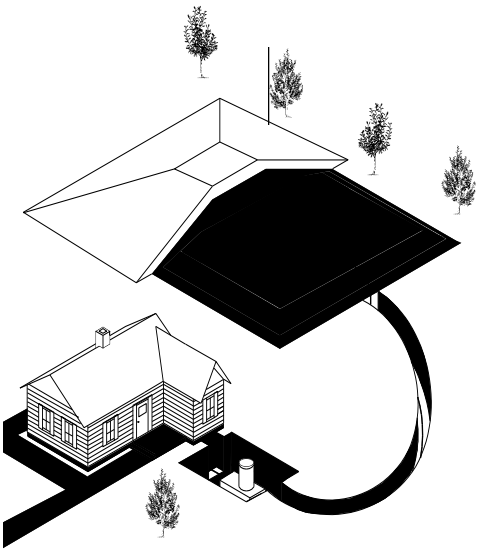

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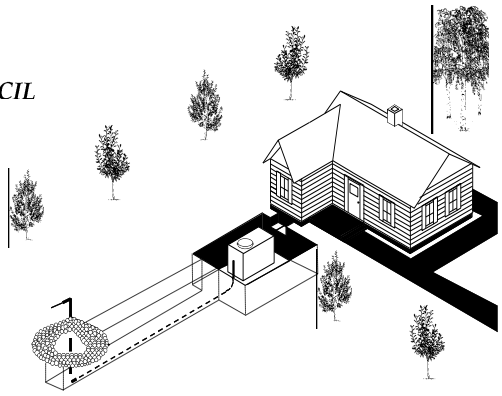

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Private Sewage Systems
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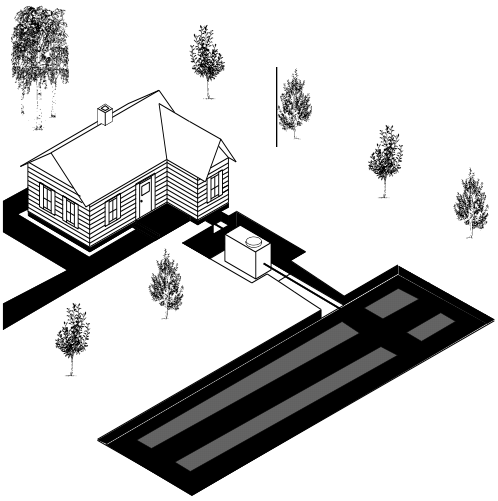

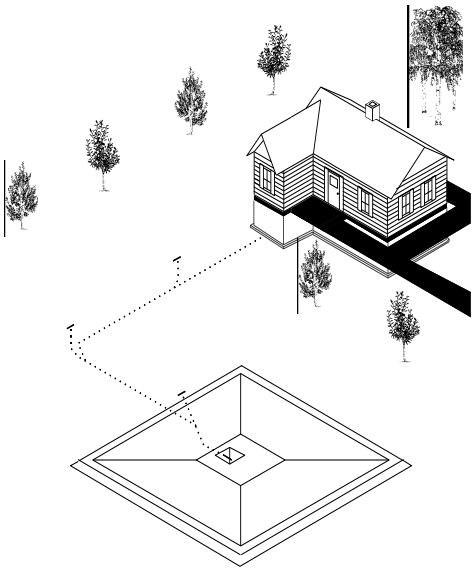

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Alberta Private Sewage System Standard of Practice 1999

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SAFETY CODES COUNCIL

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Safety Codes Council - Plumbing Technical Council

The Safety Codes Council is a statutory corporation that formulates and oversees the development and administration of safety codes and standards in Alberta. The Plumbing Technical Council is one of nine technical councils forming the Safety Codes Council and deals with all matters related to plumbing. Based upon public review, the Plumbing Technical Council establishes the content of the Private Sewage Systems Standard of Practice and proposes its adoption to the Minister of Labour by an Alberta Regulation, the *Private Sewage Disposal Regulation*.

Technical Task Group

This Standard of Practice is developed by a Plumbing Technical Council Task Group made up of industry stakeholders. Task Group Members represent the following stakeholder groups:

A) Association of Alberta Municipal Districts & Counties

B) Alberta Urban Municipalities Association

C) Installation Contractors

D) Plumbing Technical Council

E) Manufacturers of sewage disposal equipment

F) Association of Professional Engineers, Geologists, and Geophysicists of Alberta

G) Alberta Health

H) Alberta Labour

I) Private Sewage Inspection Agencies

J) Alberta Environmental Protection

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Table of Contents

List of Figures

Introduction

This Standard of Practice identifies the objectives of Private Sewage Systems and sets out the minimum requirements for health, safety and structural sufficiency for Private Sewage Systems. Sewage contains chemical and biological constituents that can cause environmental and public health problems or nuisances if the waste is not safely treated and disposed. Of particular importance is the treatment and safe disposal of sewage to prevent the contamination of food or water and to prevent the incidence and transmission of disease.

In order to achieve this objective, the Standard of Practice is only one component of an administrative system that must also include enforcement elements to ensure proper design and construction of systems. The maintenance of systems is necessary to continually meet the original objectives of the system designed to this Standard of Practice.

This Standard of Practice sets out requirements for suitable solutions that will satisfy the objectives. The application of requirements set out in the Standard of Practice may be considered an appropriate solution if the performance of the system meets the objectives. The use of this Standard is in no way intended to inhibit the development and testing of new and innovative products and procedures.

Private Sewage Systems using methods not described in this Standard of Practice but consistent with its intent, may be designed for specific applications by a Professional Engineer who is licensed to practice in the Province of Alberta and has related experience. Private sewage systems may also follow other published guidelines or standards of practice acceptable to the Technical Administrator.

Notes

Alberta Private Sewage Systems Standard of Practice 1999

1 Scope, Objectives, and Interpretation

1.1. Scope

1.1.1. This Standard of Practice sets out design standards, installation standards and material requirements for *on-site private sewage systems* handling less than 25 m^3 (5,500 Imperial gallons) expected *sewage* volume per day, and which include

(a) *holding tanks* and *septic tanks,*
(b) *packaged sewage treatment plants,*
(c) *disposal fields,*
(d) *treatment mounds,*
(e) *open discharge systems,*
(f) *sewage* or *effluent lagoons,* and
(g) *sand filters.*

1.2. Objectives

1.2.1. The objective of a *private sewage system* designed and installed in accordance with this Standard is to treat and dispose of sewage and effluent so that the sewage or effluent

(a) does not present a risk to public health, and
(b) does not cause degradation of the environment.

1.3. Interpretation

1.3.1. Intent statements, notes, and warning statements are not intended as enforceable statements but are included to provide additional information or an explanation regarding specific requirements.

1.3.2. This Standard and standards referenced herein do not make or imply any assurance or guarantee with respect to life expectancy, durability or performance of equipment and materials referenced herein.

1.3.3. Metric units of measure are the official measurement used in this Standard with approximate Imperial equivalents provided in brackets for user convenience.

1.3.4. Words italicized in this Standard are defined in Section 2.

1.3.5. The numbering system in this Standard uses this format

5	Section,
5.1.	Subsection,
5.1.1.	Article,
5.1.1.(1)	Sentence,
5.1.1.(1)(c)	Clause,
5.1.1.(1)(c)(i)	Subclause.

1.3.6. Sections 2 to 11 are each divided into three subsections dealing with

(a) design standards,
(b) installation standards, and
(c) requirements for materials.

2 Definitions and Abbreviations

2.1. Definitions

2.1.1. Definitions not listed.

Definitions or words and phrases used in this Standard of Practice and not included in the list of definitions, shall have the meanings that are commonly assigned to them in the context in which they are used in this Standard of Practice, taking into account the specialized use of terms by the trades and professions to which the terminology applies.

2.1.2. Italicized words and terms in this Standard of Practice shall have the following meanings:

Administrator means an *Administrator* appointed pursuant to Section 14 of the Safety Codes Act.

Aquifer means any porous water-bearing geologic formation capable of yielding a supply of water.

Berm means the raised area as in a *treatment mound, a sand filter* or around a *lagoon.*

Biochemical Oxygen Demand or BOD_5 means the concentration of oxygen (expressed as mg/l) utilized by micro organisms in the oxidation of organic matter during a 5-day period at a temperature of 20EC (68EF).

