SCHEDULE E

REGULATIONS, STANDARDS AND SPECIFICATIONS FOR THE DESIGN AND CONSTRUCTION OF SANITARY SEWERS

This is Schedule E of the City of
Vernon Subdivision and Development
Servicing Bylaw No. 3843, 2008

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City Clerk

SCHEDULE E – BYLAW NO. 3843

REGULATIONS, STANDARDS AND SPECIFICATIONS FOR THE DESIGN AND CONSTRUCTION OF SANITARY SEWERS

1.0 GENERAL DESIGN

Sanitary sewer systems shall be designed in accordance with the requirements of this schedule and the latest version of the Master Municipal Construction Documents. City of Vernon standards and specifications shall take precedent over the MMCD. Standards and specifications contained in this Schedule shall apply to all sanitary sewer installations constructed in the City of Vernon. All standards not specifically covered in these standards and MMCD standards shall be as directed by the City Engineer.

Where a sanitary sewage collection and disposal system is required, sanitary sewer facilities including, but not limited to, gravity sewer mains, pump stations, force mains, odour control, manholes, service connections and related appurtenances shall be provided. All sewer system components must be installed in the City roadway unless prior approval is given by the City Engineer. Where a statutory right-of-way is required to accommodate the installation of a sanitary sewer system, the location of statutory right-of-way is to be determined by pre-design engineering of the ultimate sewer catchment area at the owners cost.

Where sanitary sewer facilities are not required, rights-of-way may be required to be provided by the Applicant to allow for the eventual installation of this facility. Such rights-of-way shall be registered in favour of the City of Vernon at the Applicant's expense.

Where a subdivision is located in a zone where on-site disposal is permitted, all lots shall be provided with a dry sanitary sewer service gravity connection installed from the property line to building envelope to facilitate connection of the individual service lines to a future sanitary sewer system.

Sanitary Sewer Lift Stations shall conform with this schedule and generally follow the Lift Station Design and Construction Guidelines as outlined in Section 8.0 of this Schedule and drawings 400-5 and 400-6 of Schedule O of this bylaw.

Comprehensive odour control analysis will be required for all sanitary sewer facilities where odour potential exists.

2.0 ENGINEERING DRAWINGS

Complete engineering drawings showing detailed design of all works shall be submitted to the City Engineer for approval prior to construction. No construction shall commence until the drawings have received approval of the City Engineer.

Engineering drawings shall show alignment and size of pipes, proposed grades, distances between manholes, manhole invert elevations, existing ground line and proposed final ground line over pipe, location of all service connections to the property line, all easements, lift stations, force mains, odour control systems, pipe bedding requirements, hydraulic grade lines for interim and ultimate flow conditions and all other details which may be required by the City Engineer, MMCD and by other schedules of this bylaw.

3.0 DESIGN CRITERIA

3.1 Pipe Capacity

Sanitary sewer facilities shall be designed to provide sufficient capacity to carry the required quantity of sewage resulting from the ultimate contributing area, as determined by the owners professional engineer, and approved by the City Engineer.

3.2 Pipe Flow Calculations

Gravity sewers are to be designed using Mannings formula with a roughness coefficient of 0.011 for PVC pipe and 0.013 for concrete pipe. Roughness value for all other pipe materials shall be per manufacturers recommendation and as approved by the City Engineer.

Sewer Force mains to be designed per section 7.5 of this schedule.

3.3 Design Flow

Sewage design flows shall be based on the OCP equivalent population of the ultimate contributing area as determined by the owners professional engineer and approved by the City Engineer. The minimum per capita flow is to be 360 liters per day unless otherwise approved by the City Engineer. Sanitary sewer system modeling may be required, at the owners cost and discretion of the City Engineer to validate design flows and ultimate catchment areas.

3.4 Peak Factor

Harman peaking factor shall be applied to the average dry weather flow (ADWF) with a 25% reduction applied to new residential areas not subject to inflow and infiltration to determine the peak dry weather flow (PDWF).

3.5 Inflow and Infiltration

An inflow and infiltration rate of 5,000 liters per hectare per day shall be added to the PDWF to determine the peak wet weather flow (PWWF) also referred to as the design flow. In areas where the water table is present in the pipe zone, an inflow and infiltration rate of 8,000 liters per hectare per day shall be used.

