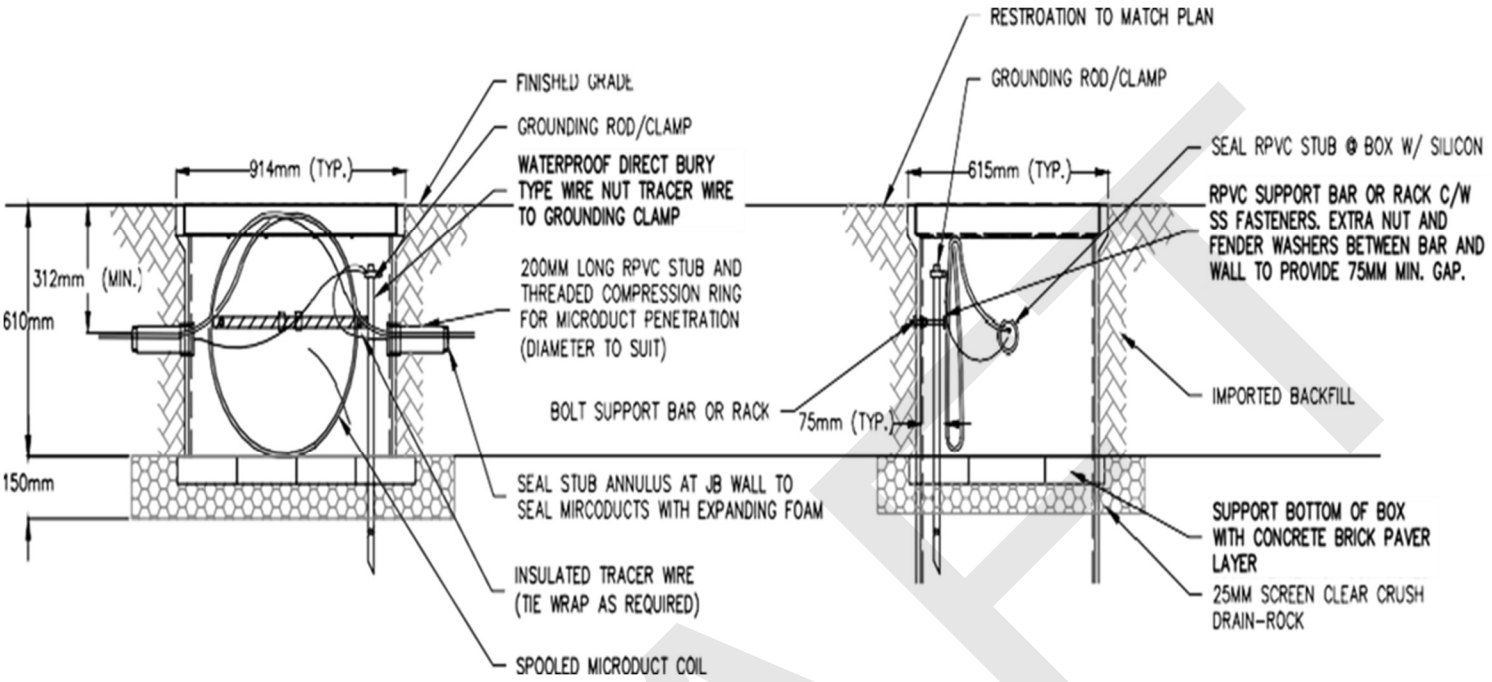
3.5.2 – Vault/Service Box Detail

- Lids to be installed with Penta head lockdown ss bolts.
- Steel checker plated lids to be engraved and marked "TOC-FN"
- Vault composite covers to be marked "TOC-FN" by supplier.
- All Vaults/Service boxes will include grounding buss and 20mm x 1.5m long grounding rod.
- The longest dimension of vaults/boxes to be orientated and parallel to sidewalk unless otherwise identified on plan or approved by TOC.
- Microducts will enter the vault/box via the RPVC stub, of suitable diameter, and microducts to be sealed in conduit with expanding foam.
- Gap between ducts entering box, and holes cut into box, to be sealed with silicon sealant on both inside and outside of box.
- Refer to manufactures installations procedures for all vaults/service boxes.
- All box penetrations to be sealed water tight with grout or approved equal.

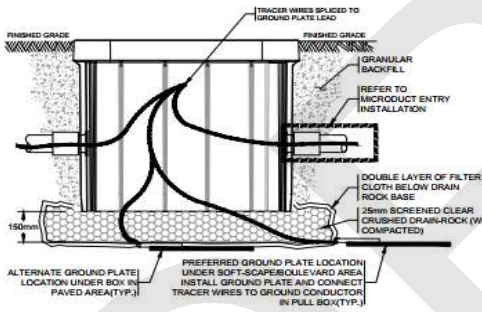
3.5.3 – Vault Installation Detail

- Vaults must be installed flush and level with grade at all times.
  - Vault install locations must be reviewed by the TOC engineer for approval and restoration requirements.
- Preferred vault install location include softscape boulevards or sidewalk panels.
- The position of the vault must be installed away from the road or curb to prevent damages from vehicles and snow plows.
- If roadway installation is only option, then vault must be Type 1 (see 3.5.1 above).
- Vault placement should blend in with the surrounding conditions.
- The vaults will have 7cm of 14mm pea stone installed inside for drainage purposes.
- Warning signs to be placed at all vault locations unless property owner does not want them.
  - Bond the FOSC to the vault grounding system. This must be approved by a telecom engineer and certification provided to the TOC
- Install and clamp HDPE InnerDuct/MicroDuct at least 30cm inside wall of vault.
- All microduct must be capped with heat-shrink wrap and industry standard plugging (see diagram 3.5.d)
- All grounds to be megged.

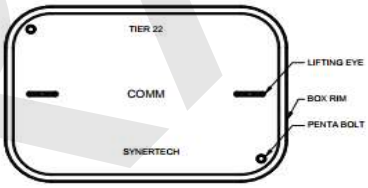
3.5.a – OldCastle Vault Installation Diagram



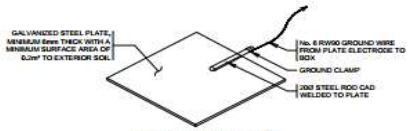
3.5.b – Synertech Vault Installation with Grounding Plate Diagram



SIDE OF BOX ELEVATION

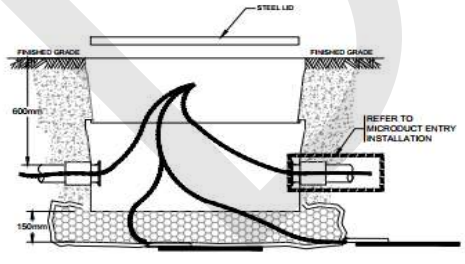


BOX WITH ONE - PIECE POLY-CONCRETE LID - PLAN VIEW

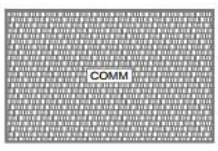


GROUND PLATE ELECTRODE

SYNERTECH 1118-18 FIBRE OPTIC PULL BOX DETAILS
N.T.S.



SIDE OF BOX ELEVATION



BOX WITH GALVANIZED STEEL CHECKPLATE LID - PLAN VIEW

AE CONCRETE TYPE 5686 FIBRE OPTIC JUNCTION BOX DETAILS
N.T.S.

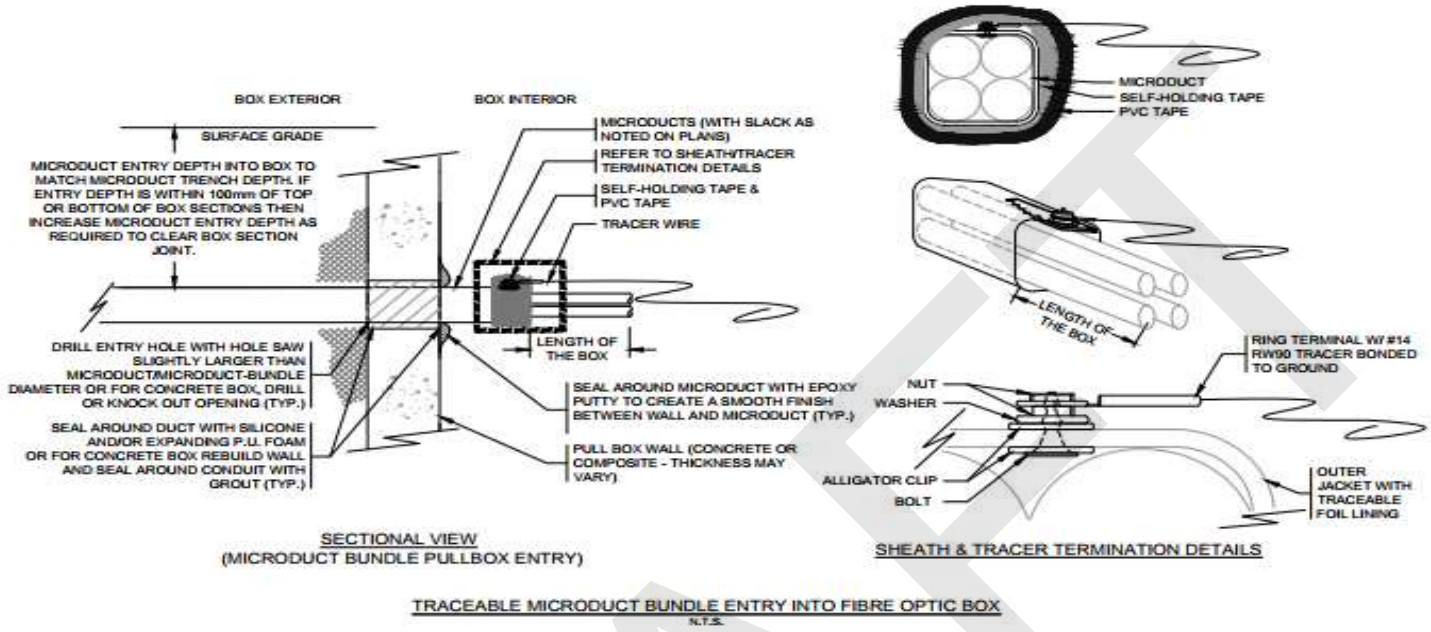
INSTALLATION NOTES:

1. REFER TO MMCD SECTION 16550 FOR DETAILED SPECIFICATIONS.
2. ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED.
3. INSTALL LID ON BOX BEFORE BACKFILLING, TAMPING & PAVING OPERATIONS.
4. INSTALL TOP OF BOX FLUSH WITH FINISHED GRADE. ADJUST AS NECESSARY TO BE FLUSH WITH FINAL SURFACE GRADE.
5. LONGEST DIMENSION OF BOX TO BE ORIENTED PARALLEL TO DUCT BANK (DUCTS ENTER SHORT SIDES OF BOX) UNLESS OTHERWISE NOTED.
6. DUCT ENTRIES TO BOXES TO BE SECURELY SEALED AROUND DUCTS.
7. EMPTY DUCTS TO BE PROVIDED WITH PULL STRING AND TO BE CAPPED.
8. BOXES SHALL NEVER BE SITUATED IN ROADWAYS, DRIVEWAYS OR PARKING SURFACES.
9. OPEN AREA UNDER BOX TO BE FULLY COVERED WITH CRUSHED DRAIN-ROCK AND TO BE SUPPORTED WITH DOUBLE LAYER OF FILTER CLOTH (CONCRETE PAVER BRICKS BELOW THE BOX IS AN ACCEPTABLE ALTERNATE TO FILTER CLOTH).
10. BOXES IN SIDEWALKS SHALL BE SUPPORTED BY SIDEWALK CONCRETE EXTENDING UNDER TOP FLANGE TO PREVENT BOX SETTLEMENT.
11. BOXES IN ONGOING CONSTRUCTION AREAS SHALL BE SUFFICIENTLY MARKED WITH STAKES AND HOARDING SURROUNDING THE BOX TO PREVENT DAMAGE/BURIAL BY CONSTRUCTION VEHICLES/EQUIPMENT.
12. LABEL DUCTS&MICRODUCTS PER CITY OF DELTA SPECIFICATIONS.
13. ALL BOXES SHALL BE LOCATED A MINIMUM OF 75mm FROM THE NEAREST EDGE OF THE SIDEWALK PANEL

PRODUCT NOTES:

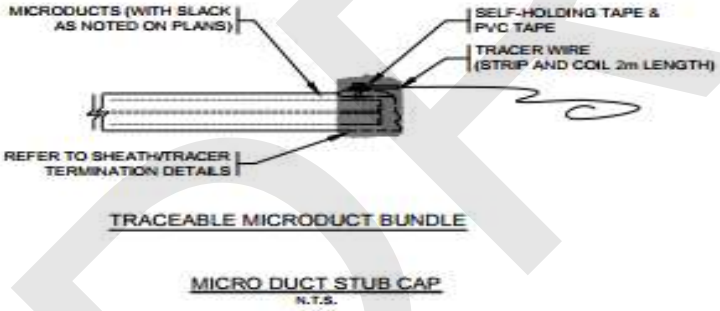
1. JUNCTION BOX WILL BE A.E. CONCRETE NO. MOTH 5686 UNLESS APPROVED OTHERWISE.
2. REFERENCE MMCD PLATINUM DRAWING E2.3 & E2.4 "LARGE CONCRETE JUNCTION BOXES" FOR FURTHER DETAILS.
3. PULL BOX TO BE "SYNERTECH DUO-MOLD 1118-18 SINGLE SECTION TYPE WITH TOTAL DEPTH OF 18 INCHES.
4. BOX LID WILL BE ONE-PIECE POLY-CONCRETE BOLT DOWN TYPE AND WILL BE SUITABLE FOR MINIMUM TIER 15 (20K) LOADING.
5. BOX WILL BE OPEN BOTTOM TYPE.
6. LID HOLD-DOWN BOLTS WILL BE SPECIAL STAINLESS STEEL PENTAGONAL HEAD TYPE WITH STAINLESS STEEL BOLT HARDWARE ON TOP SECTION OF BOX.

3.5.c – Microduct Bundle Entry in Vault Diagram

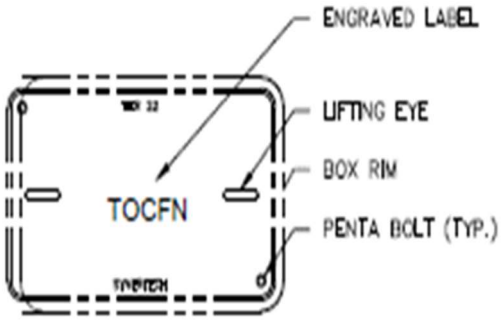


TRACEABLE MICRODUCT BUNDLE ENTRY INTO FIBRE OPTIC BOX
N.T.S.