Building means any structure used or intended for supporting or sheltering any use or occupancy.

Building Drain means the horizontal piping including any vertical offset that conducts *sewage,* clear-water waste or storm water in a *building* to a *building sewer.*

Building Sewer means a pipe connected to a *building drain* starting 1 m (3.25 ft.) outside a wall of a *building* and that leads to a public sewer or *private sewage system.*

Certified means tested by a nationally recognized testing agency and *Certified* as conforming to a National Standard of Canada or other Standard recognized by the *Administrator*.

Diameter, unless otherwise indicated, means the nominal *diameter* by which a pipe, fitting, trap or other item is commercially designated.

Disposal Field means a system of *effluent* treatment and disposal by distributing *effluent* within trenches containing void spaces that are covered with soil and includes the following types

(a) a ***conventional disposal field*** means a system of *effluent* treatment and disposal utilizing perforated piping laid in a bed of gravel in trenches for distributing *effluent* within the trenches,

(b) a ***chamber system disposal field*** means a system of *effluent* treatment and disposal using preformed structures to provide a void space for storage and movement of *effluent,* and an interface with the exposed infiltrative surface of the soil, and

(c) a ***gravel substitute disposal field*** means a *conventional disposal field,* in which the gravel is replaced with an alternate media having characteristics that will provide void space and performance similar to gravel.

Distribution Header means a non-perforated pipe connected to an *effluent line* or an *effluent sewer* which distributes *effluent* to *distribution laterals, weeping lateral pipes* or *weeping lateral trench*es.

Distribution Lateral Pipe means a perforated pressurized pipe used to distribute effluent throughout the entire length of a weeping lateral trench or over a surface area in a sand filter or treatment mound.

Drain Media (as used in a *sand filter*) means clean washed gravel, clean crushed rock, or other media for distributing *effluent.*

Dwelling or ***Dwelling Unit*** means a suite operated as a housekeeping unit used, or intended to be used, as a domicile by one or more persons and usually contains cooking, eating, living, sleeping and sanitary facilities.

DWV Pipe means the pipe use for drain, waste, and vent purposes.

Effluent means the discharge from any on-site *sewage* treatment component.

Effluent Line means piping for the flow of *effluent* by mechanical forces.

Effluent Sewer means piping for the flow of *effluent* through the action of gravity.

Field Header means a main *weeping lateral pipe* that also distributes *effluent* to other *weeping lateral pipes* in a level disposal field.

Filter Fabric means a synthetic woven or spun-bonded sheet material used to impede or prevent the movement of sand, silt and clay into the spaces between larger media but does not impede the movement of air or water.

Fines means silt or smaller soil particles which would pass through a 200 sieve, or are less than 80 microns in particle size.

Grade means the gradient, slope, or rate of ascent or descent.

Grain or Particle Size Analysis means establishing the percentage of sand, silt or clay particles in a soil sample by means of a standard hydrometer method.

Holding Tank means a tank designed to retain *sewage* or *effluent* until transferred into mobile equipment for disposal elsewhere.

Lagoon means a shallow artificial pond for the stabilization of *sewage* or *effluent.*

Mottling means a soil zone of chemical oxidation and reduction activity, appearing as splotchy patches of red, brown, orange or grey in the soil, that may indicate the presence of a *water table.*

Nominally Level means level, so as to not affect the performance of the system.

On-site means on the *property.*

Open Discharge System means a system designed to discharge *effluent* to the ground surface to accomplish evaporation and absorption of the *effluent* into the soil as a method of disposal.

Packaged Sewage Treatment Plant means a unit, which complies with the National Sanitation Foundation International Standard for Wastewater Technology, NSF-40 Standard, Residential Wastewater Treatment Systems, Class 1 or other Standard recognized by an *Administrator.*

Percolation Test means a test performed to determine a rate at which soil will absorb water.

Potable means safe for human consumption.

Pressure Head means the pressure existing in a fluid expressed as the height of a column of water that would exert an equal pressure.

Private Sewage System means a system for the *on-site* treatment and/or disposal of *sewage* and includes all components downstream of a point starting at 1800 mm (6 ft.) or less, upstream of any *septic tank, packaged sewage treatment plant, sewage holding tank* or the *berm* of a sewage *lagoon* but does not include a *building drain.*

Property means the land described in the Certificate of Title issued under the Land Titles Act.

Residential Strength Sewage means *sewage* which has a BOD_5 of less than 300 mg/l, *T.S.S.* of less than 350 mg/l, and oil and grease content of less than 25 mg/l.

Residential Strength Effluent means *effluent* which has a BOD_5 of less than 230 mg/l, *T.S.S.* of less than 150 mg/l, and oil and grease content of less than 25 mg/l.

Sand (when referring to a treatment or disposal component) means a soil texture composed of soil particulate defined for use in the component.

Sand Filter means a component of a *private sewage system* designed to treat *effluent* from a *septic tank* or *packaged sewage treatment plant*, by filtering the *effluent* through a *sand* media on an intermittent basis.

Sand Filter Media means the granular filter media used in the construction of a *sand filter.*

Sand Filter Surface Area means the area of the level plane section of the *sand filter media* in contact with the *drain media* containing the pressurized distribution piping.

Sand Layer (when referring to a treatment mound) means the required 300 mm (1 ft.) layer of sand that will receive the effluent from a gravel bed or chambers above the sand layer.

Saturation Percentage means the moisture percentage of a saturated soil paste, expressed on a dry weight basis.

Septic Tank means a digestion chamber

(a) in which *sewage* is received and retained, and
(b) from which the *effluent* is discharged.

Serial Distribution means a *disposal field* design where discharged *effluent* is forced to travel through one weeping lateral trench to get to another weeping lateral trench.

Sewage means

(a) human excreta, or
(b) the water-carried wastes from drinking, bathing, laundering, or food processing.

Sewage Effluent Tank means any tank installed upstream of a *packaged sewage treatment plant* (commonly referred to as a trash tank) designed to retain or treat *sewage* prior to treatment in the *packaged treatment plant* or any tank used downstream of a *septic tank* or *packaged sewage plant* which receives *effluent* (commonly referred to as an *effluent* chamber).

Shore means the edge of a body of water and includes the land adjacent to a body of water that has been covered so long by water as to wrest it from vegetation or as to mark a distinct character on the vegetation where it extends into the water or on the soil itself.

Size unless otherwise indicated means the nominal size by which a pipe, fitting, trap or other item is commercially designated.

Sodium Adsorption Ratio or S.A.R. means a ratio for soil extracts and waters used to express the relative activity of Sodium ions in exchange reactions with the soil.

Soil Texture Classification means a classification of soil set out in Table 7A.1.5. having a soil composition determined by *Grain or Particle Size Analysis.*

Storm Water means water discharged from a surface as a result of rainfall or snowfall.

Subsoil Drainage Pipe means a piping system that is installed underground to intercept and convey subsurface water.

Technical Administrator means an *Administrator* appointed pursuant to Section 14 of the Safety Codes Act.

Total Suspended Solids or T.S.S. means the quantity of solids (expressed as mg/l) which can be readily removed from a well mixed sample with standard laboratory filtering procedures.

Treatment Mound means a system where the *effluent* treatment area includes a bed of *sand* and is built above *grade* to overcome limits imposed by proximity to *water table* or bed rock, or by highly permeable or impermeable soils.

Underdrain Media (as used in a *sand filter*) means that material placed under the *sand filter media* in a *sand filter and is of a size to support the sand*.

Underdrain Piping means piping placed under a *sand filter* in the underdrain or *drain media* to collect the *effluent* that has traveled through the *sand filter*.

Vertical Separation means the depth of unsaturated soil between the bottom of an *effluent* disposal component and a limiting layer such as a *water table* or impervious layer of rock or soil.

Water Course means

(a) a river, stream, lake, creek, swamp, marsh or other natural body of water marked by the shore, or

(b) a canal, reservoir or other manmade surface feature intended to contain water for a specified use, whether it contains or conveys water continuously or intermittently.

Water Source means a manmade or natural source of *potable* water.

Note: A cistern is also considered to be a water source when buried in the earth. A free standing tank would not have to meet minimum distance requirements from disposal components.