3.6 Minimum Pipe Size

The minimum pipe size for all single family residential zoned lands shall be 200mm. Where no future extensions will occur, the terminal section of pipe may be reduced to 150mm to provide increased flushing velocity. In no case shall the reduced size terminal section of pipe exceed the maximum allowable distance between manholes. No reduction of pipe size shall be made downstream, irrespective of pipe grade, without prior approval of the City Engineer.

The minimum pipe size for all industrial, commercial or institutional zoned lands shall be 250mm. Where no future extensions will occur, the terminal section of pipe may be reduced to 200mm to provide increased flushing velocity. No reduction of pipe size shall be made downstream, irrespective of pipe grade without prior approval of the City Engineer.

Pipe sizes shall be selected such that sewers flow a maximum of ¾ full at design flow. In the case where pipes are designed to flow less than ¾ full at design flow, the system design shall ensure that minimum flushing velocities are achieved for both the ultimate and existing design conditions.

3.7 Minimum Velocity and Design Grade

Minimum flushing velocity at design flow shall be 0.6 meters per second for all pipes, including terminal pipe sections. Where a pipe size reduction has been made to increase velocities in terminal pipe sections, minimum grade for such sections shall be 1%.

3.8 Depth of Cover

The depth of the main shall be sufficient to provide all service connection piping with a minimum cover of 1.5 meters to top of the service piping anywhere within the finished right-of-way. Sanitary mains shall be designed such that gravity sanitary sewer drainage is possible from the full basement level of all lots. In no instance shall the depth of cover over the crown of the main be less than 1.5 meters or greater than 3.0 meters. Where depth of cover is expected to exceed

3.0 meters, other design options are to be considered, such as pumped connections. The use of pumped connections, or other options, must be approved by the City Engineer.

3.9 Manholes

Manholes shall be installed at a maximum spacing of 100 meters for all curvilinear sewers and in sewers where grade exceeds 5% and a maximum spacing of 150 meters for all others. In addition, manholes shall also be installed at the following locations:

- at all changes in grade and/or alignment (for non curvilinear sewers);
- at all changes in pipe size;
- at all pipe junctions and intersections;
- at the beginning and end of pipe curvature for curvilinear sewers;
- at the terminal end of a sewer pipe.

Inside drop type manholes shall only be used with prior approval of the City Engineer. Maximum drop on all outside drop or outside ramp type manholes to be 3 meters.

The Design Engineer must consider hydraulic losses across manholes to ensure manholes do not cause a loss in hydraulic capacity of the system. The hydraulic drop through a manhole must be representative of the pipe grades and hydraulic conditions and shall be no less than a 30mm drop where the inlet pipe is at 180 degrees to the outlet pipe and a minimum drop of 60mm for all other conditions.

All manholes not in asphalt roadway must have minimum 0.5 meter asphalt or concrete apron around the frame and cover.

3.10 Service Connections

All lots shall be serviced by a single sanitary sewer service connection installed directly into a sanitary sewer collector pipe along the lot frontage or utility right-of-way per this bylaw.

A single sanitary sewer service shall be installed to each lot created by subdivision and to any other existing or possible future lot which can be serviced from mains installed by or for the subdivision.

Sewer services shall be installed, wherever possible, in a common trench with the water and storm services.

The terminal end of sewer services installed in hillside development areas shall be the building envelope and such installation shall occur concurrent with the

installation of the sewer collector pipe and prior to installation of shallow utilities, curb and gutter, sidewalks and any other surface works.

All sewer services shall include an inspection chamber per MMCD standard drawing S9 installation in driveway and road. Where an inspection chamber is

installed off the driveway or traveled road surface, installation per MMCD standard drawing S9 is required and the concrete pull box and lid shall be installed flush to the finished landscape grade.

Service connections into curvilinear sewer shall be made only with wye type fittings. No insert- a Ts or saddles permitted without prior approval of the City Engineer.

Service connections are only permitted in a utility right-of-way with prior approval of the City Engineer and only by way of manhole type connections.

4.0 SEWER MAIN LOCATION

4.1 General

Sanitary sewer mains shall be installed within the roadway as shown on the applicable Standard Drawings of this bylaw. All lots shall be serviced directly from a collector pipe in the roadway. Pumped sewer service connections shall be required, where applicable, to ensure the maximum depth of cover provided for under this bylaw is not exceeded.

Rear yard sewers or sewer in easements are not permitted without prior approval of the City Engineer.