3.5.d – Microduct Stub Cap example



3.5.e – TOC Vault Label Standard



4.0 – Aerial Fiber Optic Cable Installation Guideline (TOC Owned Poles)

- Contractor shall ensure that fiber optic cable is installed as specified on the drawings and that Contractor installs fiber optic cable in accordance with the manufacturer's recommendations, and that the work is performed in accordance with the Telecommunications Industry Association/EIA-568-C standards, CAN/CSA T529/T530 Standards and the Canadian Electrical Code, manufactures standards and specifications.
- Contractor will ensure that all work performed on TOC poles will only be conducted by a certified journeyman. Proof of certification must be provided to TOC before pole access will be granted.
- Contractor shall ensure that each reel of fiber optic cable will be tested at the factory and prior to installation. TOC assumes no responsibility whatsoever for the fiber cable until acceptance by TOC.
- Contractor shall ensure that all strand and fiber cable, down guys, pole-to–pole, guys, anchors, arms, risers, lateral cables, etc. are installed as per industry standards or as shown on the drawings. Bonds to other communication strands (not power communication) and vertical ground at first, last, and every tenth pole, fiber tags at every pole, tree trims, down guy guards, u-guards, and pole stepping as required
- Contractor shall ensure that there shall be strand continuity throughout the system and that strand-to-strand bonds shall be accomplished using a separate bond clamp and #6 copper bond, (i.e. double framed poles).
- Contractor shall ensure that any anchors and guy wires shall always be installed and tensioned prior to sagging.
- Contractor shall ensure that guys shall be attached to standard pole line hardware and anchor rods using a perform dead end, two-bolt clamp for 6.6M (1/4") strand, three-bolt clamp for 10M (5/16") strand or strand vice.
- Where authorized by the TOC an auxiliary eye attachment may be used to attach a guy to an existing anchor rod.
- Contractor shall ensure that anchor rods shall not protrude more than thirty (30) centimeters above ground level and, where required by the TOC, strain insulators are installed on all down and pole-to-pole guys.
- Contractor shall ensure that guy guards (shields) are utilized on all down guys.
- Contractor shall ensure that at junction poles and dead end poles, all strands are bonded or grounded.
- Contractor may use metal, wood, or fiberglass standoff to clear obstructions if approved by the TOC.
- Contractor shall ensure that fiber optic cable and lashing machines shall NOT be pulled with a vehicle at ANY time.

- Contractor shall ensure that fiber optic cable shall be smoothly installed using double lashing to strand. Loose lashing or excessive twisting or weaving of cable around messenger shall be cause for rejection.
- Contractor shall ensure that cable is not pulled with more than 225kgs of dynamic tension and that safeguards, such as breakaway swivels, adjustable slip- clutch capstan winches, or pulling dynamometers are used.
- Contractor shall ensure that cable rollers are placed every fifteen (15) metres, or closer where required, to protect the cable and property and to assure proper clearance over driveways and streets and that separator blocks are used on multi-cable runs to prevent wrapping.
- Contractor shall ensure that special corner cable rollers are used for pulling cable around any corner.
- Contractor shall ensure that cables are double lashed to a supporting strand using a 0.045" stainless steel lashing wire maintaining an average of 730 metres of lashing wire per 300 metres of strand.
- Contractor shall ensure that bends of small radii and twists that may damage the fiber optic cable are avoided and that during cable placement, cable is bent in a radius less than twenty (20) times the outside diameter of the cable or as specified by the Manufacturer. Pulleys, sheaves or radius wheels shall be used to meet this requirement.
- Contractor shall ensure that cable is not pulled at greater than 180 degrees of cable bend per pull.
- Contractor shall ensure that lashing wire is terminated with a lashing wire clamp on each side of every pole, that the lashing wire is wrapped two times around the strand before terminating in the lashing wire clamp, is placed between the two washers, is wrapped no more than ½ turn, and does not cross itself under the washers. Contractor shall ensure that when the lashing wire is securely fixed, the end of the lashing wire is not exposed and that when double lashing, both lashing wires are not placed under the same washer.
- Contactor shall ensure that at each pole the cable and strand are separated by cable support and spacers with a minimum of two (2) straps and spacers.
- Contractor shall ensure that fiber optic cable slack loops are placed in slack shoes as shown on the drawings and are located a minimum of two (2) metres from the pole. Slack loops and splice cases may be coiled on the pole (provided that the recommended bend radii is not exceeded), but must be promptly lased to messenger strand.
- Contactor shall ensure that fiber warning tags are placed at each pole that Contractor labels all cable tags with a permanent marker and that labels include the count of fiber and any requested TOC information.
- Contractor shall redline as-built/civil drawings to produce and submit to TOC record drawings of the installed fiber optic cable.

- Contractor shall perform bonding and grounding of all armored cables, hand holes and metal conduits to meet or exceed industry standards and local, provincial, and federal codes. All bonding and grounding are performed in accordance with the splice case manufacturer's specifications.
- Contractor shall ensure that all bonds are clean and free of debris and sealed within the splice closure.
- If ground rods are required, they shall be installed to leave twenty (20) centimetres exposed above ground with a #6 AWG jacketed solid copper wire from the ground rod to the splice closure attached via mechanical clamps.

4.1 - Standard Riser Pole

Riser Pole selection shall be based on available climbing space on the pole. Avoid installing a riser to a pole that already has multiple risers attached.

- Riser poles must meet TOC, local telecommunication and/or BC Hydro engineer certified requirements and be applied for during licensing.
- When possible, position the riser on the field side of the pole away from vehicle traffic.
- PVC conduit must be sealed at the base of the pole to prevent debris and water from entering the underground plant.
- Riser cable(s) shall be protected by one, 3m section of heavy gauge galvanized steel U-Guard attached with the proper hardware.
- Install innerduct up to the strand secured by 2-hole clamps once it exits the U-Guard.
- A slack location is required in the span before the riser dip and in the span after the riser.
- Spare conduits must be capped at the sweep at the base of the pole.

5.0 – Alternative Fibre Optic Cable Installation Options

The following is provided as optional consideration for fibre optic cable installation and deployment within the Town of Comox. Both cost effective methods have been used successfully for fibre optic deployment in similar municipalities.

It is recommended that a review of existing and abandoned infrastructure be conducted and included in the planning and development of a formal broadband strategy for the Town of Comox.

5.1 - Existing and Abandoned Conduits

Existing conduits may have spare capacity to host fibre optic cabling and abandoned infrastructure may still have viable use for supporting the installation of fibre optic cabling. Cost effective subducts will be required in existing and abandoned infrastructure to protect the micro-cable. TOC could investigate the availability of existing ducts along the route:

- Telco, BC Hydro, Fortis or MOTI (requires a lease per meter per year)
- Abandoned water mains
- Abandoned sewer and storm water infrastructure

.

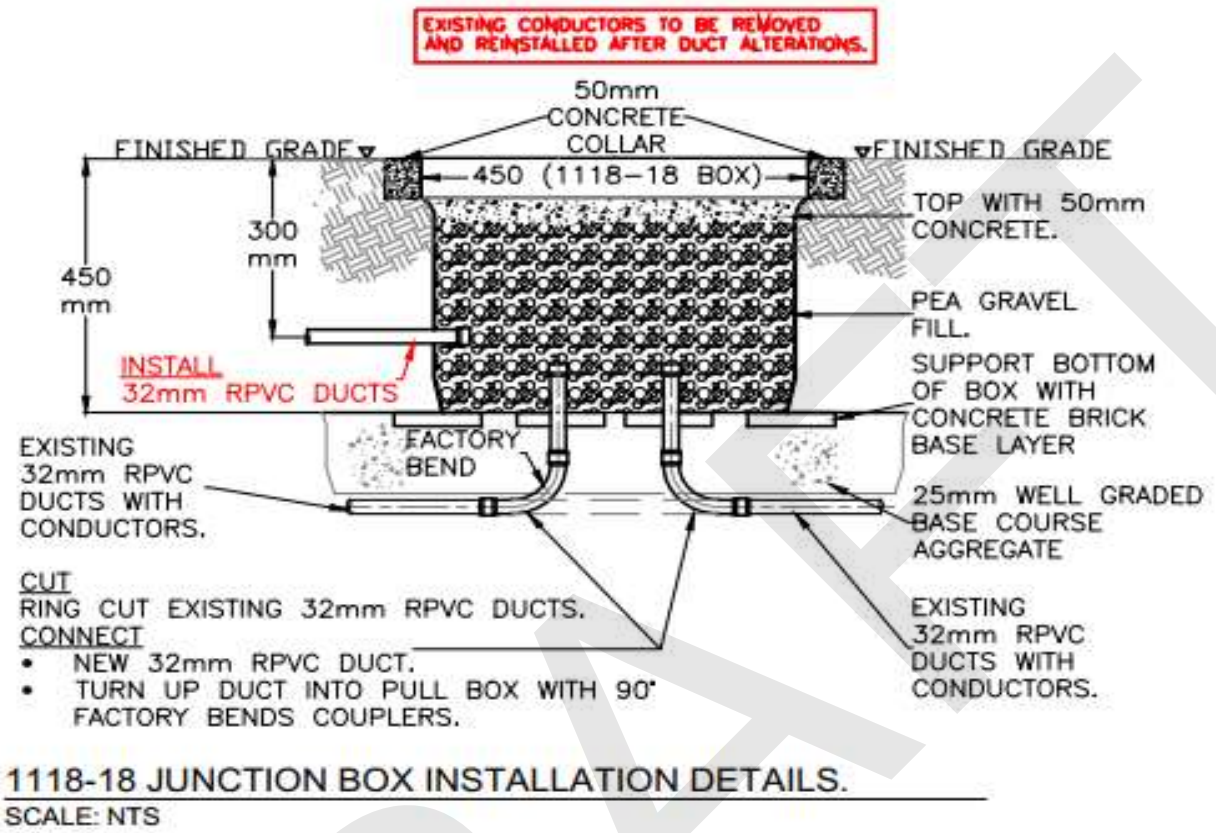
5.2 – Streetlights – see diagram 5.0.a

When space is available in a streetlight duct a small fibre optic cable can be added to toe the electrical wiring. It requires pulling back the electrical wires and inserting them again with the fibre optic cable.

The fibre optic cable is 100% dielectric; there no interference between the electric and the fibre optic system.

Disclaimer: Although some cities in Canada are using this method, it is not approved by the CSA Electrical code.

5.0.a – Streetlight Fibre Optic Install Diagram



The fibre optic cable type G657 A or B is recommended for street conduit installation due to its superior bend tolerance in challenging streetlight conduit's bend radii.

6.0 - Building Entry- General Guidelines

6.1 - Civil Work

- Contractor will create a new entry point where there is no access to an existing conduit.
- Contractor will install T-drains on the outside entry conduit to mitigate water migration.
- Building access conduit will be installed on an outside wall and enter above grade if possible.
- Contractor will ensure that the duct is sealed using fire-retardant at both the entry vault and the building's inside entry point. This seal will also act as a water seal, preventing damage.

6.2 – Building Entry Service/Pull Box

- A service/pull box will be installed near the entry point either inside or outside the building.
- Service/pull box will provide transition from PVC to Electrical Metallic Tubing (EMT).
- EMT metal conduit will be placed inside a building to protect the cable and to provide a safe fire-code rating for the fibre optic cable.

6.3 - Bend Radius

- Bend radius will not exceed 180° between service/pull points (boxes or vaults).

6.4 - Private property

- In-building terminations for fibre conduit/cable will be completed in the building's communications room.
- Under CRTC regulations, the property owner owns any structure and/or cables on their property.
- Contractors will build from the public RoW and then connect into commercial duct or vaults on the private property. The TOC will contact the structure installer and consult the legal department before providing the contractor with authorization to proceed.
- The TOC will enact a formal Building Access Agreement with the building owner and connected clients/tenants before authorizing the Contractor to proceed with property integration

7.0 - Safety Specifications

7.1 – General Guidelines

- Safety is the foremost concern in any contract operation. Any contractor performing an unsafe act or operation shall be notified to stop work until the unsafe act or operation is corrected. If unsafe acts or operations continue, it shall result in the termination of the contract. This project encompasses areas that may include both public and private right-of-way. Therefore, in addition to the workmen, consideration must also be made for the general public and for private property.

- Guidelines for health, safety and traffic control standards have been established by the Occupation Health and Safety, Workers Compensation Board and Town of Comox. Contractor shall comply with all Health, Safety and Traffic Control standards and procedures as required by the jurisdictional agencies and regulations as applicable.

- Manhole/Vault safety procedures, including testing and monitoring of manhole atmosphere and installing proper manhole barricading, shall be required when accessing utility manholes to perform work under this contract. This includes purging each manhole a minimum of ten (10) minutes prior to entry unless testing of gaseous content proves entering the manhole to be unsafe.

- Any personal injury to the contractor's employees or agents engaged in work under this Contract, which requires the services of a physician or hospitalization, shall be reported at once to the Town of Comox. Contractor shall also report immediately to the TOC any injury to other person(s) in which circumstances may concern the TOC.

- Weekly Toolbox Safety Meetings shall be conducted by the contractor and attended by all Contractor field personnel and the TOC field representative(s). The past week and anticipated hazards shall be discussed, with preventive measures outlined. For new types of activities, a hazard analysis (as applicable to present work) shall also be reviewed at this time. TOC field representatives shall inspect the work sites on a weekly basis. Any violations observed shall be immediately brought to the attention of the Contractor's Supervisor for correction. TOC shall correct any violations not corrected by the Contractor, and all cost incurred shall be back-charged to the Contractor. Continued violations shall result in termination of the contract. The contractor must support and insist on having a quality, productive, and safe project.

- All personnel in construction areas shall wear hard hats and reflective vests at all times. NO EXCEPTIONS. Appropriate clothing and footwear shall be worn at all times. Clothing with offensive or objectionable printing shall not be permitted.

- All open excavations in paved areas shall be covered with a suitable steel plate or patched at the end of the working day, subject to approval by the TOC and the authorities having jurisdiction over this work. All excavations in other areas shall be fenced with safety fencing or otherwise protected as directed by the TOC or governing authority.

- All excavations which require protection with either shoring or a trench box shall follow OSHA and WCB regulations. In areas that the Contractor is required to place shoring per OSHA and WCB specifications, the Contractor shall incur all cost associated with protection of the site.

- Under no circumstances shall pedestrian traffic be routed or rerouted onto the Roadway or in an area where vehicular traffic is present.

- Contractor will reference the TOC construction site safety requirement bylaws for further information.

7.2 – Traffic Management Plan (TMP)

- Contractor will provide a comprehensive Traffic Management Plan (**TMP**) to the Town of Comox two (2) weeks in advance of project start for approval. Project will not start until TMP is approved by the Town of Comox. Traffic cones, barricades, police details, flagmen and warning signs shall be inspected each day at each site.

7.3 – Confined Spaces

- Many vaults and manholes are considered a confined space.
- The TOC will require that contractor crew members provide a copy of their OH&S program and confined spaces training cards.
- Contractor will ensure that all crew have received confined space training and certification is current.
- Contractor will ensure that all crew follow the proper procedures for confined spaces.