Water Table means the highest elevation in the soil where all voids are filled with water, as evidenced by the presence of water, soil *mottling*, or other indicators.

Weeping Lateral Pipe means the perforated pipe used to distribute *effluent* by gravity within a *disposal field* trench.

Weeping Lateral Trench means a trench in a *disposal field* that receives *effluent* and provides an infiltrative soil surface.

Working Capacity means that part of the septic tank in which the liquid volume of *sewage* that will remain in the septic chamber when the tank is properly installed and is in normal use, but does not include the air space, siphon chamber, pumping chamber or *effluent* chamber.

2.2. Abbreviations

2.2.1. Abbreviations in this Standard have the following meaning

ABS	..... acrylonitrile-butadiene-styrene	m	..... metre(s)
BOD_5	..... Biochemical Oxygen Demand	mm	..... millimetre(s)
		µm	..... micrometre(s)
cm^2	..... square centimetre(s)	m^2	..... square metre(s)
°	..... degree(s)	min.	..... minute(s)
°C	..... degree(s) Celsius	mg/L	..... milligrams per litre
CSA	..... Canadian Standards Association	mm	..... millimetre(s)
		No.	..... number(s)
dia.	..... diameter	NSF	..... National Sanitation Foundation
DWV	..... drain, waste and vent		
ft.	..... foot (feet)	NPS	..... nominal pipe size
gpm	..... gallons per minute	PE	..... polyethylene
gal.	..... gallons	PVC	..... poly (vinyl chloride)
Imp.	..... Imperial (gallons)	psi	..... pounds per sq. inch (pressure)
in.	..... inch(es)		
kPa	..... kilopascal(s)	sq.	..... square
L	..... litre(s)	temp.	..... temperature
L/m	..... Litres per minute	TSS	..... Total Suspended Solids
		US	..... United States (liquid gallon)

3 General

3.1. Design Standards

3.1.1. A *private sewage system* shall perform as intended in its original design parameters.

3.1.2. The owner of a *private sewage system* shall ensure the system

(a) is maintained,

(b) is operated within the design parameters of the system, and

(c) effectively treats and disposes of the *sewage* and *effluent*.

3.1.3. Except for a *sewage lagoon* or a *sewage holding tank*, a *private sewage system* shall include an *effluent* chamber and a method to supply *effluent* to an *effluent* disposal component, in a unit volume per flush, adequate to provide distribution of *effluent* throughout the *effluent* disposal system.

Intent: *The system should discharge effluent intermittently to an effluent disposal system with sufficient volume to encourage distribution of effluent throughout the system and to reduce the incidence of freezing problems that are inherent to "Trickle Type" systems. Required volumes are determined by the effluent treatment and disposal system size and the method of distribution. Refer to Articles 7A.1.6., 7A.1.7., 8.1.6., and 9.1.11.*

3.1.4. Substances and waste water that could adversely affect the operation of the *private sewage system* shall not be put into the system and include but are not limited to the following

(a) *storm water*,
(b) surface water,
(c) abattoir waste,
(d) subsurface seepage water,
(e) waste water from a hot tub, spa or hydro massage bath exceeding a 2-person capacity,
(f) wastes from a swimming pool,
(g) commercial or industrial process wastes,
(h) waste from a water filter or other commercial water treatment device,
(i) wastes from an iron filter, or
(j) other wastes not considered in the design of the system.

Warning: *The use of Sodium salts in a water softener may be harmful to a sewage disposal system. The increased Sodium levels in the water can reduce the effectiveness of the septic tank or other means of treatment and disposal used in a system.*

Sodium occurring naturally in the water or introduced by a water softener using Sodium salts as a regeneration agent, may affect the ability of the soil to absorb the effluent. High Sodium Adsorption Ratio effluent and the presence of expansive clays, such as Montmorillonite clay, (refer to Appendix A.3.B. and Appendix A.3.C.) in the soil may cause an effluent disposal system to fail. Additional considerations from those set out in this Standard may be required.

Note: *The use of Potassium salts as a regeneration agent in a water softener may not have the same affect on expansive clays as the use of Sodium salts.*

Warning: *The discharge of wastes in large volumes that cannot be accurately predicted or that include substances that are difficult to treat can harm the system and cause a failure.*

Intent: *The treatment and disposal methods identified in this Standard are intended for treating and disposing of domestic waste (waste normally expected from a dwelling). Waste from facilities other than a dwelling may require special consideration.*

3.1.5. Notwithstanding Article 3.1.4., a system using an *open discharge system* for the disposal of *effluent* or a *sewage lagoon* may receive

(a) subsurface seepage water, or
(b) wastes from an iron filter.

3.1.6. Surface water and runoff water shall be directed away from the disposal area.

Intent: *To prevent saturation of the effluent disposal site and/or system caused by surface or runoff water.*

3.1.7. A *private sewage system* shall be designed to receive all *sewage*.

3.1.8. *Effluent* from other than a *packaged sewage treatment plant* or *sand filter*, supplied to a system using pressure *distribution lateral pipes*, shall be screened to prevent particles greater than 3.2 mm (c in.) from entering the pressure *distribution lateral pipe* system.

3.1.9. If the strength of the raw *sewage* is projected to be greater than *residential strength sewage*, a pretreatment device upstream of the primary treatment component shall be installed to reduce the *sewage* strength to not greater than *residential strength sewage* or additional treatment shall be provided which will reduce the strength of the *effluent* to be not greater than *residential strength effluent* prior to treatment and disposal in

(a) a *treatment mound*,
(b) an intermittent *sand filter*,
(c) a subsurface disposal system,
(d) an *open discharge system*, or
(e) any other system designed for use with *residential strength effluent*.

3.1.10. *Sewage* shall not bypass any treatment phase of the *private sewage system*.

Intent: To prevent damage to an effluent disposal system caused by wastewater water which bypasses a septic tank or a packaged sewage treatment plant and is discharged directly into an effluent disposal system.

3.1.11. A *private sewage system* shall operate to its design standard under the climatic conditions recorded by Environment Canada for the specific location where the system is installed.

Intent: Temperature design data varies in different locations in Alberta and may effect the system performance. While all locations in Alberta are subject to freezing some locations are more severe. Appendix C of the Alberta Building Code provides climatic data for various locations in Alberta and may be used to satisfy design criteria. A Section of Appendix C is reprinted in Appendix A.3.A. of this Standard for reference.

3.1.12. *Sewage* or *effluent* shall not be discharged

(a) into a well, an abandoned well, an *aquifer*, a water supply,
(b) into any surface body of water such as, but not limited to, a lake, river or stream,
(c) onto any vegetable garden, or
(d) into any other system not consistent with the design provided under this Standard.

3.1.13. *Sewage* or *effluent* on the surface of the ground shall be contained within the *property*.

Intent: The focus of this Article is an open discharge system. However, a subsurface disposal system has failed when effluent ponds on the surface, not just when the effluent leaves the property.

3.1.14. The minimum expected volume of *sewage* per day shall be determined by Table 3.1.14.A., or by actual documented usage.

Intent: *The expected volumes of sewage listed in Table 3.1.14.A. are for uses reasonably expected in the corresponding type of occupancy. The load may change considerably, especially in the case of dwellings. Additional fixtures, high capacity fixtures, or frequent entertaining will increase the load substantially.* ***The designer and or installer must consider additional load factors when determining the expected sewage per day.*** *The expected volume of sewage for occupancies that may require operational personnel include an allowance for a reasonable number of personnel.*

Table 3.1.14.A.