4.2 Rights-of-way

Where a sewer main is required to cross private land(s), the sewer main shall be located in a utility right-of-way registered in favour of the City of Vernon and having a width of not less than 6.0 meters for a single pipe. The City Engineer may require a utility right of way wider than 6.0 meters in the case where utilities in addition to sanitary sewer will be placed in the same right-of-way, or where the depth of the sewer main requires a wider easement to accommodate future excavations based on WCB regulations for side slopes (normally 0.75H:1.00V). A cross-section of the proposed trench must be shown, indicating the minimum safe elevation of adjacent building footings based on a safe angle of repose from the limits of the excavation.

Where a sewer pipe is located within a statutory right-of-way, and the City Engineer requires vehicular access for utility maintenance purposes, the owner shall be required to provide a minimum 3.5 meter wide smooth graded gravel

surface, secured with gate and chain, from a Municipal road. The access road shall be designed to adequately support the maintenance vehicles for which the

access is intended and shall have a maximum cross fall of 4% and maximum longitudinal grade of 12%. Road drainage shall be considered such that adequate facilities are provided to limit runoff onto private property and to prevent erosion of the access road.

4.3 Alignment

Sewer mains shall be designed to follow a straight alignment between manholes. Curved alignments shall only be permitted with prior approval of the City Engineer and provided that the minimum pipe grade is 2% and the pipe alignment generally follows the road alignment. Radius of curvature shall be not less than twice the minimum radius recommended by the pipe manufacturer, and shall be achieved by joint deflection only.

5.0 TRUNK CONNECTION

Where sewer collector pipes are designed to connect into trunk pipes, the collector invert elevation shall be designed to connect above the trunk ultimate peak design flow elevation. In cases where the ultimate peak design flow elevation of the trunk sewer is unknown, the owner may be required to model the trunk system, at the owners cost and to the satisfaction of the City Engineer, to determine critical design information.

6.0 CONNECTION TO EXISTING SEWER MAINS

Connection to an existing sewer main shall be done by the City unless otherwise authorized by the City Engineer. The Applicant shall pay all associated costs of the tie in. Details of all work, including materials required, shall be clearly indicated on the design drawings. Application for tie in shall be made a minimum of one week in advance of the proposed work and all materials shall be supplied on site by the applicant.

Connection to existing sanitary sewer mains shall not be made until after sewer lines and services have been certified for use by the City Engineer and final connection to the existing system has been approved by the City Engineer.

All work and costs associated with connection to the existing system shall be the responsibility of the Applicant.

The existing sewer system shall remain separated from the new works by way of plugs installed in the nearest manhole to each connection so that no water or other material enters the existing sewer system. Plugs shall be left in place until final connection and acceptance of the new works by the City. The applicant shall be responsible for ensuring all manhole plugs are removed immediately after City acceptance of the works and prior to intended use. Under no circumstances shall the new system be connected into the existing system without prior approval of the City Engineer. The Applicant shall be charged a minimum of $500.00 for each occurrence that water, sewage or any other material from the new system enters the existing system, plus any additional costs for cleaning the existing sewers.

7.0 SANITARY LIFT STATIONS AND FORCE MAINS

7.1 General

The use of sanitary sewer pump stations shall only be permitted with prior approval of the City Engineer and is to be discouraged due to the high cost of operation, maintenance and future replacement funded by utility customers. Approval shall be contingent on the applicant demonstrating to the satisfaction of the City Engineer that the proposed lift station will not pose an unacceptable cost burden on existing utility ratepayers or the City. A cost benefit analysis shall be provided for all proposed sewer lift stations detailing full life cycle costs and required revenue on an annual

basis to fully fund the proposed works. Sanitary lift stations should normally be located within a right-of-way outside the required road dedication.

These criteria cover both dry well and submersible sewage lift stations. Larger capacity sewage lift stations or lift stations with special design or siting requirements may require additional assessment and review of criteria. Stations with a design flow in excess of 30 l/s or with a design combined horsepower requirement (excluding standby unit) in excess of 50 hp or a structure depth in excess of 8 meter from top to bottom, will require additional review of criteria.

7.2 Pre-design Requirements

7.2.1 General

The professional engineer retained by the Owner to design the Works and Services must attempt to minimize the number of sewage lift stations and thoroughly consider other options to avoid lift stations wherever practical and must obtain approval from the City Engineer prior to locating the lift station.