8.0 - Definitions and Abbreviations

a) **TOC** - The Town of Comox;
b) **MBN** - Municipal Broadband Network
c) **GIS** - Geographical Information Systems
d) **Telco** - Major Corporate Telecommunications Service Provider
e) **MMCD** - Master Municipal Construction Documents
f) **FOC** – Fibre Optic Cable
g) **FOSC** – Fibre Optic Splice Cabinet – device that allows integration of fibre strands
h) **FEC** – Fibre Entrance Cabinet – used for fibre optic terminations
i) **Directional Drill** – automated subsurface drill used to install microduct and conduit
j) **MicroTrench** – narrow trench usually does not exceed 20 cm wide by 60 cm in depth
k) **MicroDuct** – flexible ducting used to host fibre optic cable
l) **ADSS -** All-Dielectric Self-Support.
m) **AP -** Access point. Typically, a small wireless location. Not a tower or rooftop location. May be found on a street light pole.
n) **CRTC -** Canadian Radio and Telecommunications Commission.
o) **dB -** Decibel. Used as a unit of measure to show loss over distance, or loss at splice or patching locations.
p) **DWDM -** Dense Wave Division Multiplexing. Uses lasers on different wavelengths on the same fibre strand to maximize bandwidth on each fibre.
q) **EMT -** Electrical metallic tubing.
r) **Folded ring** - A fibre "ring" where the ring is made up of different fibre strands in the same cable—sometimes even in the same buffer tube. Essentially, it is still a single point of failure (SPOF).
s) **FRE PVC -** UV rated PVC. Used for installation under a bridge or anywhere the duct may have exposure to direct, or indirect sunlight (such as reflection off water).
t) **FSM -** Fibre Strand Metre
u) **HDPE -** High density polyethylene.
v) **ID -**Inside diameter (usually in reference to a conduit).
w) **IRU -** Indefeasible right of use. (Typically, a 20–year term, or the life of the fibre cable.)
x) **ISP** - Internet service provider
y) **ISP** - Inside plant.
z) **LT -** Loose-tube.
aa) **LTE -** Long-Term Evolution (a standard for mobile communications).
bb) **MH -** Manhole.
cc) **MM -** Multimode.
dd) **NDC -** Non-dominant carrier.
ee) **OD -** Outside diameter (usually in reference to a conduit or a fibre cable).
ff) **OH&S -** Occupational health and safety.
gg) **OSP -** Outside plant.
hh) **OTDR -** Optical time-domain reflectometer.

ii) **PLP -** Pre-formed line products.
jj) **POP -** Point of presence.
kk) **PVC -** Polyvinyl chloride.
ll) **RoW -** Right of way.
mm) **SB -** Service box.
nn) **SCADA -** Supervisory Control and Data Acquisition.
oo) **SDR -** Standard Dimension Ratio**.**
pp) **SFM -** Strand Fibre Metres.
qq) **SLA -** Service Level Agreement.
rr) **SM -** Single mode.
ss) **SPO -** Specific Permit of Occupation.
tt) **SPOF -** Single point of failure.
uu) **SSA -** Support Structure Agreement.
vv) **SV -** Service vault.
ww) **TMP -** Traffic management plan.
xx) **VOIP -** Voice Over Internet Protocol.

SCHEDULE 7

NORTH EAST COMOX SPECIAL REQUIREMENTS

NORTH EAST COMOX SPECIAL REQUIREMENTS

This schedule contains stormwater management requirements applicable to subdivision and/or development to those lands shown shaded in the drawing below, source North East Comox Neighbourhood Stormwater Management Plan – Phase 3 of 3, March 1, 2018, McElhanney Consulting Services Ltd.

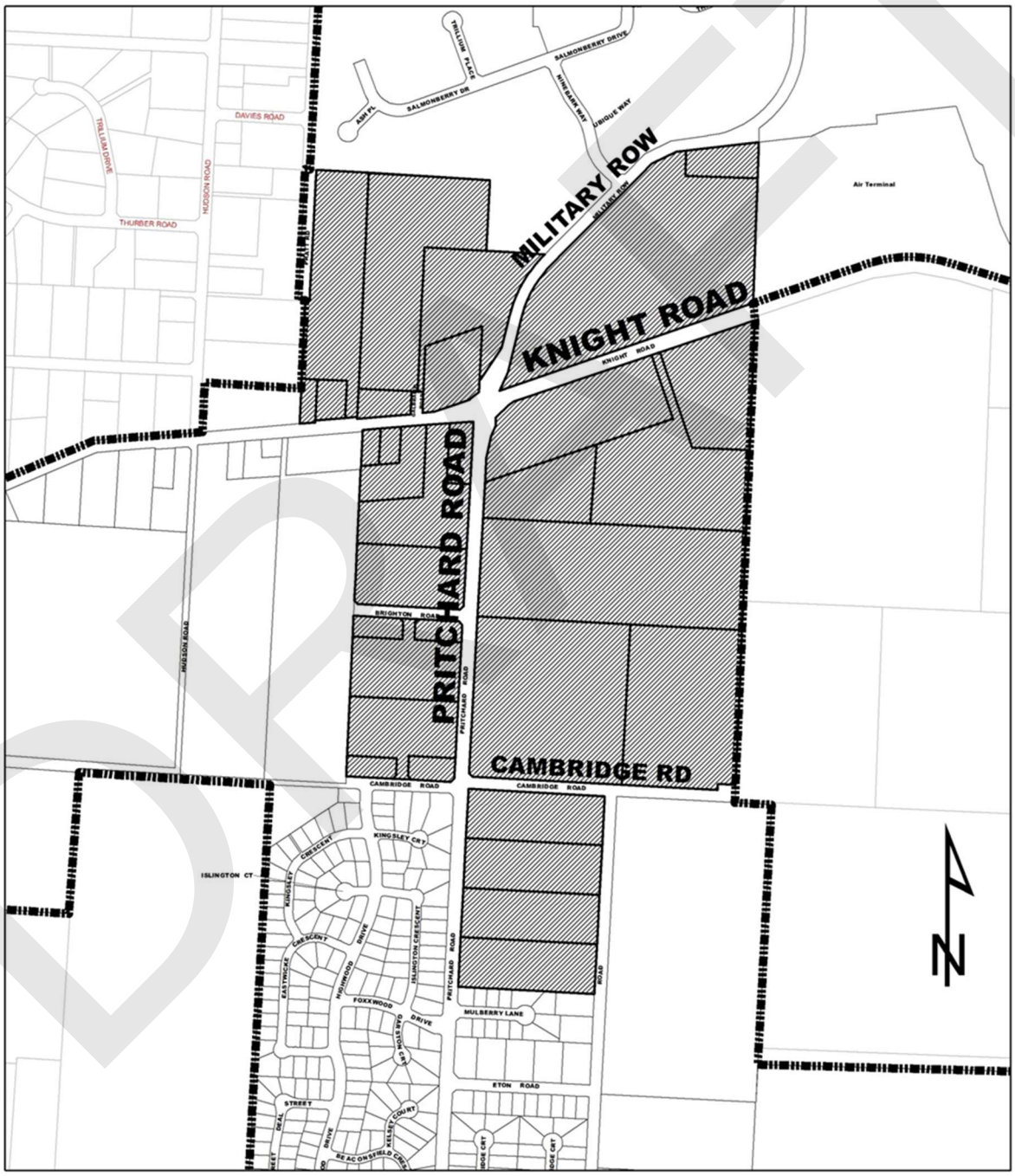


TABLE OF CONTENTS

SECTION

1.5.1	GENERAL
1.5.2	MATERIALS
1.5.3	INSTALLATION AND TESTING
1.5.4	MONITORING EQUIPMENT AND DATA COLLECTION
1.5.5	DETAILED SPECIFICATIONS

DRAWINGS

SE-3	SERVICE CONNECTION WITH DISCONNECTED ROOF LEADERS
SE-4	SEDIMENT CATCHBASIN
SE-5	INFILTRATION TRENCH CONTROL MANHOLE
SE-6	BOULEVARD INFILTRATION TRENCH
SE-7	BOULEVARD INFILTRATION TRENCH ACCEPTABLE PLANTING SPECIES
SE-8	STREET INFILTATION TRENCH
SE-9	CLEAN OUT
SE-10	CURBING OPTIONS AT BOULAVARD INFILTRATION TRENCHES
SE-11	TYPICAL LOT GRADING
SE-12	TYPICAL LOT GRADING
SE-13	DRY DETENTION POND SIGN DETAIL
SE-14	DRY DETENTION POND PLAN & SECTIONS
SE-15	DRY DETENTION POND OUTLET CONTROL STRUCTURE SECTIONS AND DETAILS

1.5.1. General

1.5.1.1 Infiltration trenches shall not be consecutive. That is, once runoff travels through a control manhole downstream of an infiltration trench, said runoff shall not be directed to additional infiltration trenches, but conveyed via the storm system to an outlet or neighbourhood dry detention pond.

1.5.1.2 Prior to design, infiltration rates for each site shall be confirmed. Infiltration rates to be verified using the Standard Test Method for Infiltration Rate of Soils in Field Using Double-Ring Infiltrometer ASTM D3385 – 09. If field tested infiltration rates vary by more than 25% of the applicable modeled rates shown in Table 4 – Model Input Parameters, the required base area and storage volume of the infiltration trench shall be re-calculated. Sub-catchment areas are identified on Figure 1.

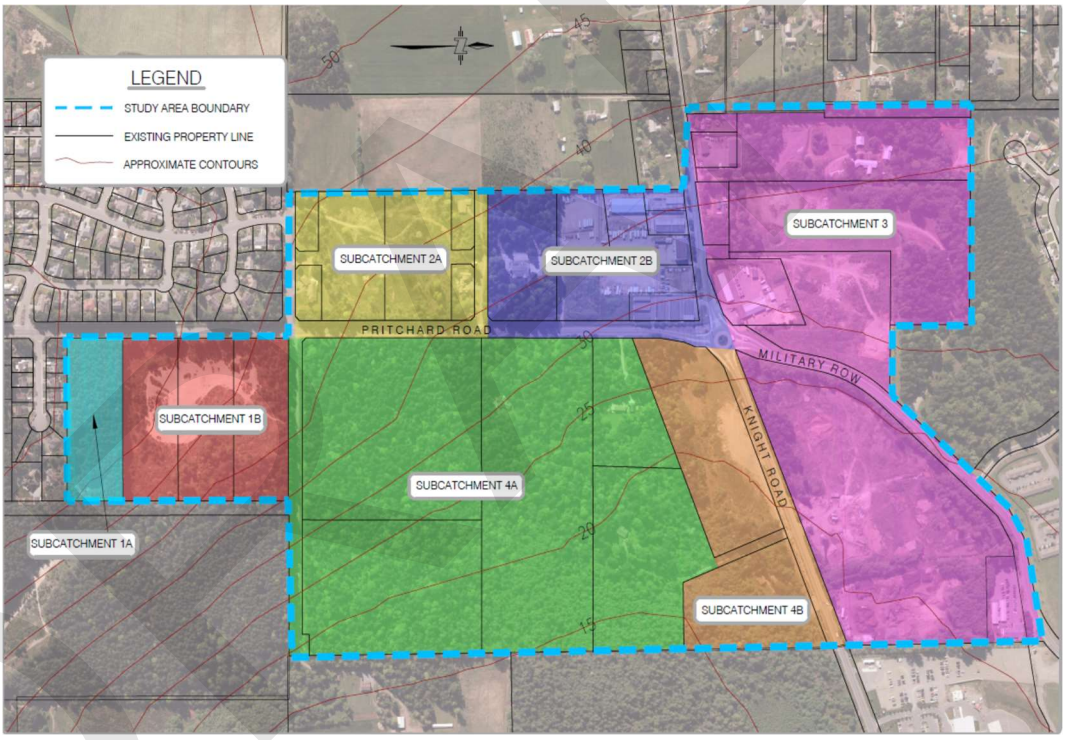


Figure 1 Sub-catchment Areas

Table 4: Model Input Parameters

Sub-Catchment	Area (ha)	% Imp.	Time to peak (hr)		Initial Abstractions (mm)		Smax	Smin	Infiltration Rate (mm/hr)
			Perv.	Imp.	Perv.	Imp.			
1A	2	60 (90)	1.5	0.75	9	2.5	250	20	40
1B	5.9	90	1.5	0.75	9	2.5	250	20	40
2A	6	60 (90)	1.5	0.75	9	2.5	250	20	10

2B	6.4	90	1.5	0.75	9	2.5	250	20	50
3	25.8	90	1.5	0.75	9	2.5	250	20	80
4A	27.5	60 (90)	1.5	0.75	9	2.5	250	20	30
4B	6.4	90	1.5	0.75	9	2.5	250	20	10

Notes for Table 4:
1) ha: Hectares
2) Imp.: Impervious
3) Perv.: Pervious
4) Smax: Maximum value of soil moisture storage (mm)
5) Smin: Minimum value of soil moisture storage (mm)
6) Parcels in residential zones are 60% Impervious and all other Land Uses are 90% Impervious.

1.5.1.3 Infiltration trenches must meet both the base area and storage volume for the applicable sub-catchment as specified in Table 5 as shown on SE-6 and SE-8. The outlet rating curves for the infiltration trench storage are based on orifice controls sized to convey 4 lps/ha at 1 metre of head.

1.5.1.4 Infiltration trenches shall be sized based on the tributary area of developed land and the land use, and in accordance with the surface areas and volumes specified in Table 5 – Infiltration Trench Sizing as shown on SE-6 and SE-8. To calculate the required Infiltration trench base area and storage volume, multiply the tributary area (in hectares) by the per hectare base area and storage volumes, for the applicable subcatchment, tabulated in Table 5 as shown on SE-6 and SE-8.

1.5.1.5 Base areas for infiltration trenches shall be calculated as the total base area of the drain rock reservoir.

1.5.1.6 Storage volumes for infiltration trenches shall be calculated as the total volume of the drain rock reservoir multiplied by a porosity of 30%.

1.5.1.7 Maximum discharge rate, infiltration rate, storage volume and drawdown time (the time it takes for an infiltration trench or dry detention pond to completely drain once inflow has stopped) shall be calculated and submitted to the Town for acceptance.

1.5.1.8 Infiltration trenches shall be dispersed throughout the development, unless otherwise approved by the Municipal Engineer.

1.5.1.9 All stormwater facilities except for amended soil shall be located within municipal rights-of-way (i.e. highway or or statutory rights-of-way in favour of the Town).

1.5.1.10 All paved areas, such as streets, driveways and walkways, shall either be sloped to drain onto adjacent unpaved landscape areas, boulevard infiltration trenches, or collected in catch basins and routed through subsurface infiltration trenches.

1.5.1.11 Infiltration trenches and landscaped areas designed as infiltration trenches shall be designed in accordance with the guidelines below, to encourage runoff from these areas to infiltrate into the soil.

1.5.1.12 Roof runoff shall not be directly connected to the storm service connection. All roof runoff shall be directed onto adjacent unpaved landscape areas. Lots shall be graded

to direct overland flow onto adjacent unpaved landscape areas, or permeable infiltration trenches.

1.5.1.13 Maximum ponding depth of boulevard infiltration trenches shall be 150mm. All boulevard infiltration trenches shall drain away from buildings and shall have an overflow to the 100-year return period flow path.

1.5.1.14 The surface of unpaved landscape areas shall be designed for positive drainage away from buildings. Slopes of 1% to 4% are desirable to encourage infiltration of small rainfalls while facilitating drainage of large storms and to prevent flooding of buildings.

1.5.1.15 Geotechnical investigation will be required prior to implementing infiltration trenches in the areas within 30m of a slope that is steeper than 3 (horizontal) to 1 (vertical) and higher than 6m, or other unstable slopes as determined by the Town.

1.5.1.16 Infiltration trenches are required in all developments.
All utility crossings of infiltration trenches shall have trench dams installed to stop infiltration water from flowing down the utility trench. Trench dams to be constructed of either non-shrink grout, a minimum of 150mm thick and keyed into trench walls a minimum of 150mm, or compacted impermeable earthen material approved by a geotechnical engineer a minimum of 450mm thick and keyed into trench walls a minimum of 300mm.