Table 3.1.14.A. Expected Volume of *Sewage* Per Day

Facility	**Expected *sewage* volume in litres (gallons) per day**
Assembly Hall	32 (7) per seat
Campground (full service)	80 (18) per campsite
Church without kitchen	23 (5) per seat
Church with kitchen	32 (7) per seat
Construction Camp	225 (50) per person
Day Care Centre	113 (25) per child
Single family *dwelling* and duplex	340 (75) per person at 2 persons per bedroom 2 bedrooms and less, or at 1.5 persons per bedroom 3 bedrooms and more
Dwelling other than single family or duplex	675 (150) per bedroom
Golf Club Golf Club with bar and restaurant add	45 (10) per member 113 (25) per seat
Hospital (no resident personnel)	900 (200) per bed
Industrial and Commercial Building (does not include process water, showers or a cafeteria) Industrial and Commercial Building (with showers)	 45 (10) per employee 90 (18) per employee
Institution (residential)	450 (100) per resident
Laundry (coin operated)	1800 (400) per machine
Liquor Licence Establishment	113 (25) per seat
Mobile Home Park	1350 (300) per space
Motel/Hotel	90 (18) per single bed
Nursing and Rest Homes	450 (100) per resident
Office Building	90 (18) per employee
Recreational Vehicle Park (special considerations are required for systems receiving waste from RV's as it may contain formaldehyde that could cause the system to fail)	180 (40) per space
Restaurant (24-hour) Restaurant (not 24-hour)	225 (50) per seat 160 (35) per seat
School: Elementary Junior High High School Boarding	70 (15) per student 70 (15) per student 90 (18) per student 290 (64) per student
Service Station (not including café or restaurant)	560 (125) per fuel outlet
Swimming Pool (public) based on design bathing load	23 (5) per person

3.1.15. A high level alarm to warn of *sewage* backup shall be included in a system serving other than a single family *dwelling*, where

(a) fixtures located below grade are subject to backflow, and

(b) the movement of *sewage* or *effluent* is achieved by a mechanical device.

Intent: If the backup of sewage will spill into the building before escaping the system outside, a warning device needs to be installed. Although this Article does not require an alarm device for systems serving single family dwellings, it should be considered by the owner of the building. Alarms are not required for single family dwellings since additional sewage that may back up in a dwelling can be prevented by the occupants of the home not using additional water.

3.2. Installation Standards

3.2.1. (1) A *private sewage system* shall not be installed on a *property*

(a) that is less than 1800 sq. metres (19,500 sq. ft.) unless the lot was created prior to July 1,1992,

(b) that is not of sufficient size to meet all minimum distance requirements of this Standard for the intended system, and

(c) where site conditions on the *property* are not able to support a self sustaining *private sewage system*.

Note: A site evaluation to determine the suitability of a site for a sewage system includes confirming that the characteristics of the site meet the requirements as set out in this Standard. This evaluation includes, but is not limited to, the determination of:

(a) the existence and distance to limiting barriers in the soil such as an impervious layer or high water table,

(b) the location and size of bodies of water,

(c) surface water drainage characteristics,

(d) volume and strength of the sewage generated by the facility being served,

(e) classifications and percolation rates of soils to establish the types and sizes of systems that may be used for treatment and disposal, and

(f) the area available for the sewage system and distance requirements to property lines, bodies of water, and water sources.

(2) Notwithstanding (1), a *holding tank* system may be installed with the permission of the Local Municipal Government and shall conform with this Standard.

Intent: Sewage holding tanks are not a self sustainable method of private sewage disposal for an individual owner due to the ongoing direct costs of removing the sewage on an individual basis and limited approved locations for sewage disposal.

When considering the use of holding tanks, the need to provide for approved disposal in a sewage lagoon or other safe location and the increased traffic on road systems in the area must be part of the considerations.

3.2.2. On a *property* that adjoins a permanent body of water such as a lake, river, stream or creek, the effluent disposal component of a *private sewage system* shall be located

(a) not less than 90 m (300 ft.) from the *shore* of the body of water, or

(b) where a principal *building* is located between the system and a body of water, the distance may be reduced to the minimum distance requirements for that method of treatment and disposal.

Intent: The intent of this Article is to position the disposal component of a system far enough from the body of water that upon a failure of the disposal component, effluent that surfaces should not reach the body of water. The positioning of

the disposal component of a system to the front of the lot will make a failure more easily noticed and encourage repair of the system. A water tight septic tank or similar component need not meet the requirements of this Article.

3.2.3. The installer of a *private sewage system* shall provide an operations and maintenance manual to the owner detailing principles of operation, construction details, and all operating and maintenance requirements.

3.3. Requirements for Materials

3.3.1. All materials, systems, and equipment installed to meet the requirements of this Standard shall possess the necessary characteristics to perform their intended function when installed.

4 Piping

4.1. Design Standards

4.1.1. Piping shall not leak except where intended in the design.

4.1.2. Piping shall be *graded* and sized to allow for the designed flow of *sewage* or *effluent* and the draining of piping when required to prevent freezing.

Intent: Gravity piping should maintain a continuous and designed grade. Pressure distribution piping shall be of sufficient size to deliver the required volume at the required pressure. Table A.1.C.1., Table A.1.C.2., Table A.1.C.3., Table A.1.C.4., or Table A.1.C.5., may be used for sizing of pressure distribution piping, manifolds and supply piping at the required pressure head loss.

4.1.3. A *building sewer*, an *effluent sewer* or a *distribution header* shall be evenly and continuously supported.

4.1.4. A *distribution header* serving weeping lateral trenches at different elevations shall be evenly and continuously supported on a bed of undisturbed earth, or tightly compacted earth between trenches.

Intent: The intent of this Article is to prevent the migration of effluent through the soil from a weeping lateral trench at a higher elevation into another weeping lateral trench at a lower elevation. In a system that uses bilateral crosses, it is the intent that the trench depth of the weeping lateral trench continues as it crosses under the distribution header.

4.2. Installation Standards

4.2.1. A *building sewer* having less than 1200 mm (4 ft.) of soil cover, or an *effluent sewer* having less than 1200 mm (4 ft.) of soil cover where it crosses under a ditch, driveway or path, shall be protected from freezing by a frost box, culvert, or other equivalent means.

4.2.2. Piping for *effluent sewers* shall not be smaller than 75 mm (3 in.) nominal pipe *size*.

4.2.3. A 100 mm (4-in.) *building sewer* or *effluent sewer* shall have a minimum *grade* of 1% (1/8 inch per foot).

4.2.4. A 75 mm (3-in.) *building sewer* or *effluent sewer* shall have a minimum *grade* of 2% (1/4 inch per foot).

4.2.5. Backfill shall be carefully placed to prevent damage or dislocation of piping and the backfill shall be free of stones, boulders, cinders and frozen earth.

Intent: To prevent damage to the pipe during and after backfill.

4.2.6. Any plastic piping connected to a *septic tank*, *holding tank* or *packaged sewage treatment plant* shall not be less in wall thickness than *DWV piping* to a point at least 1800 mm (6 ft.) from the tank.

Intent: *The inlet and outlet piping connected to the septic tank are subject to distortion caused by settling of the tank and the excavation around the tank. Heavy wall pipe, and close excavation to minimize the distance to undisturbed earth, provides an added element of safety.*

4.3. Requirements for Materials

4.3.1. Every joint between pipes and fittings of dissimilar materials or *sizes* shall be made by adapters, connectors or mechanical joints manufactured for that purpose.

4.3.2. The piping used for a *building sewer*, *effluent sewer*, or gravity *distribution header*, shall be *certified* to the following Standards

(a) CAN/CSA B181.1 Standard for ABS Drain Waste and Vent Pipe and Pipe Fittings,
(b) CAN/CSA B181.2 Standard for PVC Drain Waste and Vent Pipe and Pipe Fittings,
(c) CAN/CSA B182.1 Standard for Plastic Drain and Sewer Pipe and Pipe Fittings, or
(d) CAN/CSA B182.2 Standard for PVC Sewer Pipe and Fittings (PSM Type).

4.3.3. Where there is no existing Standard for the intended use of a piping material, piping use shall comply with Appendix A.5.A. Piping Materials.

5 Septic Tanks, Sewage Holding Tanks and Sewage Effluent Tanks

5.1. Design Standards

5.1.1. A *septic tank* shall have a minimum *working capacity* of

(a) not less than 1800 litres (400 gal.),
(b) not less than the expected volume of *sewage* per day as prescribed in Table 3.1.14.A.,
(c) for a single family *dwelling* and duplex not less than
    (i) 1800 litres (400 gal.) for a 3-bedroom home or less,
    (ii) 2700 litres (600 gal.) for a 4-bedroom,
    (iii) 3400 litres (750 gal.) for a 5-bedroom home, and
    (iv) 4000 litres (900 gal.) for a 6-bedroom home, and
(d) 2700 L (600 Gal.) but not less than 1.5 times the expected volume of *sewage* per day as prescribed in Table 3.1.14.A. if the *septic tank* supplies *effluent* to a treatment or disposal component that uses a pressure *distribution lateral pipe* system.