7.2.2 Report

Prior to commencing detailed design of a lift station, the professional engineer must submit a pre-design report that addresses the design considerations of these criteria. Approval of the pre-design report must be obtained prior to the professional engineer commencing detailed design. The professional engineer must refer to Section 8.0 of this schedule “Design and Construction Guidelines for Sewage Lift Stations and Force Mains”, and other sections as applicable, in preparing the pre-design report for approval. Odour control analysis must be included in the pre-design report and shall include expected odour levels/compounds, odour control options and system recommendations. Complete life cycle cost analysis of lift station and all associated piping and components shall be included in the pre design report. The analysis shall include initial capital cost, operation and maintenance costs, replacement costs, annual revenue required to completely fund the infrastructure and any other items required by the City Engineer. In addition to financial information, the estimated useful life of all infrastructure shall also be provided.

7.3 Location and Layout

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

1. The lift station must be designed to handle the ultimate flows of the designated catchment.
2. Type of station and impact on neighbours.
3. Construction dewatering requirements.
4. Access for construction.
5. Access for maintenance.
6. Aesthetics, noise, odour control and landscaping requirements.

7. Security against vandalism and theft.
8. Flood elevations.
9. Station uplift based on maximum thrust conditions.
10. Proximity of receiving sewers, water mains, and adequate power supply.
11. Minimizing energy requirement.
12. Standby power and its compatibility.
13. Soils. Sub-surface investigations must be undertaken prior to site approval.
14. Convenience of operation and maintenance.
15. Safety for operators and public.
16. Capital costs and operation and maintenance costs.

7.4 Design Requirements

7.4.1 Pumps

Pumps must be:

1. soft start;
2. capable of passing solids up to 60 mm in size;
3. equipped with hour meters;
4. easily removed for maintenance;
   operate with a motor running at 1750 RPM;
5. operate on a 347/600 volt electrical source (pump motors 5 hp and greater are to be 600 volt 3 phase type);
6. able to operate alternately and independently of each other;
7. able to meet maximum flow condition with one pump in failure mode;
8. Designed so that each motor does not cycle more than 7 times in one hour under normal operating conditions. For example, in a duplex pump station that is designed to alternate the pump starts, each motor can have a maximum of 7 starts in an hour which could result in a total of 14 motor starts per hour for this station.

7.4.2 Auxiliary Equipment

All auxiliary equipment (valves, check valves, air valves etc.) and electrical control panels must be mounted in suitable above ground kiosks or building adjacent to the station. The kiosks must be located a minimum of 3.0 meters from the station lid. – Refer to Guidelines Document for typical station layout.

Check valves must be ball lift check valves.

The entrances to all stations must be waterproof and be provided with a lock approved by the City Engineer. The access must be a minimum of 900 mm x 900 mm in size. The access hatch shall have:

1. an aluminum ¼" tread place;
2. a perimeter drain;
3. a perimeter sealing gasket;
4. a slam lock with an aluminum removable sealing pug and opening tool;

5. a flush lift handle;
6. a gas spring assist cylinder;
7. a 90 degree hold open arm;
8. a flush fitting padlock tang.

7.4.3 General Design

1. The hatch must be reinforced for 1465 kgs/m² (300 lbs./sq/ft.). All fasteners to be made of 316 stainless steel.
2. The entrance hatch must be located 600 mm above ground level where feasible.
3. Internal ladder or platform is not required.
4. All equipment must be CSA approved and have at least a one year guarantee for parts and labour. The professional engineer is to provide to the Municipality three sets of Operating and Maintenance Manuals. All pumps must be factory tested prior to installation.
5. A gate valve is required on the influent line and on each pump discharge. The influent valve must be outside the station and be complete with square operating nut and Nelson Box. Pump discharge valves to be located in the auxiliary equipment kiosk.
6. Connection of lift station effluent pipe to force main to be made by way of robar or equivalent type connection. Flanged connections not acceptable.
7. Provision(s) must be made for standby pumping from an external source. An adaptor flange ("Kamlock") complete with a 150mm diameter quick coupling and lockable cap will be required.
8. The area around the station and all associated equipment or building must be asphalted. The size of the area to be determined by the requirements for maintenance. Consideration must be given to providing adequate drainage facilities for the lift station site. The surfaces of all steel components and fiberglass stations must receive at least two coats of two component white epoxy enamel.
9. The wet well bottom must be benched to direct all solids into the pump suction. The influent line must be located tangent to the wet well to encourage scouring of the wet well. Lift stations with a wet well diameter of 2.44 meters or greater shall be equipped with a mixer pump in the wet well.
10. Minimum storage between the high level alarm and the start of overflow under the more critical of:
    - Minimum 1 hour in wet well at average wet weather flow;
    - Minimum 1 hour in wet well and influent pipes at peak wet weather flow.
11. Station to have a magnetic flow meter unless otherwise approved.
12. Station to allow removal of pumps using hoist truck with 1.8 m (6') boom.
13. Station perimeter to be secured with 2.1 meter high black chain link perimeter fencing.
14. Gates to be black chain link cantilever roll type, minimum 4.0 meters wide, to suit paved lift station access road.
15. Landscaping per City of Vernon Landscape Standards Bylaw to be provided around lift station perimeter. All landscaping to employ xeriscape principles