1.5.2 Materials

1.5.2.1 Infiltration Drain Rock: clean round stone or crushed rock conforming to the following gradations:

Drain Rock	
Sieve Designation	Percent Passing
25.0 mm	100
19.0 mm	0 – 100
9.50 mm	0 – 5
4.75 mm	0

1.5.2.2 Sand: Pit Run Sand, well graded, free from organic materials and conforming to following gradations:

Pit Run Sand	
Sieve Designation	Percent Passing
12.5 mm	100
4.75 mm	35 – 100
2.36 mm	20 – 100

1.18 mm	13 – 70
0.60 mm	8 – 50
0.30 mm	5 – 35
0.15 mm	2 – 25
0.075 mm	0 – 6

1.5.2.3 Amended soil shall meet the requirements of Guidelines and Resources for Implementing Soil Quality and Depth of section T5.13 in WDOE Stormwater Manual for Western Washington (see also North East Comox Neighbourhood Stormwater Management Plan Phase 2 of 3), with organic matter requirements modified as follows:
(1) For lawn areas 4 – 8%
(2) For plant bedding areas 4 – 18%

1.5.3 Installation and Testing

Infiltration trenches to be tested prior to acceptance by the Town. The recommended procedure for testing infiltration rate, and storage volume of infiltration trenches is as follows:

- Check the weather. Testing must be completed on a dry day with no rain in the forecast.
- Prior to testing, a complete inspection of the infiltration trench is required. Check the control manhole, cleanouts, observation well, upstream catch basins and manhole inlet piping. Remove any signs of sediment or debris buildup with the use of a vactor truck or other means capable of removing sediment without flushing sediment and debris into the infiltration trench or storm sewer. Allow system to completely drain prior to testing.
- Check the observation well to ensure the infiltration trench is completely empty.
- Ensure that there is ample supply of clean water free of contaminants. Fill the infiltration trench at a minimum rate of three times the maximum design infiltration rate. A minimum available volume of water of one half the infiltration trench design storage volume is required.
- Block the downstream outlet.
- Install a water level meter at ¼ of the depth of the infiltration trench either in the observation well or the control manhole overflow piping.
- Fill infiltration trench with clean water via manhole, catch basin or cleanout until ¼ full.
- Record total input volume, and time to fill ¼ full.
- Let infiltration trench completely drain through infiltration and record the total time.
- First calculate the infiltration rate using the following formula:

$(total\ input\ volume\ /\ total\ time\ )$ = $infiltration\ rate$

If calculated infiltration rate is not within 15% of design infiltration rate, the Town will require the infiltration trench be reconstructed.

- Second, calculate the storage volume using the following formula:
  $4 \times [total\ input\ volume - (infiltration\ rate \times time\ to\ fill)]$ = $storage\ volume$

If calculated storage volume is not within 15% of design storage volume (this could mean that sediment has filled in a portion of the available volume), the Town may require the storage volume to be rehabilitated.

- Ensure that all manhole covers, catch basin grates, clean out and observation well lids are securely in place once test is complete.

For ponded areas of boulevard infiltration trenches, the ponded area drain time shall also be checked using the following method:

- On a dry day with no rain in the forecast, fill surface collection area with clean water to a ponded depth of 100mm and record time to completely drain.
- Drain time must be less than 4 hours. If drain time is greater than 4 hours, the Town will require the amended soil / washed sand layer to be removed and replaced.

1.5.4 Monitoring Equipment and Data Collection

Specifications are based on manufacturers approved products. Where modifications or updated products have been issued the latest approved product shall be used.

1.5.4.1 **Velocity Flow Meters**

Developers will be required to install data collectors (velocity flow meters) at the downstream end of each phase of development (to monitor infiltration trench performance) and downstream of dry detention ponds (to monitor pond performance).. Data collection shall include depth (m), velocity (m/s) and temperature (Degree Celsius) at 5 minute intervals.

Velocity flow meters shall be installed in pipe and be easily accessible by manhole.

Velocity flow meters will be installed with sufficient water depth to provide continuous operation. A short weir may be required to be installed in the pipe downstream of the sensor to maintain water depth over the sensor.

Velocity flow meters shall be compatible with Remote Transmittal Unit (RTU) unit and software for data collection and processing.

1.5.4.2 **Ultrasonic Sensors**

Dry Detention Pond water levels will be measured using Tough Sonic CHEM10 ultrasonic sensors. Ultrasonic sensors are to be mounted in the pond outlet control structure on the upstream side to measure the pond water level in meters and at 5 minute intervals .

The sensor leads connect to the RS-2323 interface (a port and connection type between data terminal equipment and data circuit terminating equipment) to

communication with the RTU. Distance measurements from the sensor to the water level are automatically calibrated for elevation inside the RTU.
In order to operate properly, a deadband of 0.50 m is required for the sensor (refer to Figure 1-2). This is the distance between the bottom of the sensor and the highest recordable elevation (or depth) required, which is usually the HWL. the HWL elevation is to be set below the required deadband to provide additional clearance.

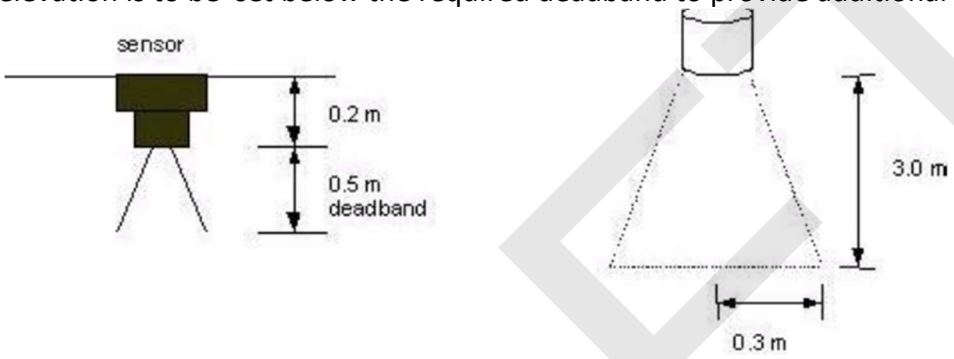


Figure 2 Dead Band and Sensor Band for Ultrasonic Sensors

Due to the conical shape of the sensor band, it is important that there be sufficient radial clearance (refer to Figure 2) between the signal from the sensor and any structure wall or protrusions. A radial distance of 0.30 m per 3.0 m of vertical distance is required. Ensure that MH rungs, trash racks, etc., do not interfere with the signal.
As a backup to the ultrasonic sensor, a mechanical float (Flygt bulb) is installed at or just below the HWL elevation.
The system will be set to send an alarm when:

- the water level reaches the design High Water Level.
- There is a loss of power, and

When any of these conditions are encountered the monitoring system will send an alarm to the person designated by the Town of Comox.
If monitoring of an adjacent similar subdivision is required, area velocity flow meters shall be installed in a storm sewer. The Town will provide the specific manhole location and corresponding catchment area. Data collection shall include depth, velocity and temperature at 5 minute intervals.
RTU unit shall be Sutron Xlink 500, HSPA loger/transmitter (or approved equal).
This device contains datalogging, sensor interface, solar charge controller and communications both on and off site. The devise is used to collect, store, and transmit sensor data.
Monitoring equipment shall be;

- Capable of monitoring reverse flow (flow meters only).
- 20W solar panel kits c/w 48 Hr battery or alternative option to connect directly to power source..
- .

- Connected to the internet and/or capable of remote data collection by cell phone connection.
- Capable of storing a minimum of 6 months of data at 5 minute intervals.
- Capable of field data collection.
- NEMA 4 weatherproof enclosure (or approved equal) secured on a 4m tall Type 4A galvanized steel pole type B concrete base (or approved equal).
- Equipped with alarm capabilities in the form of either a dial out or text message to notify of pond water levels approaching overflow or power failure..

1.5.4.3 Setup and Calibration

Due to the complexity of the equipment, setup must be completed by a qualified contractor. A calibration certificate from the service provider (or the equipment vendor) is also required to ensure that the elevations (HWL, and pond bottom) have been set correctly. Calibration certificates and phone numbers must be submitted to the Town of Comox. Monitoring equipment must be operational prior to Construction Completion Certificate; delays in servicing phone and electrical lines must be approved by the Town of Comox

- All work to be done in accordance with Canadian Electrical Code.
- High level regulator switch and ultrasonic level transmitters shall be connected to the RTU Package.
- The RTU shall be programmed to log the following conditions
  - Ultrasonic-high water level (HWL) alarm at elevation _____.
  - Power failure condition. (The RTU and the ultrasonic unit must be on the same breaker.)
- The contractor shall arrange for installation of one telephone/celluar line to the control panel enclosure. The line must be suitable for voice touch-tone communications. The RJ-II Box must be labelled with proper phone number with a permanent label.
- The contractor shall install the ultrasonic level sensor and regulator switch in appropriate locations. The regulator switch must be secured in an area subject to minimal water turbulence outside the trash rack and the ultrasonic level sensor must be located such that there is 0.3m of radial clearance per 3.0m depth in the control chamber. (No interference with trash rack, walls, etc.)
- The unit shall be mounted to the ceiling and above the level of the weir wall. A minimum clearance of 0.5m is required between the bottom of the unit and the top of the weir wall (PWL) to accommodate the sensor's dead zone (blanket distance).
- The contractor shall ensure all necessary equipment can be installed in the equipment enclosures.
- The contractor shall ensure proper operation of the RTU monitoring and communication functions. The ultrasonic level sensor must be calibrated. All alarm conditions must be tested.

- Installation and operating manuals must be supplied.
- The contractor must ensure that the alarm system is tied to the storm pond monitoring system. Calibration and testing of equipment to be completed by service provider.

1.5.5 Detailed Specifications

1.5.5.1 Disconnected Roof Leaders (Standard Drawing SE-3)
On parcels in residential zones, roof leaders shall not be connected to the municipal storm service. Roof leaders shall be disconnected and directed via lot grading to an unpaved landscaped area per Standard Drawing SE-3. Splash pads, drain rock or other similar means to displace energy and eliminate erosion at roof leader outlets must be used. Building lots shall be graded so that each property either drains directly to a municipal / statutory right-of-way or, at most, across one (1) other lot before reaching a municipal / statutory right-of-way. Subdivision lot grading and ultimate lot grading (post-building construction) shall be per the details on Standard Drawing SE – 11 or SE – 12 as applicable. Grading away from buildings shall be as per the latest edition of the British Columbia Building Code with a minimum grade away from buildings of 4% for 1.8 metres or 2% for 4.0 metres.

1.5.5.2 Sediment Catch Basin (Standard Drawing SE-4)
Catch basins shall have an underdrain connected to an infiltration trench per Standard Drawing SE-4.

1.5.5.3 Control Manhole (Standard Drawing SE-5)
Control manholes shall conform to Standard Drawing SE-5. Flow control to consist of a PVC tee, pipe stub cut at 30 degrees to the horizontal and a 15mm thick PVC plate solvent welded to pipe stub. Orifices to be sized to discharge 4 litres per second per hectare of tributary area per the sizing table on Standard Drawing SE-5. Overflow shall be a PVC pipe stub securely attached to the manhole wall with an inlet elevation set at the top elevation of the upstream infiltration facility.

1.5.5.4 Boulevard Infiltration Trench (Drawing SE-6) – General

1.5.5.4.1 Smaller, distributed infiltration trenches are preferred to single large-scale facilities.

1.5.5.4.2 Locate boulevard infiltration trenches so there is at least 3m of undisturbed soil between the trench and any building. Where the trenches are within 30m of wells or unstable slopes, a geotechnical review will be required.

1.5.5.4.3 Flow to boulevard infiltration trenches shall be distributed sheet flow, travelling through a filter strip: non-erodible material for erosion and scour protection, either vegetated (grassed) or non-vegetated (drain rock) filter area or swale (500mm minimum, greater than 3000mm desirable filter length) see Standard Drawing SE- 10.

1.5.5.4.4 Boulevard infiltration trench to have a level perforated drain pipe with either a manhole or clean out per Standard Drawing SE-9 installed at the upstream end.

1.5.5.4.5 Outflow from boulevard infiltration trench will be regulated by a control manhole per Standard Drawing SE-5 prior to discharge into a storm main.

1.5.5.4.6 Boulevard infiltration trench bottom to be level.

1.5.5.4.7 Boulevard infiltration trench bottom width – 600mm minimum.

1.5.5.4.8 Install boulevard infiltration trench in native ground, and avoid over-compaction of the trench sides and bottom, which reduces infiltration.

1.5.5.4.9 Provide erosion control along all sides of drainage inlets.

1.5.5.4.10 Pavement edge at the swale to be per Standard Drawing SE-10. Provide a 100mm drop at the edge of paving to the filter strip, to allow for positive drainage and buildup of road sanding/organic materials at this edge. Ensure positive drainage from curb into the ponded invert.

1.5.5.4.11 Ponded area side slopes of a maximum of 2H:1V, 4H:1V are required to aid operations and maintenance. Provide amended soil on side slopes similar to bottom. Approved plantings are provided below. Alternative native species may be used upon acceptance of the Town. See Standard Drawing SE-7 for an overview of the three planting zones; Center, Sloped Sides and Bermed Edges.

Center:

This area floods often and requires species that tolerate frequent flooding. Approved species that will be used in this zone are as follows:

- Tall sedge (Carex appressa)
- Spike rush (Eleocharis)
- Common cottongrass (Eriophorum angustifolium)
- Land quillwort (Isoetes histrix)
- Dwarf cattail (Typha minima)
- Giant leather fern (Acrostichum danaeifolium)
- Lady fern (Athyrium fillix –femina)
- Cinnamon fern (Osmunda cinnamomea)
- Royal fern (Osmunda regalis)
- Sword fern (Polystichum munitum

Sloped Sides:

This area floods briefly and requires plant species that tolerate damp soil but require only modest amounts of water during the dry season. Deciduous native shrubs, ferns, and grasses could be considered for use in this zone. Approved species of grasses and native shrubs that will be used in this zone are as follows:

Grasses for 4:1 slopes:

- Big bluestem (Andropogon gerardii)
- Meadow pinegrss, reedgrass (Calamagrostis Canadensis)
- Meadow barley (Hordeum secalinum)
- Moor grass (Molinia caerulea)
- Switchgrass (Panicum virgatum)

Shrubs for 2:1 or 4:1 slopes:

- Dogwood (cornus)

- Oceanspray (Holodiscus discolor)
- Sumac (Rhus)
- Thimbleberry (Rubus parviflorus

Bermed Edges:
These areas are outside the flood zone. Approved species of herbaceous perennials that will be used in this zone are as follows:

- Yarrow (Achillea millefolium)
- Swamp milkweed (Asclepias incarnata)
- Purple coneflower (Echinacea purpurea)
- Tuffted bluebell (Wahlenbergia communis)

1.5.5.4.12 Provide observation well for each boulevard infiltration trench: vertical standpipe, with perforated sides (perforated in drain rock reservoir only), and locking lid, to allow monitoring of water depth and sediment loading.

1.5.5.4.13 Maximum ponded level: 150mm.

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

1.5.5.4.15 Avoid utility or other crossings of the boulevard infiltration trench. Where utility trenches must be constructed crossing below the boulevard infiltration trench, install trench dams to avoid infiltration water following the utility trench.

1.5.5.4.16 Construction

1.5.5.4.17 Isolate the ponded area 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 ponded area, until all sediment-producing construction in the drainage area has been completed.

1.5.5.4.18 Prevent natural fill soils from intermixing with the infiltration drain rock. All contaminated stone aggregate must be removed and replaced.