Note: Where additional biological loads, such as garbage grinders or fixtures that may increase sewage volumes, are included in the design of the facility served by the system, the size of the septic tank should be increased.

5.1.2. A *holding tank* shall have a storage capacity of not less than 1800 litres (400 gallons) or the expected volume of *sewage* per day as prescribed in Table 3.1.14.A., which ever is greater.

Intent: The capacity of the holding tank should be large enough to make effective use of trucking services and provide a reserve volume for the owner. In no case should the size of the tank be less than the volume of sewage per day. It is not the intent of this Standard to exclude the use of a septic tank as a holding tank providing the requirements of the Standard are met regarding holding tanks.

5.1.3. A *holding tank*, when used, shall be located and installed to accommodate the regular removal of *sewage* by vacuum truck or other approved means.

Intent: Holding tanks are meant to hold a volume of sewage and facilitate the removal of sewage for disposal in a municipal lagoon or other suitable location.

5.1.4. Access openings and manhole extensions shall prevent water from entering a *septic tank*, *sewage holding tank* or *sewage effluent tank.*

5.2. Installation Standards

5.2.1. *Septic tanks*, *sewage holding tank*s or *sewage effluent tanks* shall not be located within
(a) 1 m (3.25 ft.) from a *property* line,
(b) 9 m (30 ft.) from a *water source*,
(c) 9 m (30 ft.) from a *water course*, and
(d) 1 m (3.25 ft.) from a *building*.

5.2.2. A *septic tank*, *sewage holding tank* or *sewage effluent tank* shall be provided with an access opening that is not more than 600 mm (2 ft.) below the surface of the ground.

Intent: To facilitate cleaning of the tank by requiring a deep buried tank to include an access opening near the surface of the ground . Access requirements for maintenance of equipment must be considered when locating the access opening.

5.2.3. Access openings that are not protected by their location shall be equipped with a secure lid or cover.

Intent: To increase safety by preventing unauthorized or accidental entry into the access opening of a septic tank or holding tank. Acceptable protective measures include but are not limited to:

(a) a padlock,
(b) a cover that can only be removed with tools, or
(c) a cover having a minimum weight of 29.5 kilograms (65 pounds).

5.2.4. An access opening extension shall be water tight at the connection to the *septic tank*, *sewage holding tank* or *sewage effluent tank* and at the joints between all sections.

5.2.5. The bottom of an excavation for a *septic tank, sewage holding tank* or *sewage effluent tank* shall provide a uniform base to support the tank in a level position.

Intent: A tank must have a stable base so it will not settle, shift or crack after installation.

5.2.6. Piping connected to the *septic tank, sewage holding tank* or *sewage effluent tank* shall be supported to within 300 mm (1 ft.) of the *tank* on a solid base, or equivalent.

Intent: The inlet and outlet piping connected to a tank must be protected from distortion caused by settling of the backfill material. The excavation for a tank should not be any longer than is necessary to install the tank. This provides undisturbed earth closer to the tank to support the inlet and outlet piping connected to the tank. A pipe with a greater wall thickness provides an added factor of safety.

5.3. Requirements for Materials

5.3.1. No person shall manufacture or install a *septic tank, sewage holding tank* or *sewage effluent tank* unless it

(a) meets or exceeds the requirements of CAN3-B66-M90 Standard and is *certified* by an accredited testing agency, or

(b) is subject to an engineering assessment acceptable to an *Administrator* and complies with a nationally recognized Standard or test requirements acceptable to an *Administrator.*

6 Packaged Sewage Treatment Plants

6.1. Design Standards

6.1.1. Sewage that exceeds the maximum limits for residential strength sewage shall not be discharged to a *packaged sewage treatment plant*.

6.1.2. The minimum treatment capacity of a *packaged sewage treatment plant* shall be not less than 1800 litres (400 gal.) per day, and not less than the expected volume of *sewage* per day.

6.1.3. Access openings and manhole extensions shall prevent water from entering the *packaged sewage treatment plant* .

6.2. Installation Standards

6.2.1. A *packaged sewage treatment plant* shall not be located within

(a) 1 m (3.25 ft.) from a *property* line,
(b) 9 m (30 ft.) from a *water source*,
(c) 9 m (30 ft.) from a *water course*, and
(d) 1 m (3.25 ft.) from a *building*.

6.2.2. A *packaged sewage treatment plant* shall be provided with an access opening at or above the ground surface.

Intent: To ensure an access opening for required maintenance.

6.2.3. Access openings that are not protected by their location shall be equipped with a secure lid or cover.

Intent: To provide an element of safety by preventing unauthorized or accidental entry into the access opening of a tank. Acceptable protective measures include but are not limited to:
(a) a padlock,
(b) a cover that can only be removed with tools,
(c) *a cover having a minimum weight of 29.5 kilograms (65 pounds)*.

6.2.4. An access opening extension shall be water tight at the connection to the *packaged sewage treatment plant* and at the joints between all sections.

6.2.5. The bottom of an excavation for a *packaged sewage treatment plant* shall provide a uniform base to support the tank in a level position.

Intent: A tank must have a stable base so it will not settle, shift or crack after installation.

6.2.6. Piping connected to the *packaged sewage treatment plant* shall be supported to within 300 mm (1 ft.) from the tank on a solid base, or equivalent.

Intent: The inlet and outlet piping connected to a tank must be protected from distortion caused by settling of the backfill material. The excavation for a tank should not be any longer than is necessary to install the tank. This provides undisturbed earth closer to the septic tank to support the inlet and outlet piping connected to the septic tank. A pipe with a greater wall thickness provides an added element of safety.

6.3. Requirements for Materials

6.3.1. A *packaged sewage treatment plant* shall be

(a) *certified* by the National Sanitation Foundation as meeting the requirements of the National Sanitation Foundation (NSF) 40 Standard, for Class 1 plants, relating to Residential Wastewater Treatment Systems, or
(b) subject to an engineering assessment acceptable to an *Administrator* and in compliance with a nationally recognized Standard or test requirements acceptable to an *Administrator*.

Note: When a Canadian Standard for *packaged sewage treatment plant*s becomes available, certification to the Canadian Standard may be acceptable.

7 Effluent Treatment and Disposal

7.1. Design Standards

7.1.1. If an *effluent* treatment and disposal system is installed, it shall meet the requirements of this Standard for

(a) a *disposal field*,
(b) a *treatment mound*,
(c) an *open discharge system*,
(d) a *lagoon*, or
(e) a *sand filter* or *sand filter* and *disposal field*.

7.1.2. *Effluent* treatment and disposal systems shall be designed and sized using the results of a *percolation test* or by using a *soil texture classification* test where that system is

(a) a *disposal field*,
(b) a *treatment mound*, or
(c) a *sand filter*, or *sand filter* and *disposal field*.

7.1.3. Where a *percolation test* is used the *effluent* loading rates shall be calculated as set out in Article 7A.1.4.

Intent: A percolation test is used to determine the rate that the soil will accept water. The results of this test provide some system sizing criteria. Other criteria will also need consideration when sizing a system, such as soil structure, soil texture, type of clay, seasonal high water table and water quality, for example: Sodium Adsorption Ratio.

7.1.4. When a particle or *grain size analysis* test is used to establish a *soil texture classification* determined in Table 7A.1.5.A., the *effluent* loading rates shall be determined by Article 7A.1.5.

Intent: A soil grain size analysis is used to determine a soil texture classification that can be related to the hydraulic conductivity of the soil or the rate that the soil will accept water. The results of this test provide some system sizing criteria. Other criteria will also need consideration when sizing a system, such as soil structure, soil texture, type of clay, seasonal high water table and water quality, for example: Sodium Adsorption Ratio.

7.1.5. A subsurface *effluent* disposal system, or other systems that use the absorption of *effluent* into the soil for treatment and disposal, shall absorb the *effluent* into the soil at a rate of

(a) not faster than 5 minutes per 25 mm (1 in.) as determined by a percolation test using water or, 5 Litres per square metre per minute, and
(b) not slower than 60 minutes per 25 mm (1 in.) as determined by a percolation test using water or, 0.042 Litres per square metre per minute.