and be designed to provide an effective visual barrier between the lift station site and surrounding areas.

16. Noise control may be required when noise levels exceed 65 dB at property line or 20 meters away, whichever is closer.
17. Odor control may be required when criteria in Section 9.0 of this bylaw is exceeded.
18. Minimum barrel size must be 1800 mm (6') in diameter.
19. Paved vehicular access to be provided to sewage lift stations. The minimum standard shall be as for a rural highway, except with minimum 6.0 meters paved surface with curbing and drainage provisions as may be required by the City Engineer.
20. All doors, gates and other access points to be master keyed to City standards.
21. First upstream gravity manhole shall be located immediately outside the lift station compound (or within 5 meters of wet well) off the travelled roadway, in an area where off street vehicle access to the manhole is possible without impeding traffic. No lateral connections at the manhole will be permitted.
22. Motor cables, power cables, etc., must be continuous from within the pump station to within the kiosk unless an adequate exterior pull pit and junction box is installed.
23. Levels to be controlled by ultrasonic level transmitter with emergency high and low level balls (floats).
24. The electrical control kiosk must be designed to contain all control and telemetry equipment on the front panel and all power equipment on the rear panel.
25. All stations require an explosion-proof exhaust fan which can be activated by manual switch, and which meets WCB requirements for ventilation in a confined space.
26. All wiring must be explosion-proof, Class 1, Division 2, and electrical design and installation is subject to the acceptance of the Provincial Safety Inspector. Metal stations must be protected by impressed current cathodic protection.
27. All stations must provide an automatic generator for standby power in case of power failure. Provision for a telemetry system must be included for connection into the Municipality's Telemetry System.
28. An explosion-proof light with protective cover activated by a switch inside the kiosk is to be provided.
29. The station shall be complete with an Uninterruptable Power Supply (UPS) to serve all alarms and controls.
30. The pump control panel must incorporate an operator interface, (Panelmeter or equivalent), and the panel must be complete with a lamp test button.
31. Separate starter enclosures must be provided for each pump.
32. PLC control to be based on City of Vernon standards.
33. Station communication to be provided via dedicated land line telephone connection compliant with the City's telemetry system.
34. An hour meter must be built into the panel for each pump.
35. An amp meter must be provided for each pump.

7.5 Force Mains

In conjunction with sanitary pumping facilities, the following criteria must be noted in the design of force main systems: Design computations for force mains must be made using a ‘C’ factor of 120 (for PVC pipe) and then re-calculating the system curve using a ‘C’ factor of 145 to ensure adequate motor horsepower and pump characteristics. For force main pipe material other than PVC, the 'C' factor shall be per manufacturers recommendations and as approved by the City Engineer.

7.5.1 Velocity

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

7.5.2 Air Relief Valve

An automatic air relief valve must be placed at high points in the force main and other locations as required to prevent air locking. Location of air valve to be such that staff and maintenance vehicle are able to access the air valve off the traveled roadway for maintenance purposes.

7.5.3 Termination

Force mains should enter the gravity sewer system at a point not more than 600 mm above the obvert of the receiving manhole. An inside pipe must be incorporated to transition the force main into the flow channel of the manhole such that turbulence is minimized. If the receiving manhole design does not allow this, then a manhole drop structure in accordance with the standard drawings is required.

7.5.4 Size

The minimum size for force mains is 100 mm diameter unless otherwise approved by the City Engineer.