1.5.5.4.19 Infiltration drain rock shall be installed in 300mm lifts and “compacted” to eliminate voids between the geotextile and surrounding soils.

1.5.5.5 Street Infiltration Trench (Standard Drawing SE-8)

1.5.5.5.1 Locate street infiltration trenches so there is at least 3m of undisturbed soil between the trench and any building. Where the trenches are within 30m of wells or unstable slopes a geotechnical review will be required.

1.5.5.5.2 Provide a sump manhole or catch basin upstream of all street infiltration trenches for pre-treatment grit separation to avoid sedimentation in the infiltration trench. Do not allow drainage from land uses with a high risk for water pollution (e.g. refueling stations) to enter an infiltration trench.

1.5.5.5.3 Installation of perforated drain pipe within the drain rock reservoir to be level.

1.5.5.5.4 Outflow from street infiltration trenches will be regulated by a control manhole per Standard Drawing SE-5 prior to discharge to a storm main.

1.5.5.5.5 Street infiltration trench bottom to be level.

1.5.5.5.6 Street infiltration trench bottom width - 600mm minimum.

1.5.5.5.7 Install the street infiltration trench in native ground, and avoid over-compaction of the trench sides and bottom, which reduces infiltration.

1.5.5.5.8 Provide observation well for each street infiltration trench: vertical standpipe, with perforated sides (perforated in drain rock reservoir only), and locking lid, to allow the monitoring of water depth and sediment loading.

1.5.5.5.9 Avoid utility or other crossings of the street infiltration trench. Where utility trenches must be constructed crossing below the street infiltration trench, install trench dams to avoid infiltration water following the utility trench.

1.5.5.5.10 Construction

1.5.5.5.11 Physically isolate the street infiltration trench from flow during construction by capping all inlet and outlet pipes and directing runoff directly to the municipal storm main.

1.5.5.5.12 Prevent natural fill soils from intermixing with the infiltration drain rock. All contaminated stone aggregate must be removed and replaced.

1.5.5.5.13 Infiltration drain rock shall be installed in 300mm lifts and compacted to eliminate voids between the geotextile and surrounding soils.

1.5.5.6 Dry Detention Pond (Standard Drawings SE-14 and SE-15) -

1.5.5.6.1 General

1.5.5.6.2 General landscaping, vegetation requirements, pathway access, will be designed with collaboration with the Town of Comox Parks Department.

1.5.5.6.3 Size dry detention ponds by continuous flow modeling to provide rainfall capture of historic rainfall adjusted for 2050 climate change. As listed in the Source as Table 6 – Dry Detention Pond Sizing, provides a rough estimate of required dry detention pond sizing based on the tributary area of developed land and current Official Community Plan designation. Sub-catchment areas are shown on Figure 1.

Table 6: Dry Detention Pond Sizing

Sub-Catchment			Dry Detention Pond	
(#)	Total Area (ha)	% Impervious[1] (%)	Approximate Storage Volume (m^3)	Storage Volume per Hectare (m^3/ha)
1A	2.0	60 (90)	900 (900)	450 (450)
1B	5.9	90	2655	450
2A	8.0	60 (90)	2700 / (2700)	450 / (450)
2B	4.4	90	2880	450
3	25.8	90	11610	450
4A	27.5	60 (90)	12375 (13000)	450 (475)
4B	6.4	90	2880	450

Notes:
1) Parcels in residential zones are 60% impervious and all other parcels are 90% impervious.

1.5.5.6.4 All dry detention ponds must drain by gravity to the Town's Storm System within Town Right-Of-Way (i.e. highway or Town held statutory right of way).

1.5.5.6.5 Dry detention pond locations to be determined at time of detailed design, in conjunction with Town acceptance, to maximize the upstream tributary area and minimize the number of ponds while allowing for downstream conveyance to the Town's Storm System.

1.5.5.6.6 Design

1.5.5.6.7 Dry Detention Ponds and underground storage reservoirs (secondary) are the preferred method of stormwater detention for the NE Comox neighborhood, as water fowl pose a risk to the nearby airport. Dry Detention Ponds shall be built in conformance with Transport Canada's document TP 1247 - Aviation - Land Use in the Vicinity of Aerodromes.

1.5.5.6.8 Base elevations of dry detention ponds shall be above the seasonal groundwater elevation to avoid saturation in the winter months.

1.5.5.6.9 The design maximum water level shall be at or below the existing ground elevation. Maximum pond water level above the existing ground elevation may be considered provided the following issues are addressed to the satisfaction of the Town: potential inspection, maintenance and replacement costs as well as the downstream implications if there is a failure.

1.5.5.6.10 A minimum freeboard of 0.6m shall be provided above the designed maximum water level.

1.5.5.6.11 The dry detention pond berms shall be constructed with a maximum interior side slope of 5H:1V and a maximum exterior side slope of 5H:1V.

1.5.5.6.12 Despite section 1.5.5.6.11 the Municipal Engineer may reduce the minimum slope requirement to 4:1 should the proposed 5:1 slope present unique challenges of a significant nature in regards to the amount of land needed and the impact to the developability of the surrounding parcels only taking into account the following factors:

1. Submission of a report prepared and certified under seal by a P.Eng analyzing:

    a. Impact on Land (difference in area)
    b. Impact to the Developability of Surrounding Parcels
    c. Maintenance Impact
    d. Certification that Town Equipment can Access and Maintain.
    e. Cost Comparison
    g. Assessment Confirming Stability of the 4:1 for the Anticipated Life of the Pond.

1.5.5.6.13 The top of dry detention pond berms shall be a minimum width of 3.0m.

1.5.5.6.14 Pilot channels may be piped.

1.5.5.6.15 A pre-treatment sump or sediment forebay is to be provided at the inlet to pilot channels.

1.5.5.6.16 Pond inlets and outlets shall have safety grillage and be constructed of either precast concrete or fiberglass materials as approved by the Town.

1.5.5.6.17 The dry detention pond and outlet structure shall be designed to function with the overall objective of the NE Comox Stormwater Management Plan.

1.5.5.6.18 The flow control structure is to be constructed with a removable orifice plate sized to restrict flows to the pre-development target rates and shall be located within a lockable manhole positioned within the embankment for purpose of maintenance, access, safety and aesthetics. Discharges will be controlled by two orifices where the bottom of the lower orifice is placed at the pond bottom elevation and the bottom of the upper orifice is placed 0.6 m above the pond bottom. The orifices will be sized for the combined total discharges as shown below:

Subcatchment Discharge (L/s/ha)				
Depth (m)	1	2	3	4
0	0	0	0	0
0.6	7.5	7.3	8.3	8.0
1.0	16.7	16.4	16.8	16.9

1.5.5.6.19 An emergency spillway shall be designed to accommodate the post-development runoff in excess of a 1:100-year storm event. The discharge path from the dry detention pond to the receiving environment shall be adequately protected from erosion.

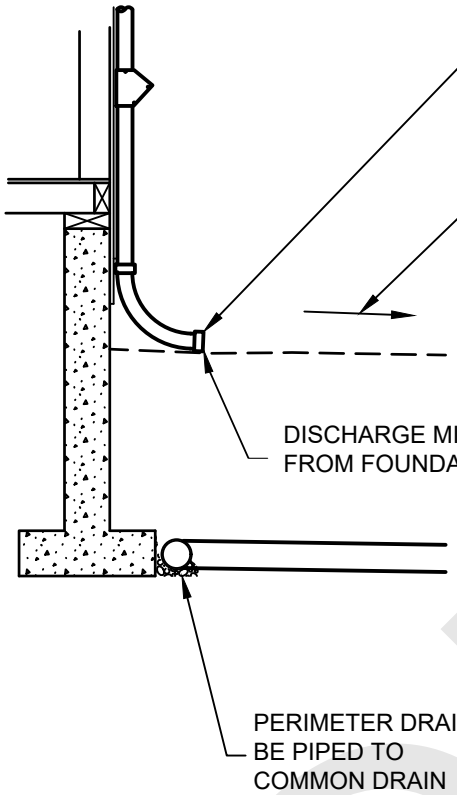
1.5.5.6.20 The design of the emergency spillway shall be determined based on the exit velocity of stormwater runoff from the dry detention pond.

1.5.5.6.21 A minimum of 4 signs shall be installed around the perimeter of dry detention ponds. Signs to be per Standard Drawing SE-13.

1.5.5.6.22 An access tract or road sufficient to accommodate maintenance vehicles shall be provided from the public right-of-way to the inlet and outlet structures and to the pond bottom.

1.5.5.6.23 Pedestrian trails to Town Standards may be included where applicable and desired, subject to Town acceptance.

1.5.5.6.24 Dry detention pond and surrounding green space landscaping must be designed and installed under the direction of a landscape architect with preference given to native species. The developer must submit for approval by Parks Superintendent an irrigation plan, complete with meter, meter setter and controller, landscaping plan which identifies top soil depth, plant varieties, plant sizes, planting details and planting locations and meet requirements of BCLNA Standards as published by the BC landscape and Nursery Association.



NORTHEAST COMOX

SERVICE CONNECTION WITH DISCONNECTED ROOF LEADERS

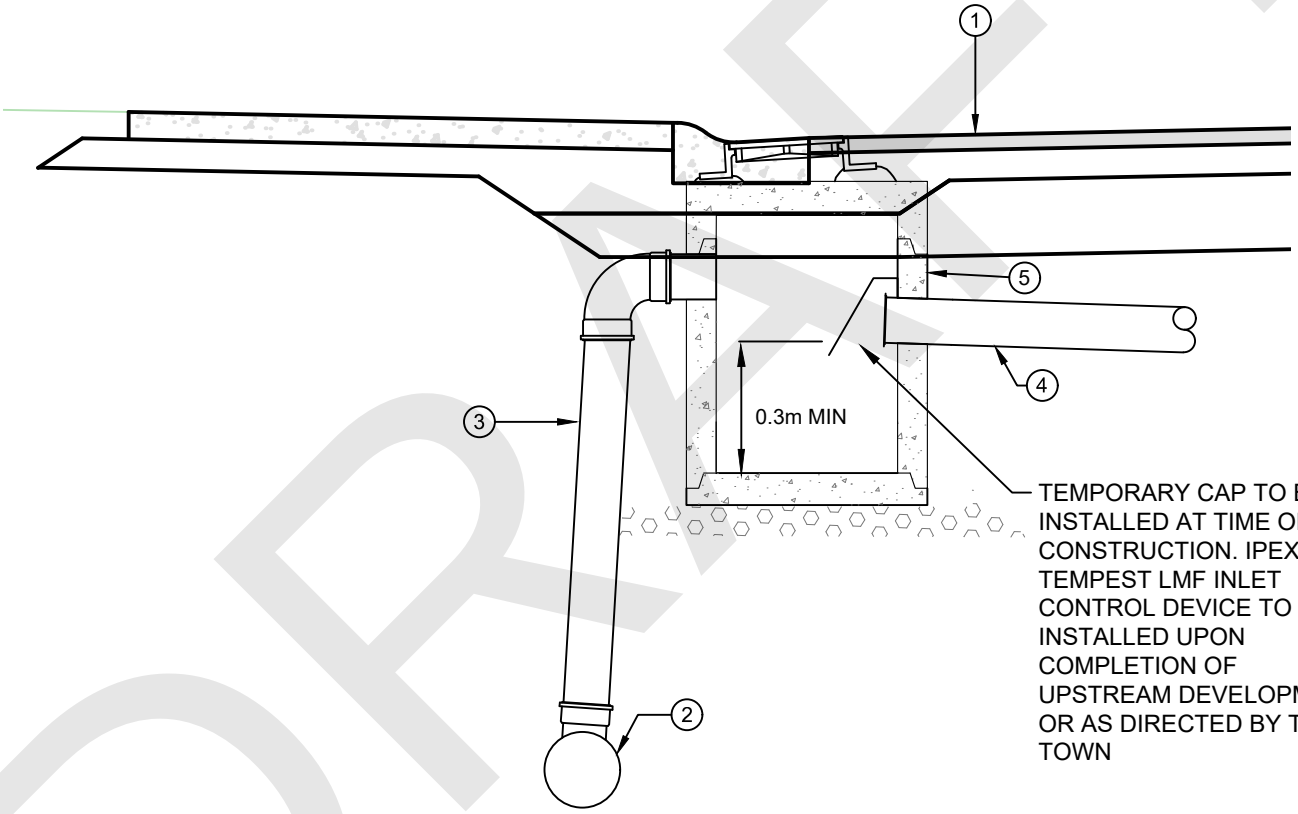
Drawing No.

SE-3

DATE : Feb 2021

Source: North East Comox Neighbourhood Stormwater Management Plan - PHASE 3 OF 3, March 1, 2018, McElhanney Consulting Services Ltd.

1. ROAD SURFACE, BASE, AND SUBBASE
2. MUNICIPAL STORM MAIN
3. 150mm Ø (MIN.) OVERFLOW TO STORM MAIN
4. 150mm Ø (MIN.) UNDERFLOW TO INFILTRATION TRENCH
5. CATCHBASIN - TO CONFORM TO THE CURRENT EDITION OF THE TOWN OF COMOX SUBDIVISION AND DEVELOPMENT SPECIFICATIONS BYLAW



TEMPORARY CAP TO BE INSTALLED AT TIME OF CONSTRUCTION. IPEX TEMPEST LMF INLET CONTROL DEVICE TO BE INSTALLED UPON COMPLETION OF UPSTREAM DEVELOPMENT OR AS DIRECTED BY THE TOWN

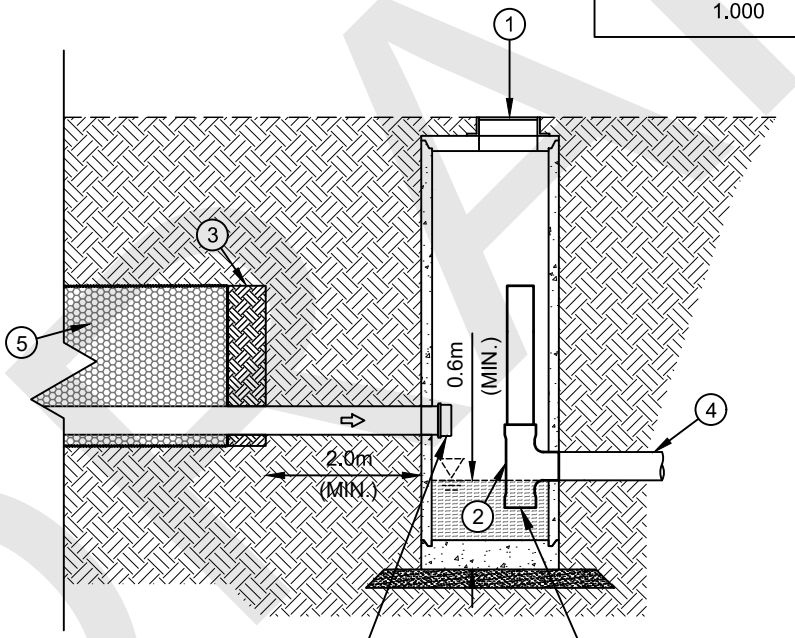
TOWN OF COMOX	NORTHEAST COMOX	Drawing No. SE-4
	SEDIMENT CATCHBASIN	DATE : Feb 2021

Source: North East Comox Neighbourhood Stormwater Management Plan - PHASE 3 OF 3, March 1, 2018, McElhanney Consulting Services Ltd.