7.1.6. A subsurface *effluent* disposal system, or other systems that use the absorption of *effluent* into the soil for treatment and disposal, shall maintain a *vertical separation* between the point of *effluent* infiltration into the soil and a *water table* or an impervious layer of not less than

(a) 1500 mm (5 ft.) in a disposal system supplied with *effluent* from a *septic tank* and no other treatment, or

(b) 900 mm (3 ft.) in

(i) a *disposal field* supplied with *effluent* from a Class 1 *packaged sewage treatment plant* or a *sand filter*,

(ii) a *treatment mound*, or

(iii) an open bottom *sand filter*.

Intent: Depending on the level of initial or primary treatment, the effluent must travel a corresponding distance through the soil to complete treatment.

7.2. Installation Standards

7.2.1. At a *disposal field*, *treatment mound*, *sand filter* or *lagoon* site, tests shall be made to determine that the minimum *vertical separation* requirements of the system to be installed will be satisfied.

7.2.2. Where *percolation tests* are required, a minimum of 2 tests shall be done at the disposal site in accordance with Appendix A.6. Percolation Test Procedure.

Intent: A percolation test is a standardized test procedure to determine a rate that the soil will accept water. The results of this test procedure provide some system sizing criteria.

7A. Disposal Fields - General

7A.1. Design Standards

7A.1.1. Except as required in Article 7A.1.2., and as provided in Clause 7A.1.3.(d), a *disposal field* supplied with *effluent* from a *septic tank* with no other pretreatment shall be sized in accordance with

(a) Article 7A.1.4., or

(b) Article 7A.1.5.

7A.1.2. Except as provided in Clause 7A.1.3.(d), a *disposal field* served by a *septic tank* and no other pretreatment device shall have not less than 37 square meters (400 sq. ft.) of *weeping lateral trench* bottom area.

7A.1.3. A *disposal field*

(a) supplied with *effluent* from a Class 1 *packaged sewage treatment plant* may have

(i) a 30% reduction in the area of *weeping lateral trench* bottom required in Article 7A.1.1., or

(ii) a 50% reduction in the area of *weeping lateral trench* bottom required in Article 7A.1.1. when pressure distribution of *effluent* is used in accordance with Article 7A.1.9.,

(b) supplied with *effluent* from a *sand filter* may have

(i) a 30% reduction in the area of *weeping lateral trench* bottom required in Article 7A.1.1., or

(ii) a 50% reduction in the area of *weeping lateral trench* bottom required in Article 7A.1.1. when pressure distribution is used in accordance with Article 7A.1.9.,

(c) supplied with *effluent* from an open bottom *sand filter* may have the required *area of weeping lateral trench* bottom in Clause 7A.1.3.(b) reduced by a of the area of the *sand filter*, or

(d) supplied with *effluent* from a *septic tank* may have a 20% reduction in the area of *weeping lateral trench* bottom required in Article 7A.1.1. when pressure distribution is used in accordance with Article 7A.1.9.

7A.1.4. When using the results of a *percolation test* to size a system, the total area of *weeping lateral trench* bottom required shall be determined from the following formulas

(a)

Square~Metres~=~{Litres~per~Day} OVER LEFT (LEFT ({ 3 OVER { SQRT PercolationRate } } RIGHT) ~times~27.36 RIGHT)

where

Square Metres = trench bottom area in square metres not including trench walls

Litres per Day = expected *sewage* volume in litres/day

Percolation Rate = percolation rate in minutes/25 mm, or

(b)

Square~Feet~=~{Gallons~per~Day} OVER LEFT (LEFT ({ 3 OVER { SQRT PercolationRate} } RIGHT) ~times~0.56 RIGHT)

where

Square Feet = trench bottom area in square feet not including trench walls

Gallons per Day = expected sewage volume in gallons/day

Percolation Rate = percolation rate in minutes/inch.

Note: A Table of loading rates, square roots of percolation rates, and calculations using this formula is provided for convenience in the Appendix A.4.A.

Note: The percolation tests form only part of an acceptable site evaluation. Additional evaluation of the soil type, Sodium Adsorption Ratio (S.A.R.), clay content and type of clay (Table A.3.B. and Table A.3.C.), depth to impervious layer or water table, terrain, and other factors, must also be conducted.

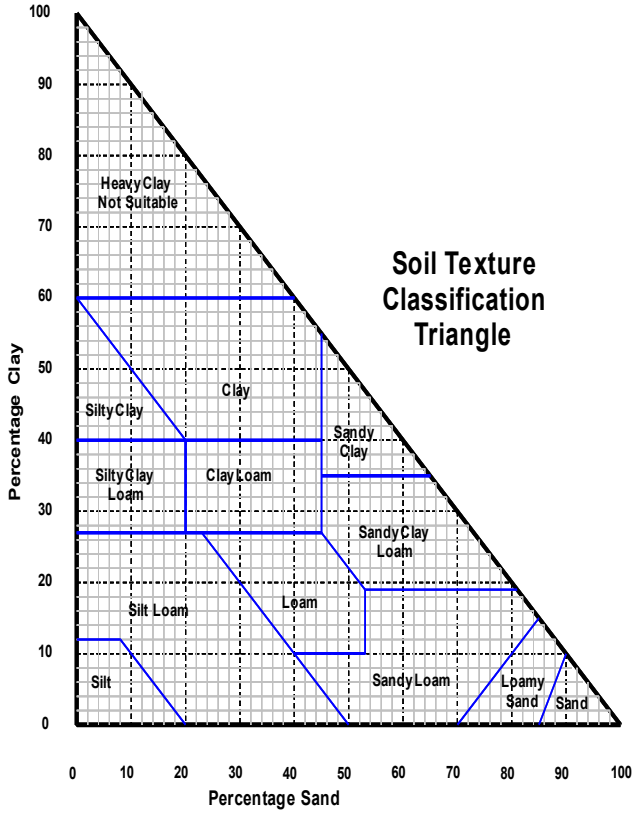
7A.1.5. When using the results of a *soil texture classification* to size a system, the *disposal field weeping lateral* trench bottom area shall be sized so that the *effluent* loading rate per day for soil classifications determined in Table 7A.1.5.A. does not exceed, in a soil classified as:

(a)	Clay,	not suitable without further testing,
(b)	Silty Clay,	not suitable without further testing,
(c)	Silty Clay Loam,	not suitable without further testing,
(d)	Sandy Clay,	not suitable without further testing,
(e)	Clay Loam,	10.78 L per square metre (0.22 gal per sq. ft.),

(f)	Silt,	12.25 L per square metre (0.25 gal per sq. ft.),
(g)	Sandy Clay Loam,	13.72 L per square metre (0.28 gal per sq. ft.),
(h)	Silt Loam,	13.72 L per square metre (0.28 gal per sq. ft.),
(i)	Loam,	17.15 L per square metre (0.35 gal per sq. ft.),
(j)	Sandy Loam,	22.05 L per square metre (0.45 gal per sq. ft.),
(k)	Loamy Sand,	30.87 L per square metre (0.63 gal per sq. ft.), and
(l)	Sand,	not suitable without further testing.

Intent: *Soils classed as not suitable without further testing for a disposal field in this table may have an infiltration rate that will accommodate a disposal field. Further testing such as a percolation test, soil structure, and determining the absence of expandable clays may indicate the soil can accommodate a disposal field.*

Figure 7A.1.5.A. Soil Texture Classification Triangle



Note: Plotting the percentage of sand and clay provides the remaining percentage of silt.

7A.1.6. Except as specified in Article 7A.1.9., *effluent* shall be delivered to a *disposal field* in a volume per flush of between 6 L and 12 L per square metre (.07 to .25 gal per square foot) of *weeping lateral trench* if a *disposal field* is served by a *septic tank* and no other treatment device.

7A.1.7. A *disposal field* shall not use *serial distribution* as a method to distribute *effluent* to *weeping lateral trenches*.

Intent: The effluent should be distributed to each lateral evenly. The effluent should not be allowed to flow through one weeping lateral trench to another weeping lateral trench at a lower elevation.