7.5.5 Materials

With the exception of valves, the material selected for force mains must meet City standards and must adapt to local conditions, such as character of industrial wastes, soil characteristics, exceptionally heavy external loadings, abrasion and similar design considerations. Polyvinyl Chloride (PVC) pressure pipe to AWWA C900 or C905 and High Density Polyethylene (HDPE) pipe to AWWA C906 shall be the preferred pipe type for all force mains. Fittings shall be of similar material to the force main pipe. All other pipe materials shall not be permitted without prior approval of the City Engineer. A tracer wire shall be required for all force mains.

7.5.6 Loads and Transient Pressures

All force mains must be designed to prevent damage from superimposed loads, or from water hammer or column separation phenomena.

8.0 DESIGN & CONSTRUCTION GUIDELINES FOR SEWAGE LIFT STATIONS AND FORCE MAINS

8.1 General

The Criteria of this section are guidelines only. They provide a general outline of plant and products to maintain uniformity in the City and a guide to developers as to what is likely to be approved. Detailed criteria and specific requirements should be obtained from, and reviewed with the City Engineer, prior to design of the facilities. Good engineering design practice shall be used in the design of sanitary sewage lift stations and sewage force mains.

8.2 Design Requirements

Detailed Design shall consider the following topics and items:

8.2.1 Design Hydraulic Requirements

1. The Designer shall provide system head curve calculations using recommended pipe friction coefficients for both new and aged pipe materials, and for pumping discharge flows at Top Water Level (TWL) and Low Water Level (LWL) static conditions. The Designer shall confirm that the pump will be suitable for each flow operating condition and shall identify the pumping unit efficiencies for the various operating conditions.

2. For Total Dynamic Head (TDH) calculations, the professional engineer shall use C=120 (for PVC Pipe) and then recalculate the system curve using a C= 145 to ensure adequate motor horsepower and pump characteristics.

3. System limiting velocities shall be:

Inlet suction pipes,	MINIMUM Velocity = 1.2 m/s MAXIMUM Velocity = 1.5 m/s
Individual pump Discharge pipes,	MAXIMUM Velocity = 3.5 m/s
Common header Discharge pipes,	MAXIMUM Velocity = 3.0 m/s
External Force Main pipe,	MINIMUM Velocity = 1.0 m/s MAXIMUM Velocity = 3.5 m/s

8.2.2 Structural

1. Electrical Kiosk:

   Electrical power distribution and control equipment shall be located in a suitable heavy duty metal kiosk, brick or concrete building to be approved by the City Engineer. Metal kiosks shall be designed with sloping roofs and rain gutters to protect equipment when access doors and panels are open.

2. Wet Well/Valving Vault

   The wet well for submersible type pump lift stations shall be fiberglass.

   The wet well will not require an access ladder or internal platform but all valving and appurtenances (other than the pumps only) must be located in an above ground kiosk or building not less than 3m from the wet well. Standard drawings 400-5 and 400-6 of this bylaw show typical configurations required – one with a kiosk mounted on the wet well tank and one with a kiosk or building.

8.2.3 Mechanical

1. Pumps: Pumps to be Flygt, Myers or pre-approved equal.

2. Submersible pump unit guide bars shall preferably be stainless steel but hot-dipped galvanized steel may be used on some smaller lift stations – confirm with City Engineer for approval.

3. All lift station internal piping will be fiberglass or 304 L stainless steel.

4. Odour Control: Where required, a suitable odour control system shall be provided and be approved by the City Engineer. The type of system will depend on the professional engineers analysis of odour potential. Where applicable and as supported by the professional engineers odour analysis, the SOL-AIR C48L Air Decontamination Unit, or equal, would be acceptable for wet well odour control. Additional odour control may be required to meet the criteria of this schedule.

8.2.4 Electrical – General

1. SCADA – Supervisory Control and Data Acquisition system and appurtenances shall be provided.

2. TWL surface of the sewage shall be monitored by a Milltronics MultiRanger PLUS Ultrasonic transducer system, and appurtenant equipment shall be used to control the sewage levels in the wet well.

3. Emergency (backup) liquid level sensing system comprising an ITT Flygt Model ENM-10 Level Regulator float switch – at High Level Alarm position outside the set-point elevation of the Milltronics MultiRanger PLUS equipment.

4. There shall be a Programmable Logic Controller (PLC) and telemetering system, compatible with the City of Vernon SCADA System, the controller shall be the Allen-Bradley Model 5/03 PLC, or approved later model of PLC.