1. CONTROL MANHOLE - MANHOLE TO CONFORM TO THE CURRENT EDITION OF THE TOWN OF COMOX SUBDIVISION AND DEVELOPMENT BYLAW
2. FLOW RESTRICTOR ASSEMBLY WITH ORIFICE PLATE AND OVERFLOW SET AT TOP ELEVATION OF DRAIN ROCK RESERVOIR
3. TRENCH DAMS AT END OF DRAIN ROCK RESERVOIR
4. OUTFLOW PIPE TO STORM DRAIN OR SWALE SYSTEM
5. DRAIN ROCK RESERVOIR (DEPTH 1.0m)
6. MINIMUM PIPE DIAMETER IS 150mm

ORIFICE SIZING TABLE

TRIBUTARY AREA (ha)	ORIFICE SIZE (mm)
0.050	10
0.075	12
0.100	13
0.125	14
0.150	16
0.175	18
0.200	19
0.225	20
0.250	21
0.275	22
0.300	23
0.325	24
0.350	25
0.375	26
0.400	27
0.450	28
0.500	30
0.550	31
0.600	33
0.650	34
0.700	35
0.750	37
0.800	38
0.850	39
0.900	40
0.950	41
1.000	42



TOWN OF COMOX

NORTHEAST COMOX

INFILTRATION TRENCH
CONTROL MANHOLE

Drawing No.
SE-5

DATE : Feb 2021

Source: North East Comox Neighbourhood Stormwater Management Plan - PHASE 3 OF 3, March 1, 2018, McElhanney Consulting Services Ltd.

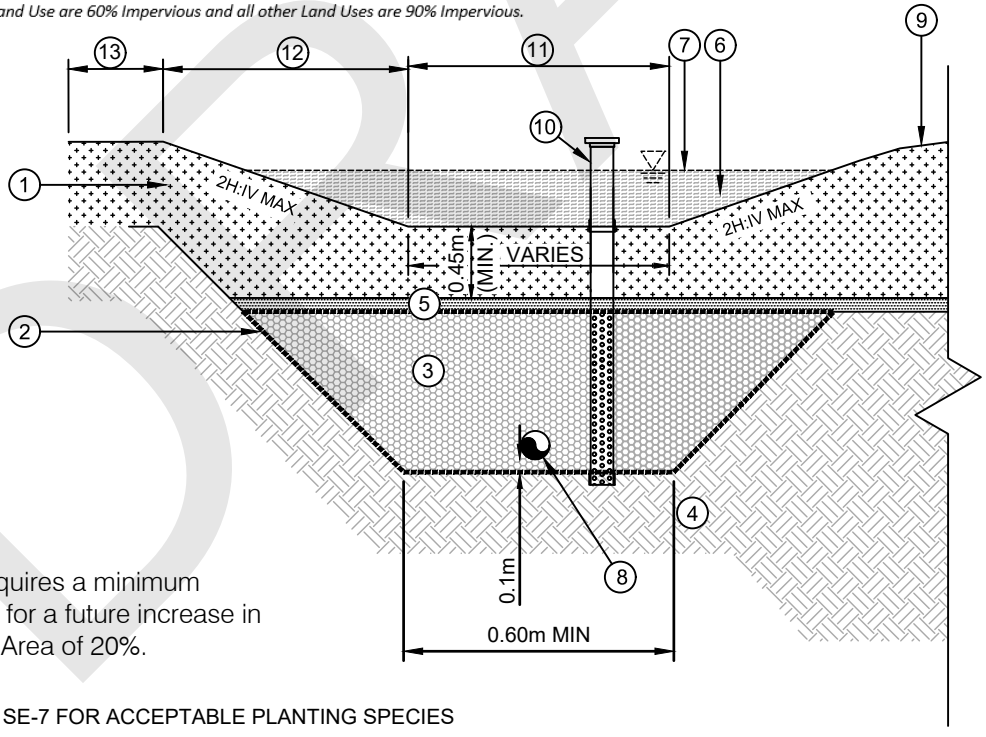
1. AMENDED SOIL (RAIN GARDENS) OR WASHED SAND (ROCK GARDENS) MIN 0.45m DEPTH
2. GEOTEXTILE ALONG ALL SIDES OF RESERVOIR
3. DRAIN ROCK RESERVOIR
4. FLAT, SCARIFIED SUBSOIL
5. 100mm WASHED SAND (RAIN GARDENS ONLY)
6. PONDING AREA - MAX 150mm DEPTH
7. MAX WATER LEVEL
8. PERFORATED DRAIN PIPE (150mm Ø MIN.) WITH FILTER CLOTH SOCK (OPTIONAL)
9. FILTER STRIP (SEE SE-10)
10. OBSERVATION WELL - 50mm Ø (MIN.) PIPE (PERFORATED INSIDE DRAIN ROCK RESERVOIR ONLY)
11. CENTER
12. SLOPED SIDES (4H:IV SIDE SLOPE REQUIRED FOR GRASS PLANTINGS)
13. BERMED EDGES

Table 5: Infiltration Trench Sizing

Sub-Catchment			Infiltration Trench Parameters		
(#)	Total Area (ha)	% Imp[2] (%)	Total Base Area (m^2)	Base Area per area (m^2/ha)	Storage Volume[1] per Hectare (m^3/ha)
1A	2.0	60 / (90)	250 / (400)	125 / (200)	38 (60)
1B	5.9	90	1180	200	60
2A	6.0	60 / (90)	2700 / (4800)	450 / (800)	135 / (240)
2B	6.4	90	1024	160	48
3	25.8	90	2580	100	30
4A	27.5	60 / (90)	4538 / (7000)	165 / (255)	50 / (80)
4B	6.4	90	5120	800	240

Notes:
1) Infiltration trench storage volume is calculated as a 1 metre deep drain rock reservoir with a long-term void ratio of 30%. I.e., for every 1 square meter of base area, the total storage volume is 0.3 cubic metres.
2) Single Family Land Use are 60% Impervious and all other Land Uses are 90% Impervious.

Infiltration trenches shall be sized by the design engineer based on the tributary area of developed land and the land use, and in accordance with the surface areas and volumes specified in Table 5 – Infiltration Trench Sizing. To calculate the required Infiltration trench base area and storage volume, multiply the tributary area (in hectares) by the per hectare base area and storage volumes, for the applicable subcatchment, tabulated in Table 5.



Design requires a minimum allowance for a future increase in Infiltration Area of 20%.

NOTE: SEE SE-7 FOR ACCEPTABLE PLANTING SPECIES

TOWN OF COMOX

NORTHEAST COMOX

BOULEVARD INFILTRATION TRENCH

Drawing No. SE-6

DATE : Feb 2021

Source: North East Comox Neighbourhood Stormwater Management Plan - PHASE 3 OF 3, March 1, 2018, McElhanney Consulting Services Ltd.

Ponded area side slopes of a maximum of 2H:1V, 4H:1V are recommended to aid operations and maintenance. Provide amended soil on side slopes similar to bottom. Approved plantings are provided below. Alternative native species may be used upon acceptance of the Town. See Standard Drawing SE-6 for an overview of the three planting zones; Center, Sloped Sides and Bermed Edges.

Center:

This area floods often and requires species that tolerate frequent flooding. Approved species that may be used in this zone are as follows:

- Tall sedge (Carex appressa)
- Spike rush (Eleocharis)
- Common cottongrass (Eriophorum angustifolium)
- Land quillwort (Isoetes histrix)
- Dwarf cattail (Typha minima)
- Giant leather fern (Acrostichum dadanaeifolium)
- Lady fern (Athyrium fillix –femina)
- Cinnamon fern (Osmunda cinnamomea)
- Royal fern (Osmunda regalis)
- Sword fern (Polystichum munitum

Sloped Sides:

This area floods briefly and requires plant species that tolerate damp soil but require only modest amounts of water during the dry season. Deciduous native shrubs, ferns, and grasses could be considered for use in this zone. Approved species of grasses and native shrubs that may be used in this zone are as follows:

Grasses:

- Big bluestem (Andropogon gerardii)
- Meadow pinegrss, reedgrass (Calamagrostis Canadensis)
- Meadow barley (Hordeum secalinum)
- Moor grass (Molinia caerulea)
- Switchgrass (Panicum virgatum)

Shrubs:

- Dogwood (cornus)
- Oceanspray (Holodiscus discolor)
- Sumac (Rhus)
- Thimbleberry (Rubus parviflorus

Bermed Edges:

These areas are outside the flood zone. Approved species of herbaceous perennials that may be used in this zone are as follows:

- Yarrow (Achillea millefolium)
- Swamp milkweed (Asclepias incarnata)
- Purple coneflower (Echinacea purpurea)
- Tuffted bluebell (Wahlenbergia communis)

TOWN OF COMOX

NORTHEAST COMOX

BOULEVARD INFILTRATION TRENCH

ACCEPTABLE PLANTING SPECIES

Drawing No.

SE-7

DATE : Feb 2021

D

Source: North East Comox Neighbourhood Stormwater Management Plan - PHASE 3 OF 3, March 1, 2018, McElhanney Consulting Services Ltd.

Table 5: Infiltration Trench Sizing

Sub-Catchment			Infiltration Trench Parameters		
(#)	Total Area (ha)	% Imp[2] (%)	Total Base Area (m^2)	Base Area per area (m^2/ha)	Storage Volume[1] per Hectare (m^3/ha)
1A	2.0	60 / (90)	250 / (400)	125 / (200)	38 (60)
1B	5.9	90	1180	200	60
2A	6.0	60 / (90)	2700 / (4800)	450 / (800)	135 / (240)
2B	6.4	90	1024	160	48
3	25.8	90	2580	100	30
4A	27.5	60 / (90)	4538 / (7000)	165 / (255)	50 / (80)
4B	6.4	90	5120	800	240

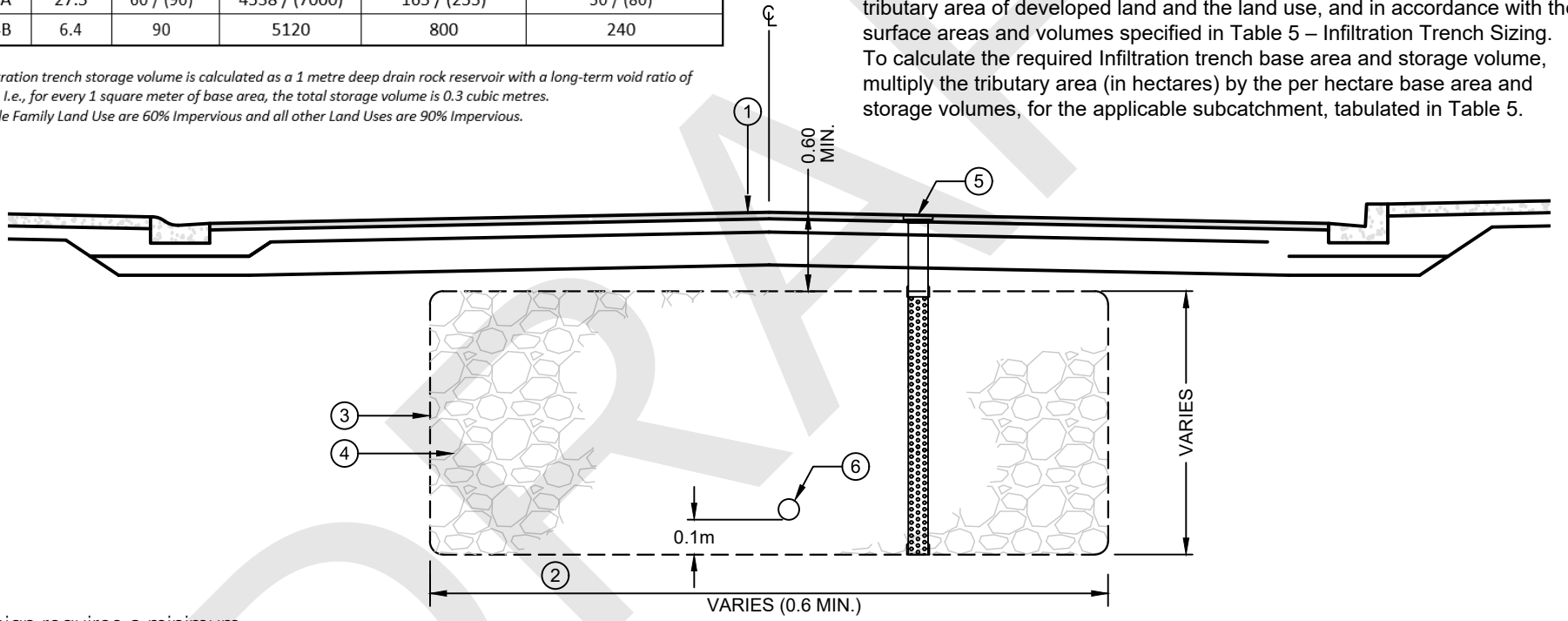
Notes:

1) Infiltration trench storage volume is calculated as a 1 metre deep drain rock reservoir with a long-term void ratio of 30%. I.e., for every 1 square meter of base area, the total storage volume is 0.3 cubic metres.

2) Single Family Land Use are 60% Impervious and all other Land Uses are 90% Impervious.

1. ROAD SURFACE, BASE, AND SUBBASE
2. FLAT, SCARIFIED SUB SOIL
3. GEOTEXTILE ALONG ALL SIDES OF RESERVOIR
4. DRAIN ROCK RESERVOIR
5. OBSERVATION WELL - 150Ø (MIN.) PIPE (PERFORATED INSIDE DRAIN ROCK RESERVOIR ONLY) C/W "ROBAR TYPE" CAST IRON VALVE BOX MARKED "STORM"
6. 150mm Ø MIN. PERFORATED DRAIN PIPE (PERFORATED INSIDE ROCK TRENCH ONLY). CONNECT TO CONTROL MANHOLE SE- 5

Infiltration trenches shall be sized by the design engineer based on the tributary area of developed land and the land use, and in accordance with the surface areas and volumes specified in Table 5 – Infiltration Trench Sizing. To calculate the required Infiltration trench base area and storage volume, multiply the tributary area (in hectares) by the per hectare base area and storage volumes, for the applicable subcatchment, tabulated in Table 5.



Design requires a minimum allowance for a future increase in Infiltration Area of 20%.