7A.1.8. A gravity *effluent* distribution system shall be designed to provide approximately equal distribution of *effluent* to each *weeping lateral trench.*

7A.1.9. A pressure *distribution lateral pipe* system shall be designed to distribute *effluent* uniformly throughout the entire length of *weeping lateral trench* in a *disposal field* and shall include in the design

(a) appropriate *pressure head* and capacity considering
  (i) maximum static lift measured from the minimum *effluent* tank level to the level of the perforated distribution piping,
  (ii) pipe friction based upon a Hazen Williams coefficient of smoothness of 150, and
  (iii) orifice *pressure head* requirements,

Note: Pipe friction loss tables can be found in the Appendix A.1.C. tables. Use these tables to determine the size of main effluent supply piping and distribution headers.

(b) a minimum *pressure head* of 1500mm (5 ft.) at the most remote orifice with not more than a 10% flow variation between any orifices in an individual system,
(c) *distribution lateral* piping sized as specified in Table A.1.A.,
(d) orifices in the *distribution laterals*
  (i) having a minimum *diameter* of 3.2 mm (1/8 in.),
  (ii) evenly spaced at a distance not greater than 1500mm (60 in.),
(e) a volume per flush not exceeding 20% of the expected volume of *sewage* per day, and

Intent: Numerous light applications of effluent provide better treatment conditions. The volumes per flush should be evenly spaced over a 24 hour day.

(f) a screen to prevent particles greater than 3.2 mm (c in.) from entering the pump and being discharged into the *distribution laterals*, when distributing *effluent* from other than a *packaged sewage treatment plant* or *sand filter.*

7A.2. Installation Standards

7A.2.1. A *disposal field*, measured from any part of a *weeping lateral trench* shall not be located within
(a) 1.5 m (5 ft.) from a *property* line,
(b) 15 m (50 ft.) from a *water source*,
(c) 15 m (50 ft.) from a *water course*,
(d) 9 m (30 ft.) from a basement, cellar or crawl space,
(e) 1 m (3.25 ft.) from a *building* that does not have a basement, cellar or crawl space, and
(f) 1 m (3.25 ft.) from a *septic tank* or *packaged sewage treatment plant.*

Note: The 9 m (30 ft.) requirement to a cellar, basement or crawl space is intended to protect excavations below grade from accumulating migrating effluent. A crawl space that is not below grade, or where the level of the ground surface at the disposal area is below the level of the crawl space, would not require 9m (30 ft) clearance and could be treated as a building without a basement.

7A.2.2. A *disposal field* shall not be installed in soil having a percolation rate faster than 5 minutes per 25 mm (1 in.) unless

(a) the *weeping lateral trenches* are lined on the bottom and sides with a minimum of 300 mm (1 ft.) of a soil having a percolation rate in excess of 5 minutes per 25 mm (1 in.), or

Intent: *The trenches, when lined with loam or sandy loam soil having a percolation rate of 5 to 10 minutes/ 25mm (1 in.) will slow the rate the effluent enters the native soil, preventing saturated flow through the soil and allowing for it to be treated.*

Note: *A disposal field shall not be installed in soils that have a percolation rate in excess of 60 minutes per inch as limited by Article 7.1.5.*

(b) sufficient test data is provided indicating that between a *water table* and the lowest point where *effluent* is discharged into the soil, there is a layer of soil over the entire area which
  (i) has a minimum thickness of 300 mm (1 ft.), and
  (ii) has a percolation rate slower than 5 minutes per 25 mm (1 in.).

7A.2.3. A *weeping lateral trench* shall

(a) be not more than 900 mm (3 ft.) deep,
(b) be not less than 450 mm (18 in.) or more than 900 mm (3 ft.) in width when using weeping lateral trench media,
(c) be not less than 300 mm (12 in.) or more than 900 mm (3 ft.) in width when using chambers in weeping lateral trenches,
(d) have a *nominally level* bottom,
(e) include a void space created by
  (i) a chamber, or
  (ii) *weeping lateral trench* media at the bottom of the trench filling the entire width of the trench to a depth of 300 mm (1 ft.), and
(f) be provided with a minimum of 900 mm (3 ft.) of earth between it and another *weeping lateral trench*.

Note: *A cover of 12 inches of soil over the top of the gravel and effluent pipe has been found to usually provide adequate protection from frost in many areas of Alberta.*

7A.2.4. A *weeping lateral pipe* shall

(a) be laid *nominally level* at a maximum depth of 600 mm (2 ft.) measured from the top of the pipe to the ground surface, and
(b) be installed with the top of the pipe at the top of the void space.

7A.2.5. Where *weeping lateral pipes* connect to a *field header*, all piping in the *disposal field* shall be installed at the same elevation.

7A.2.6. Where field constructed bi-level distribution crosses are used to connect *weeping laterals pipes* to the underside of the *distribution header*, feeder holes in the underside of the *distribution header* shall be designed to provide relatively equal distribution of *effluent* to each *weeping lateral pipe*.

7A.2.7. When used in a system, a distribution box shall

(b) have an internal dimension not exceeding 300 mm (12 in.),
(c) provide relatively equal distribution to all outlets, and
(d) be readily accessible for inspection and service.

Intent: To ensure relatively equal distribution to all weeping laterals. The maximum internal dimension minimizes the impact on even distribution in the event of soil movement or frost heave tipping the box. Accessibility is required to confirm distribution during service.

7A.2.8. Notwithstanding Article 7A.1.8., where drop boxes are used to distribute *effluent* to *weeping lateral trenches*

(a) the *disposal field* may be installed on sloping ground,
(b) the invert of the outlet piping to the next drop box shall be
    (i) above the top of the *weeping lateral pipe* outlet, and
    (ii) a minimum of 25 mm (1 in.) below, the invert of the inlet piping to the drop box, and
(c) the drop box serving each *weeping lateral pipe* shall have provision for preventing *effluent* from entering the *weeping lateral pipe*.

Intent: A drop box system is a form of an anaerobic effluent disposal system. It is intended to be used primarily in very porous soil structures where the creation of a restricting layer of biomat is desired. This biomat reduces the infiltration rate of effluent into the soil. This design is used to reduce infiltration rates where desired.

A drop box cannot be used as a "distribution box" for distributing effluent evenly to weeping lateral trenches.

7A.2.9. A *disposal field* shall not be located under

(a) a roadway or driveway,
(b) a paved area,
(c) a vehicle parking lot,
(d) any structure, or,
(e) under a vegetable garden.

7A.3. Requirements for Materials

7A.3.1. *Weeping lateral trench* media shall

(a) be materials that maintain structural integrity and will not be degraded by the environment created in the *disposal field* trench,
(b) consist of 12 mm (½ in.) to 50 mm (2 in.) particle size material,
(c) be able to withstand vertical and horizontal loads from backfill equal to a minimum of 1 m (3.25 ft.) of earth cover,
(d) not contain more than 5% *fines*, silt or clay,
(e) provide a minimum of 30% void volume under compression conditions equal to the weight of 1 m (3.25 ft.) of earth cover, and
(f) be covered to prevent migration of soil particles into the void space around the media by
    (i) 75 mm (3 in.) of a non-oil-seed straw, or other equivalent fibrous material, or

(ii) a *filter fabric*.

7A.3.2. When gravel, or gravel and *sand*, is used as *weeping lateral trench* media it shall
- (a) be placed across the full width of the trench and be
  - (i) a 300 mm (1 ft.) layer of gravel having a particle size of 12 mm (½ in.) to 40 mm (1½ in.), or
  - (ii) a 150 mm (6 in.) layer of clean *sand* covered by a 150 mm (6 in.) layer of gravel having a particle size of 12 mm (½ in.) to 40 mm (1½ in.), and
- (b) not contain more than 5% *fines*, silt or clay.

Note: The requirements of Article 7A.3.1. also apply.

7A.3.3. When shredded tires are used as *weeping lateral trench* media, they shall be individual pieces
- (a) not smaller than nominal 25 mm (1 in.) and not larger than nominal 50 mm (2 in.) in size,
- (b) washed free of iron, *fines* and dust,
- (c) compacted to the elevation of the invert of the piping, and
- (d) covered with a *filter fabric* prior to back filling the trench with earth.

Note: The requirements of Article 7A.3.1. also apply.

Intent: Materials such as gravel or tires are accepted materials that meet the requirements of Article 7A.3.1. Other materials may also be acceptable provided they meet the criteria of 7A.3.1.