5. Magnetic flow meter and transmitter, if required, installed in accordance with the precise requirements of the flow meter manufacturer for sufficient upstream and downstream straight pipe lengths from flow disturbance

   fittings, complete with data logger (minimum memory 128 KB, and 1 minute to 1 hour 'adjustable' sampling time, with output suitable for the City standardized SCADA system), confirm manufacturer's recommended number of pipe diameters of straight pipe length. The flow meter shall be sized appropriately for the full range of force main discharge flows.

6. Suitable lighting shall be provided in all areas of the pumping station facilities with a manual switch located inside the electrical kiosk, or as approved by the City Engineer.

7. Pump cables in sump chamber shall be properly secured to minimize wear and tear.

8. All pump cables and connection points shall be accessible to City personnel, in a safe and convenient manner.

9. Standby electric power generator shall be provided. The professional engineer must review full requirements of the electrical power system and controls with the City Engineer. For small stations of less than 5 hp combined power (excluding standby unit) and serving less than 50 lots, standby power may not be required at the sole discretion of the City Engineer, provided adequate emergency storage is provided and a Crouse-Hinds receptacle with reverse contacts and manual transfer switch suitable for connecting emergency electric standby power generator is provided.

10. If a metal kiosk is approved for the pumping facility power and control equipment, the following criteria will apply:

    - Place kiosk on raised concrete pad with proper drainage, minimum 300 mm high.
    - Power wiring and starters shall be in separate compartments from the control panel and control equipment within the kiosk.
    - Provide adequate light – controlled by a manual switch.
    - Provide forced air heating system to prevent condensation – thermostatically controlled, complete with a Hand-Off-Automatic (H-O-A) Selector Switch and ventilation fan.

- The vehicle access area shall have lighting operated under a photo-cell control, complete with a H-L-A selector switch.

11. Standby generators shall be diesel fueled c/w automatic transfer switch and suitably sized for the power demand. The generator shall be housed in a sound attenuated corrosion resistant metal kiosk with swing access lockable doors. The generator shall be mounted on a dual wall sub-base tank capable of providing fuel for a minimum 12 hour, full load run interval.

8.3 Documentation

Before commencement of construction the professional engineer shall provide three sealed sets of mechanical shop drawings and three sealed sets of electrical line diagrams for review by the City Engineer. Two sealed copies of design calculations shall be provided for documentation.

Before acceptance of the completed sanitary sewage lift station facility by the City, the professional engineer shall provide three copies of an Operation and Maintenance (O&M) Manual to the City. The O & M Manual shall contain the following:

1. Introduction

- Photographs of the station facility
- Revision diary for update notes
- Station description and location

2. Design Criteria

- Design flows and various stages of development, and catchment area map(s)
- System head curves for different friction coefficients and static conditions
- Pump curves, including the “Modified” pump curve
- Wet well volume and pump unit cycle time
- Hydraulic assumptions, C value, force main plan and profile on reduced drawings (11” x 17” drawings)
- Pump Start and Stop elevations and corresponding wet well volumes
- Descriptions of major mechanical, hydraulic, ventilation, electrical power and electrical control systems.

3. Electrical System

- Electrical power distribution single line diagram and service details
- Programmable Logic Controller (PLC) ladder diagram
- Control telemetry details with all Inputs and Outputs identified
- Wiring diagram(s)
- Any additional instrumentation
- Data recording systems, including programming and retrieval process

4. Suggested Maintenance Program

- Facility and pumping units start-up and shut-down procedures
- Routine and preventive maintenance schedule
- Routine and preventive maintenance diary
- Recommended spare parts and locations of suppliers
- Emergency operating procedures in response to Alarm Conditions

5. Drawings

- Appendix A – Construction Record Drawings on reduced drawings (11" x 17" size format drawings)
- Appendix B – Equipment manufacturer's data and service manuals for major mechanical, electrical and miscellaneous equipment
- Appendix C – Approved shop drawings (Record)
- Appendix D – Laminated wiring diagram(s) and PLC ladder diagrams

The above information shall be provided in suitable sized Sturdy "D" Type, Three (3)-Ring Binders to ensure that manuals do not become easily damaged during use.

Prior to completion of the Operations & Maintenance Manuals, immediately following the commissioning of the pump station facility, the Designer shall submit a Start-Up Report providing: instrument settings, pump capacities, performance testing and related data pertaining to the commissioning of the facility.