TOWN OF COMOX

NORTHEAST COMOX

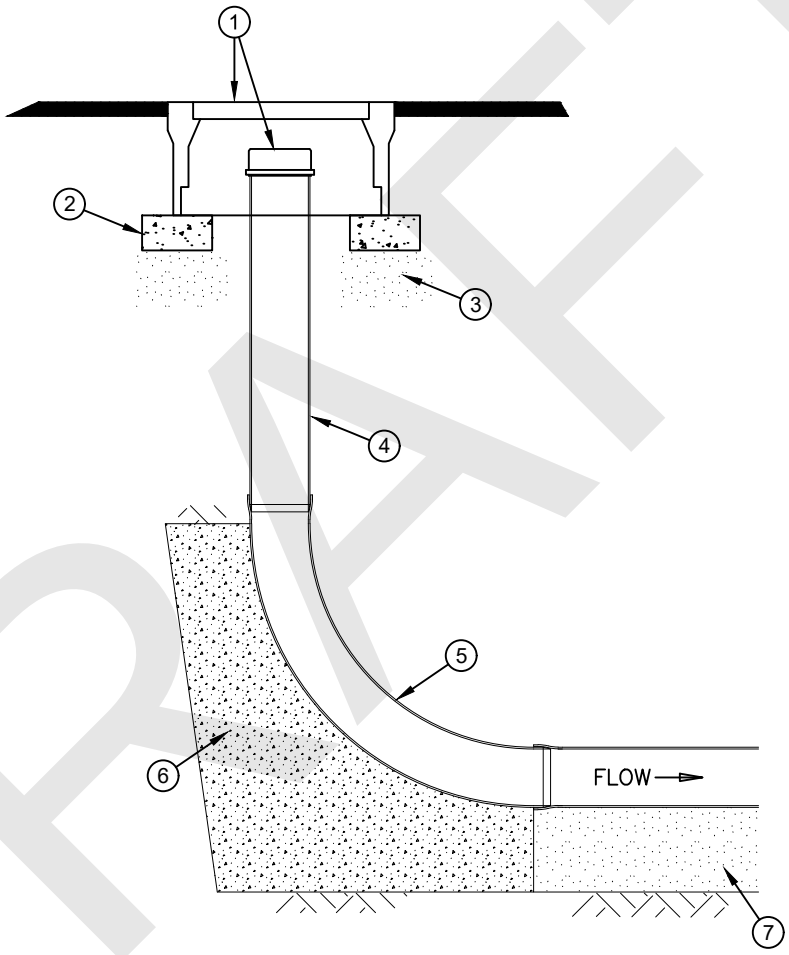
STREET INFILTRATION TRENCH

Drawing No. SE-8

DATE : Feb 2021

Source: North East Comox Neighbourhood Stormwater Management Plan - PHASE 3 OF 3, March 1, 2018, McElhanney Consulting Services Ltd.

1. 150mm Ø (MIN.) PVC CAP. FOR BOULEVARD INSTALLATIONS USE CONCRETE BOX MARKED "STORM" (LANGLEY #37 OR EQUIVALENT), FOR ROADWAY INSTALLATIONS USE "ROBAR TYPE" CAST IRON VALVE BOX MARKED "STORM"
2. CONCRETE BOX TO BE INSTALLED ON CONCRETE BLOCK SUPPORTS (ALL SIDES)
3. GRANULAR BASE MATERIAL
4. 150mm Ø (MIN.) DRAIN PIPE
5. 90° LONG RADIUS BEND (OR 2 x 45° LONG RADIUS BENDS)
6. CONCRETE ENCASEMENT MIN. 150mm THICK ALL AROUND
7. GRANULAR PIPE BEDDING AND BACKFILL



TOWN OF COMOX

NORTHEAST COMOX

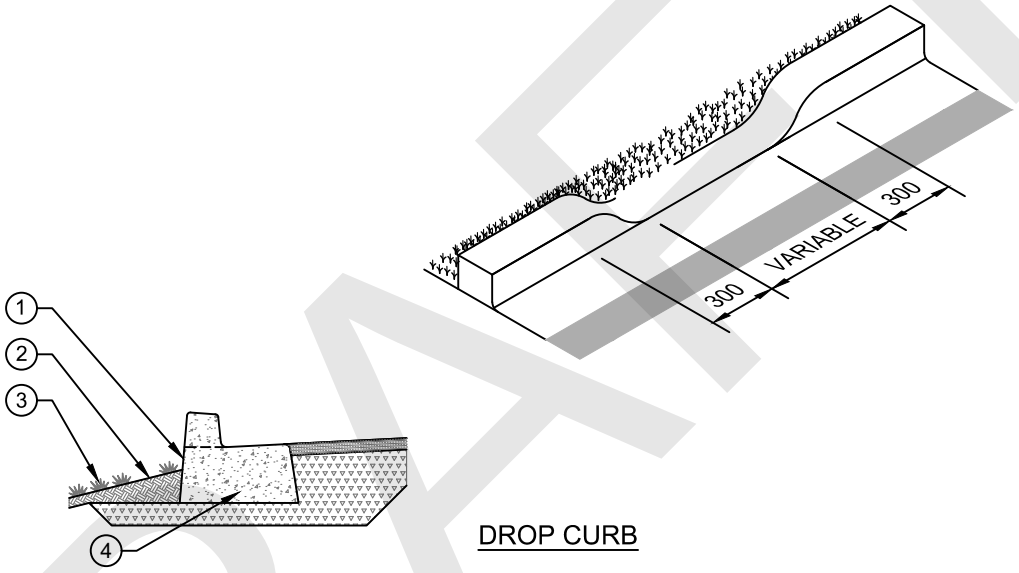
CLEAN OUT

Drawing No.

SE-9

DATE : Feb 2021

Source: North East Comox Neighbourhood Stormwater Management Plan - PHASE 3 OF 3, March 1, 2018, McElhanney Consulting Services Ltd.



DROP CURB

1. 0.10m VERTICAL DROP FROM GUTTERLINE TO FILTER STRIP (TYPICAL)
2. 4 : 1 MAX. 25 : 1 MIN. SLOPE FOR FIRST 0.5m (TYPICAL)
3. FILTER STRIP: EROSION RESISTANT TREATMENT (EG. GRASS OR EROSION CONTROL FABRIC AND DRAIN ROCK) TYPICAL
4. CURB PROFILE PER TOWN OF COMOX SUBDIVISION AND DEVELOPMENT SPECIFICATIONS BYLAW

TOWN OF COMOX

NORTHEAST COMOX

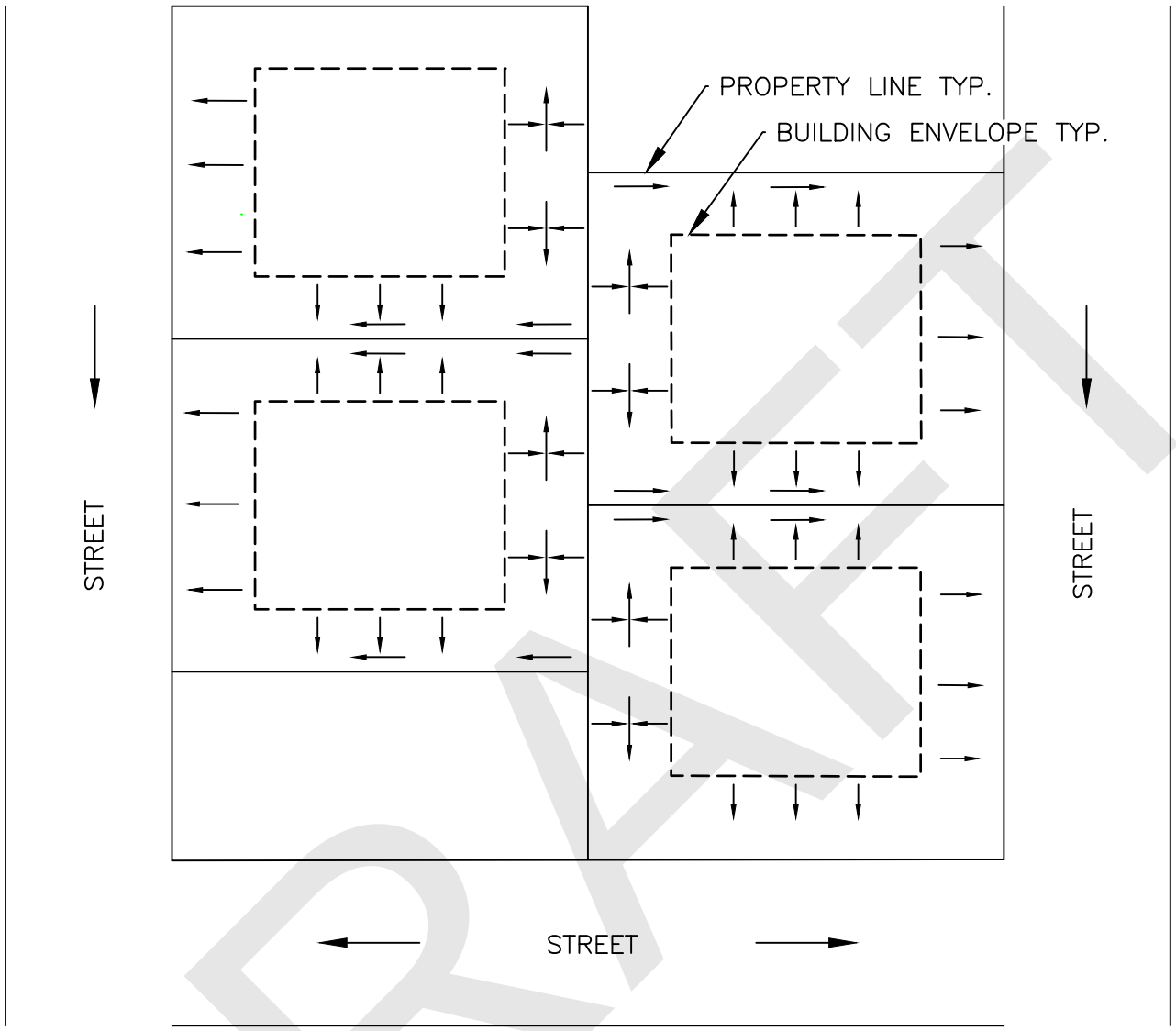
CURBING OPTIONS AT BOULAVARD INFILTRATION TRENCHES

Drawing No.

SE-10

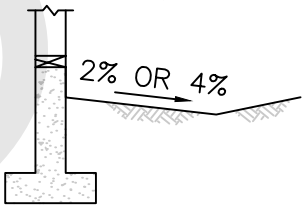
DATE : Feb 2021

Source: North East Comox Neighbourhood Stormwater Management Plan - PHASE 3 OF 3, March 1, 2018, McElhanney Consulting Services Ltd.



REAR TO FRONT LOT DRAINAGE

RECOMMENDED FINISHED GRADE TO SLOPE AWAY FROM HOUSE AT A MINIMUM OF EITHER 2% FOR MIN. OF 4.0m OR 4% FOR MIN. OF 1.8m



LOT GRADING AWAY FROM HOUSE DETAIL

NOTES:

1) ALL SURFACE DRAINAGE AROUND BUILDING TO BE PER BC BUILDING CODE LATEST EDITION

2) ALL BUILDING PENETRATIONS I.E. DOORS, WINDOWS, VENTS ETC. SHALL BE A MINIMUM OF 150mm ABOVE FINISHED GRADE UNLESS DRAINED PER BC BUILDING CODE LATEST EDITION.

LEGEND:

LOT GRADING AT TIME OF FINAL SUBDIVISION APPROVAL →

TOWN OF COMOX

NORTHEAST COMOX

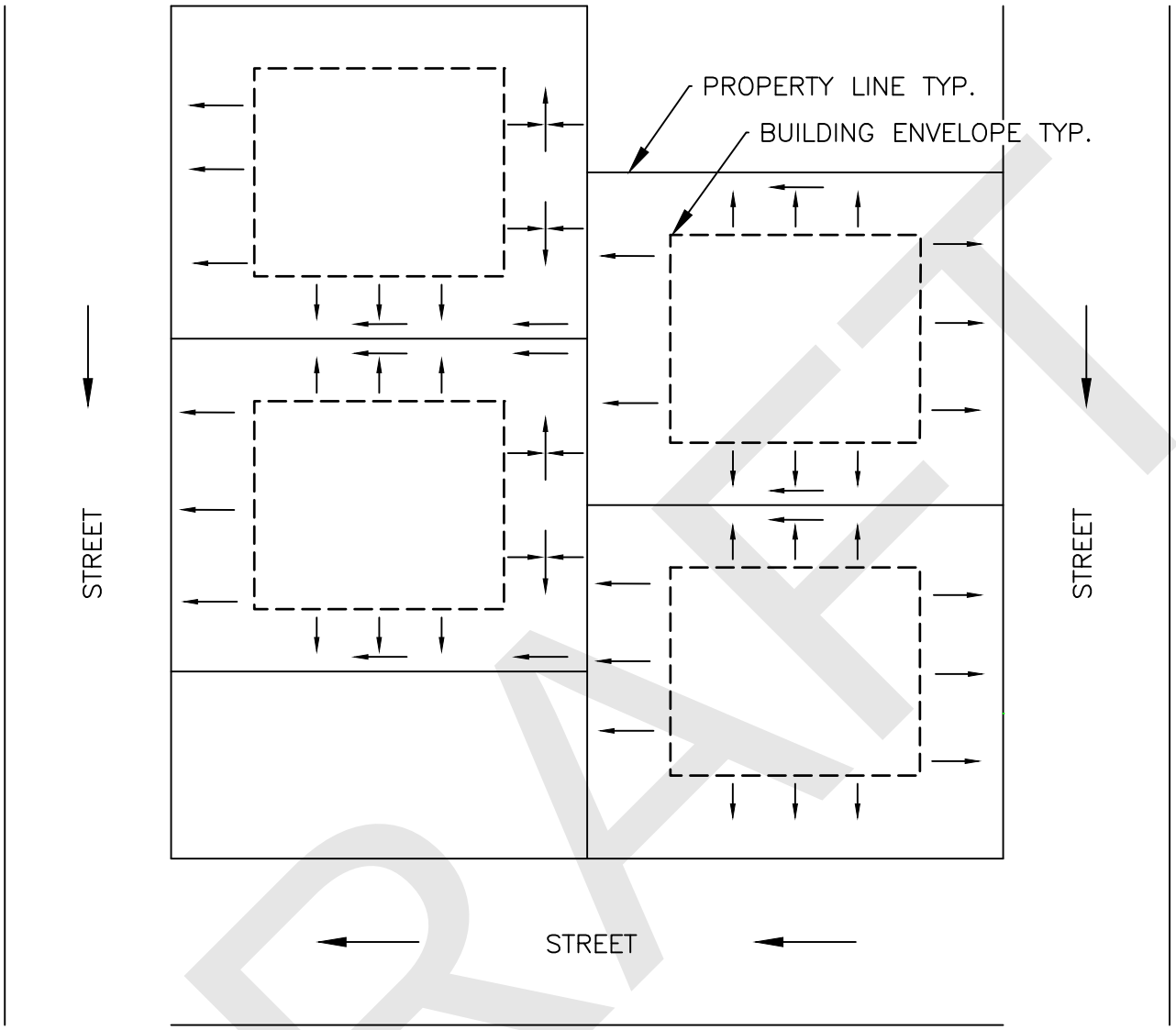
TYPICAL LOT GRADING

Drawing No.

SE-11

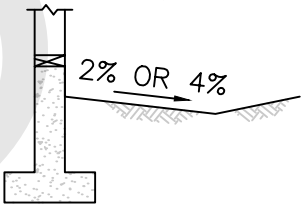
DATE : Feb 2021

Source: North East Comox Neighbourhood Stormwater Management Plan - PHASE 3 OF 3, March 1, 2018, McElhanney Consulting Services Ltd.



FRONT TO REAR LOT DRAINAGE

RECOMMENDED FINISHED GRADE TO SLOPE AWAY FROM HOUSE AT A MINIMUM EITHER 2% FOR MIN. OF 4.0m OR 4% FOR MIN. OF 1.8m



LOT GRADING AWAY FROM HOUSE DETAIL

NOTES:

1) ALL SURFACE DRAINAGE AROUND BUILDING TO BE PER BC BUILDING CODE LATEST EDITION

2) ALL BUILDING PENETRATIONS I.E. DOORS, WINDOWS, VENTS ETC. SHALL BE A MINIMUM OF 150mm ABOVE FINISHED GRADE UNLESS DRAINED PER BC BUILDING CODE LATEST EDITION.