9.0 CORROSION AND ODOUR CRITERIA

1. All new sewage facilities to be assessed for odour potential and mitigation with results presented in pre-design report per section 7.2.2 of this bylaw. The Design Engineer shall review potential need for odour control and make recommendations on control options. Where possible, system design shall be optimized to reduce potential for generation of odorous compounds and limit odour control facilities. Odour analysis may be required for lift stations and force mains under both interim and ultimate flow conditions as required by the City Engineer.
2. Lift station and force-main design to include complete odour control systems to meet the odour criteria and dissolved sulfide maximum concentration of this bylaw.
3. Dissolved sulphide maximum limit at any point in the system is to be 0.5 mg/l.
4. Odour Criteria;
   i) at 10 m from any gravity main, force main, manhole and lift station or other sewer facility (summer conditions, winds between 2-10 km/h), 1.0 odour units.
   ii) where sewer facilities are close to houses, parks or walkways, 0.0 odour units.

10.0 MATERIALS

10.1 Pipe and Fittings

Pipe for gravity sewer collectors and trunk mains shall be reinforced Concrete pipe or Polyvinyl Chloride pipe only.

Sewer service pipe and fittings shall be of similar material to the mainline sewer.

Sanitary sewer force mains shall be Polyvinyl Chloride (PVC) pressure pipe to AWWA C900 or C905 or High Density Polyethylene (HDPE) to AWWA C906 only. All force main pipe to be factory coloured and marked for non potable use.

Other types of pipe shall be used only with the prior approval of the City Engineer.

10.2 Service Connections

All service connections shall be made using approved pvc wye type fittings only. All other connections to be used only with prior approval of the City Engineer.

10.3 Manholes

Manhole bases to be pre benched. Bases to be made watertight with adjoining manhole section by use of rubber gasket per ASTM C443. No internal parging is necessary unless directed by the Developers Engineer and accepted by the City Engineer. All pre-cast bases are to include a minimum of one length of pipe stubbed out from the manhole for future mains c/w end cap. All bases to include a knockout for future connections where connections are not designed or expected but can be reasonably anticipated with future development or zoning.

The Design Engineer must consider hydraulic losses across manholes to ensure manholes do not cause a loss in hydraulic capacity of the system. The hydraulic drop through a manhole must be representative of the pipe grades and hydraulic conditions and shall be no less than a 30mm drop where the inlet pipe is at 180 degrees to the outlet pipe and a minimum drop of 60mm for all other conditions.

10.4 Manholes Frames and Covers

Manhole frame and covers shall be Dobney C-18 or approved equal factory marked City of Vernon Sanitary. Bearing faces of the cover to frame shall be machined for a non-rocking fit.

10.5 Bedding Material

All pipe bedding shall be sand or crushed rock free of clay lumps, organic and other deleterious material. Gradation shall conform to the gradation limits set out on Standard Drawings No. 100-14 and 100-15.

10.6 Backfill Material in Pipe Zone

Backfill material in the pipe zone shall be sand or crushed rock free of clay lumps, organic and deleterious material. Gradation shall conform to the gradation limits set out or Standard Drawings No. 100-14 and 100-15.

10.7 Pipe Casings

Where sewer installation requires non open cut methods of construction, a pipe casing will be required. The sewer carrier pipe shall be supported at the correct line and grade within the casing pipe annular space by way of approved mechanical pipe spacers. The annular space between the sewer carrier pipe and casing pipe shall be filled with sand or other material, as approved by the City Engineer, to prevent movement of the sewer carrier pipe. The casing pipe shall be sealed at both ends with approved mechanical device or joint filler as directed by the owners engineer and approved by the City Engineer.

11.0 TESTING

Upon request, the City shall be provided with copies of all test results and reports verifying, to the satisfaction of the City Engineer, that all works have been constructed according to the approved design and that the required specifications have been met. All video inspection reports shall be provided to the City a minimum of one week in advance of paving works being carried out. Frequency of testing for all granular materials and asphalt shall be at the rate of one test per lift for every 75 meters of trench length and one test per lift for any trench less than 75 meters.

12.0 STANDARD DRAWINGS

The following City of Vernon Standard Drawings shall form part of this Schedule:

Drawing No.	Drawing Description
100-14	Gradation Limits - 19 mm Minus Crushed Gravel
100-15	Gradation Limits - Sand Bedding Material
400-3	Sanitary and Storm Sewer Manhole Requirements
400-5	Sanitary Lift Station Recommended Layout Combined Valve Kiosk
400-6	Sewer Lift Station Alternate Layout