LEGEND:

LOT GRADING AT TIME OF FINAL SUBDIVISION APPROVAL →

TOWN OF COMOX

NORTHEAST COMOX

TYPICAL LOT GRADING

Drawing No.

SE-12

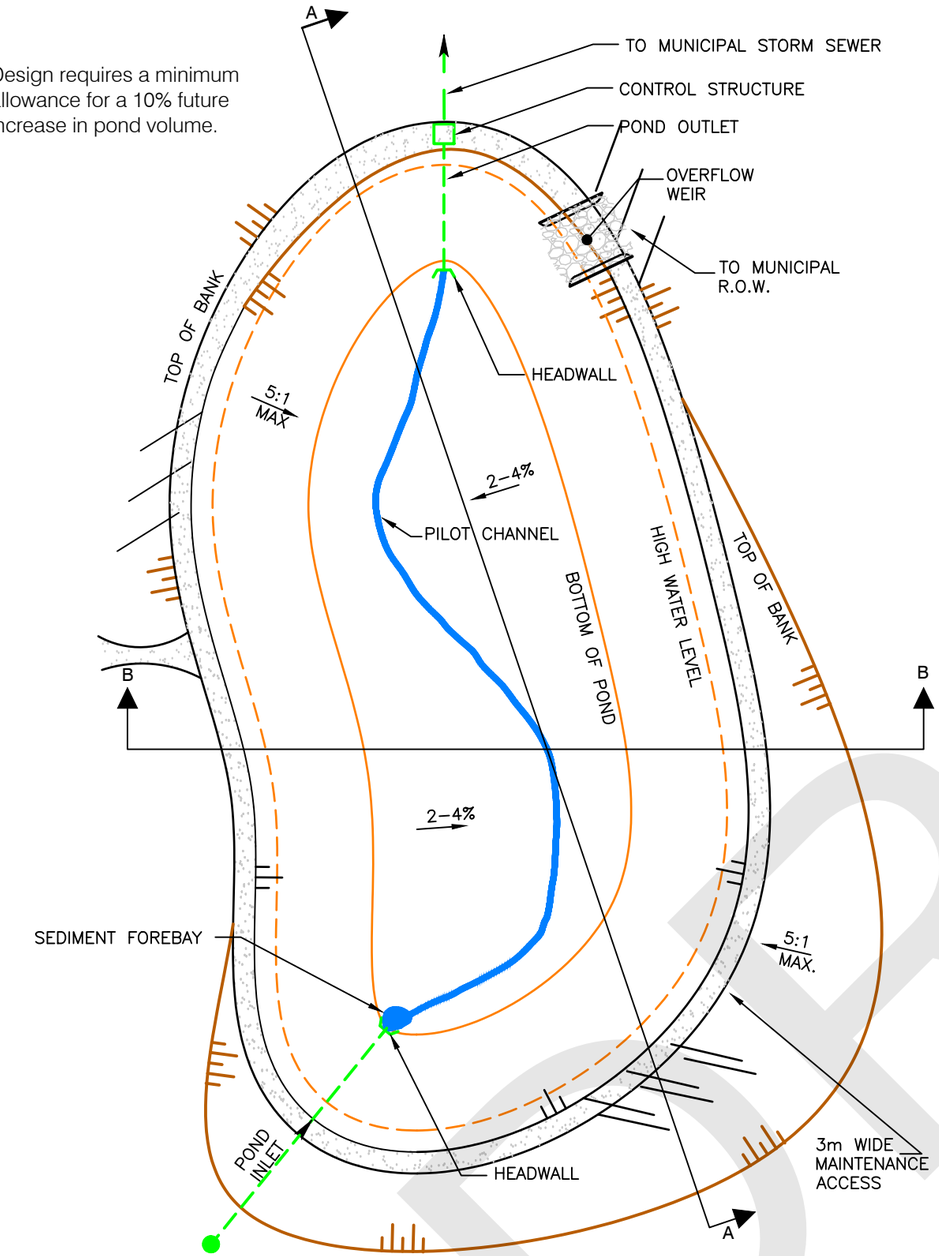
DATE : Feb 2021

Source: North East Comox Neighbourhood Stormwater Management Plan - PHASE 3 OF 3, March 1, 2018, McElhanney Consulting Services Ltd.

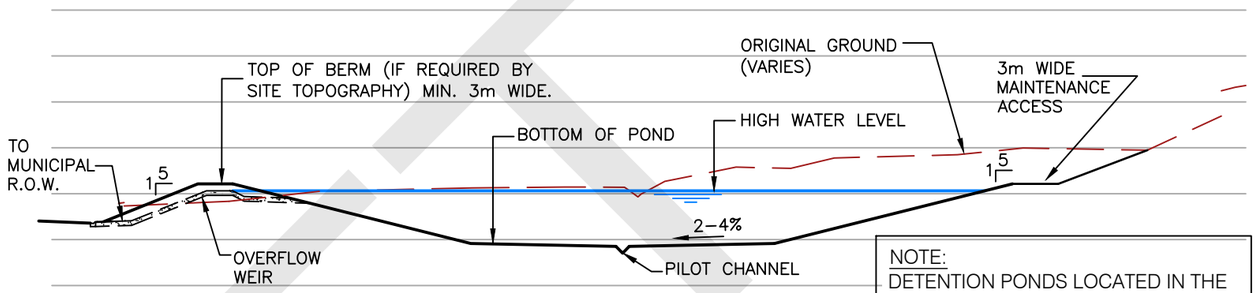
TOWN OF COMOX	NORTHEAST COMOX	Drawing No. SE-13
	DRY DETENTION POND SIGN DETAIL	DATE : Feb 2021

Source: North East Comox Neighbourhood Stormwater Management Plan - PHASE 3 OF 3, March 1, 2018, McElhanney Consulting Services Ltd.

Design requires a minimum allowance for a 10% future increase in pond volume.

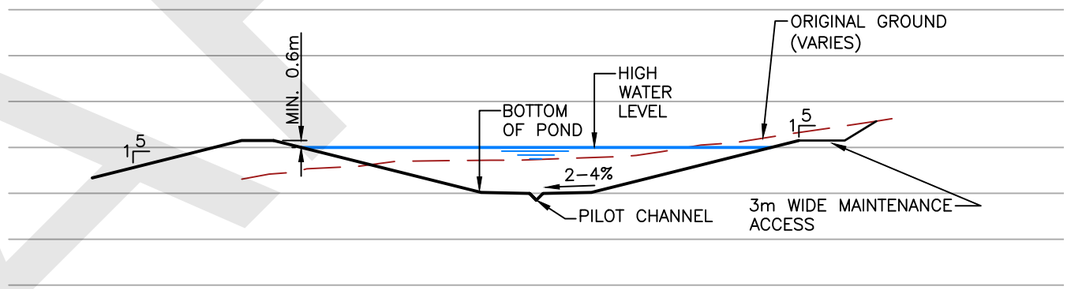


DETENTION POND - PLAN
N.T.S.

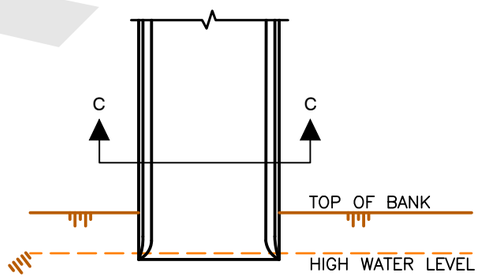


SECTION A - A
SCALE N.T.S.

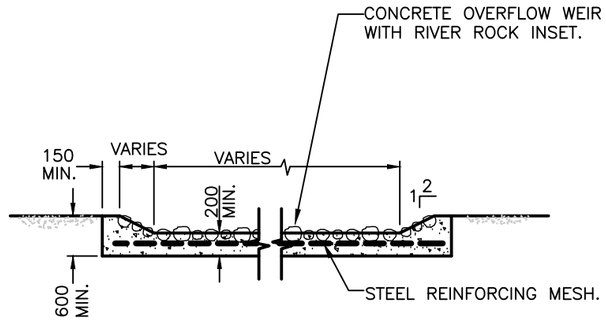
NOTE:
DETENTION PONDS LOCATED IN THE LOWER EASTERN PORTION OF SUB-CATCHMENT 4, WHERE ARTESIAN CONDITIONS EXIST, MAY REQUIRE AN IMPERMEABLE POND LINER.



SECTION B - B
SCALE N.T.S



POND OVERFLOW DETAIL
SCALE N.T.S.



SECTION C - C
SCALE N.T.S.

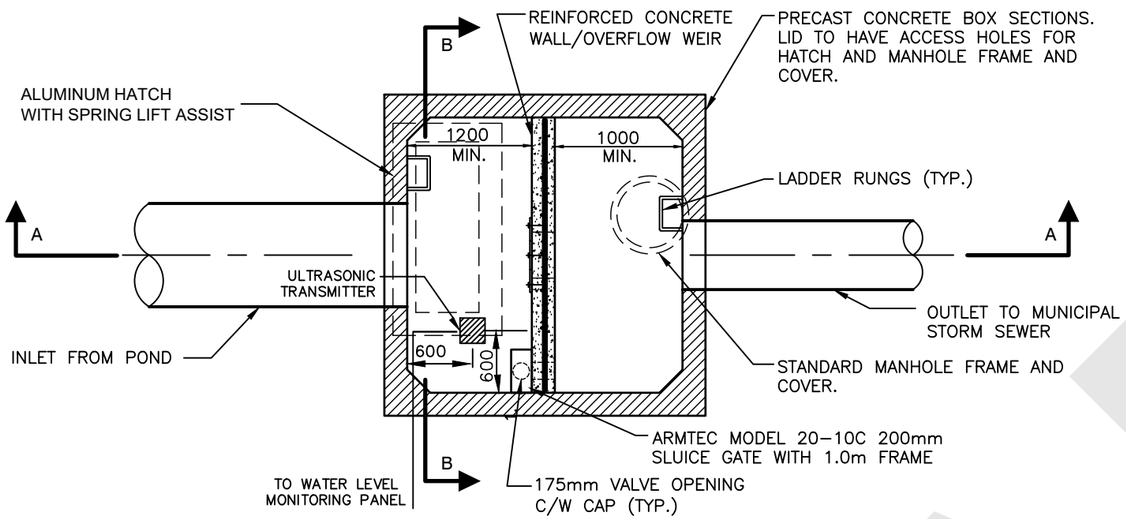
NORTHEAST COMOX

DRY DETENTION POND PLAN & SECTIONS

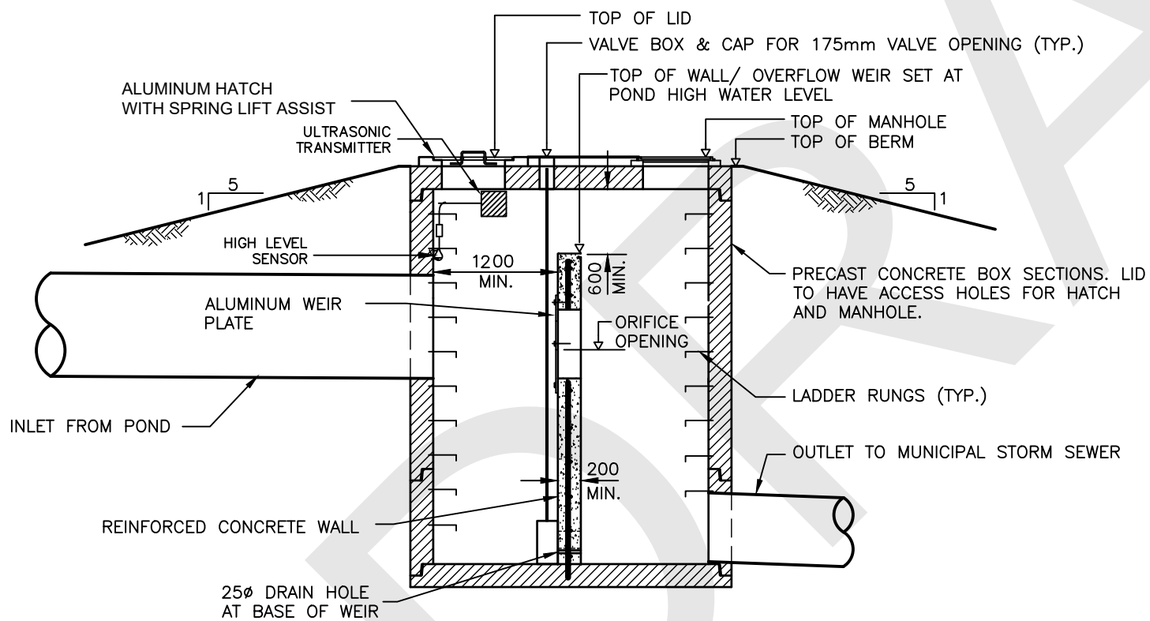
Drawing No.
SE-14

DATE : Feb 2021

Source: North East Comox Neighbourhood Stormwater Management Plan - PHASE 3 OF 3, March 1, 2018, McElhanney Consulting Services Ltd.



PLAN VIEW
N.T.S.



SECTION A - A
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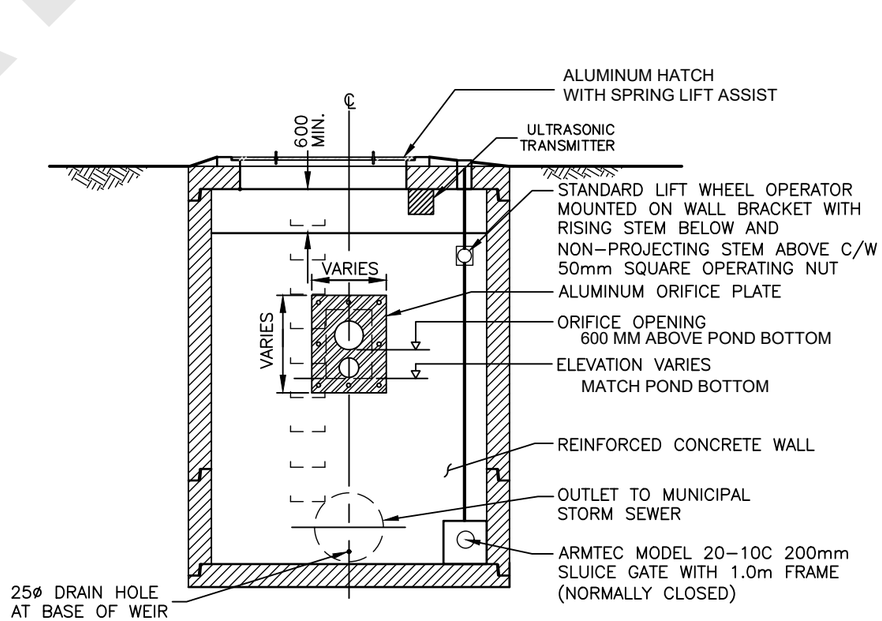

SECTION B - B
N.T.S.

NORTHEAST COMOX

DRY DETENTION POND OUTLET CONTROL STRUCTURE SECTIONS AND DETAILS

Drawing No. SE-15

DATE : Feb 2021

Source: North East Comox Neighbourhood Stormwater Management Plan - PHASE 3 OF 3, March 1, 2018, McElhanney Consulting Services Ltd.