7A.3.4. Piping materials used in the construction of pressure *distribution lateral*s for a *weeping lateral trench* shall
- (a) be smooth, rigid plastic piping, and
- (b) be *certified* for a pressure application by a testing agency recognized by the Standards Council of Canada, or acceptable to an *Administrator*.

7B Chamber System Disposal Fields

7B.1. Design Standards

7B.1.1. Chamber systems shall not use *serial distribution* as a method of distributing *effluent* to weeping lateral trenches.

7B.1.2. Chamber systems shall comply with the requirements of Section 7, *Effluent* Treatment and Disposal, and Section 7A, Disposal Fields General.

7B.1.3. Chambers shall be a minimum of 300 mm (12 in.) wide and a maximum 900 mm (36 in.) wide.

7B.1.4. The effective infiltrative area provided by chambers shall be calculated using the interior width at the base of the chamber where effluent contacts the soil.

7B.1.5. Notwithstanding Article 7B.1.4., the trench bottom area provided by a chamber used in a disposal field

(a) may be calculated using 1.6 times the actual width of the chamber, and
(b) the calculated width shall not exceed 900mm (36in.).

Note: The excavation for a trench using chambers should be equivalent to 1.6 times the width of the chamber to provide an area of disturbed earth equivalent to a gravel filled trench.

For example: A system requires 875 square ft. of trench bottom absorption area.
Gravel trenches - 438 ft long x 2ft wide = 876 square ft.
Chamber system - 438 ft. long x15 in. (or 1.25 ft.) (actual chamber width) X 1.6 = 876 square ft..

7B.2. Installation Standards

7B.2.1. Chamber systems shall be installed in accordance with the manufacturer's instructions, except that in the event of a conflict with this Standard of Practice, the requirements of this Standard of Practice shall apply.

7B.2.2. Chamber system installations shall include

(a) splash pans supplied by the manufacturer,
(b) a minimum of 100 mm (4 in.) of gravel in the most upstream 3 m (10 ft.) portion of all *weeping lateral trenches* or other area that receives *effluent*, or
(c) other suitable means to dissipate the hydraulic energy of the *effluent* it is receiving and prevent erosion or disturbance of the trench bottom.

Intent: To prevent erosion or disturbance of the trench bottom by the effluent that spills into the chamber rather than being piped the entire length of the chamber lateral.

7B.3. Material Requirements

7B.3.1. Chambers shall be *certified* as meeting or exceeding the requirements of the American Association of State Highway and Transportation Officials H -10 or H -20 ratings.

8 Treatment Mounds

8.1. Design Standards

8.1.1. Notwithstanding Article 7.1.5. , a *treatment mound* may be constructed on soils where

(a) the soil percolation rate to a depth of at least 600 mm (2 ft.) below the *sand layer* is faster than 120 minutes per 25 mm (1 in.), and
(b) below the *sand layer* there is a layer of soil at least 300 mm (1 ft.) thick that has a percolation rate slower than 5 minutes per 25 mm (1 in.).

Intent: Fill soil may be placed under the mound to provide the depth of suitable soil. The fill soil used should be a loamy sand to a sandy loam. Soil with a high percentage of clay content should not be used.

8.1.2. The *sand layer* receiving *effluent* shall

(a) have a surface area designed on the basis of not more than 50 L of *effluent* per square metre (1 gal per sq. ft.) per day loading rate,

(b) have a surface area of not less than 37 square metres (400 sq. ft.),

(c) be 3 m (10 ft.) wide or less, measured at the top of the *sand* layer,

(d) be not less than 300 mm (1 ft.) thick, and

(e) be on or above the existing soil.

Intent: Clause 8.1.2.(e) requires the mound to be built on the existing grade of the soil. Soil should not be stripped away creating a depression in the ground or be stripped away and replaced by fill material.

8.1.3. The area of the mound within the berm, excluding the end slopes, providing the infiltration area into the original soil shall

(a) be at least equal to 70 percent of the trench bottom area determined by Article 7A.1.4. or Article 7A.1.5.,

(b) when on a slope exceeding 1 percent, be measured downslope from the upslope side of the *sand layer* area receiving the effluent, and

(c) be constructed of a loamy sand or sandy loam fill material.

Intent: The intent of this Article is to assure that an adequate area of soil is available for the effluent to infiltrate, that this area is fully covered by the berm, and that the permeability of the berm fill material is suitable to distribute the effluent over the infiltration area.

8.1.4. The distribution of *effluent* into the *sand layer* shall be into

(a) a layer of gravel over the *sand layer*, or

(b) chambers that provide an infiltrative area that is not less than 80% the designed area of the *sand layer receiving the effluent.*

8.1.5. Where chambers are used

(a) the *sand layer* shall be covered with a minimum of 50mm (2 in.) of gravel, and

(b) a pressure *effluent distribution lateral* on top of the gravel shall be provided for each row of chambers.

8.1.6. The designed quantity of *effluent* delivered to the mound per pump cycle, shall not exceed 25% of the estimated or measured daily *sewage* flow.

Intent: Smaller doses provide better treatment conditions. Doses may be smaller than 25%.

8.1.7. Distribution of *effluent* shall be by *distribution laterals* under pressure.

8.1.8. The *effluent* pump rate of discharge shall be sufficient to distribute *effluent* effectively throughout the *distribution laterals* while maintaining *pressure head* in accordance with Table A.1.B.

8.1.9. The rate of discharge per orifice *diameter* and *pressure head* shall be calculated in accordance with Table A.1.B.

8.1.10. The maximum number of orifices in *distribution laterals* shall be in accordance with Table A.1.A.

8.1.11. Pipe orifices shall be sized to provide relatively even distribution of *effluent* over the *sand layer*.

8.1.12. Pipe orifices shall be located in the *distribution laterals*

(a) to direct the spray in a direction that will not cause erosion of the soil or *sand layer*, and

(b) be provided with a device that will deflect the spray to prevent erosion of the soil above and the entry of foreign material into the orifice if the orifice is pointed upwards.

Intent: Orifices may be placed at the bottom of the piping to help drain the pipe and protect from freezing. Locating the orifice on the upper half of the pipe can help prevent clogging of the orifice. Wherever the orifices are located, there must be room for the water to escape and the spraying water must not cause any erosion of the soil or sand around it.

8.2. Installation Standards

8.2.1.(1) A *treatment mound* shall not be located within

(a) 3 m (10 ft.) of a *property* line,

(b) 15 m (50 ft.) of a *water source*,

(c) 15 m (50 ft.) of a *water course*,

(d) 3 m (10 ft.) of a *septic tank*,

(e) 9 m (30 ft.) of a basement, cellar, or crawl space, and

(f) 3 m (10 ft.) of a *building* that does not have a basement, cellar, or crawl space.

(2) For the purposes of Sentence 8.2.1.(1), all measurements are to be taken from the point where the side slope of the mound intersects with the natural soil contour.

8.2.2. Whenever mounds are located on slopes, a diversion shall be constructed immediately up slope from the base of the mound to intercept and direct run-off water away from the mound.

8.2.3. The *sand* layer the *effluent* is distributed over shall be a minimum of 300 mm (1 ft.) thick and the top of the *sand* layer shall be *nominally level*.

8.2.4. Track type machinery shall be used to move the *sand* into place and at least 150 mm (6 in.) of *sand* shall be kept beneath the machinery to minimize compaction of the soil under the *sand* layer to prevent smearing or glazing of the soil under the mound area.

8.2.5. When gravel is used over the *sand* layer

(a) not less than 225 mm (9 in.) of gravel shall be placed over the contact area below the *distribution laterals*,

(b) not less than 50 mm (2 in.) of gravel shall be placed over the *distribution laterals*, and

(c) straw or equivalent fibrous material shall be placed over the gravel to an uncompacted depth of 75 mm to 100 mm (3 in. to 4 in.) to prevent the migration of soil into the gravel.

8.2.6. The *distribution laterals* shall be

(a) connected to a manifold pipe with all ends capped,

(b) spaced not less than 900 mm (36 in.) and not more than 1000 mm (40 in.) on center,

(c) located not less than 400 mm (16 in.) or more than 500 mm (20 in.) from the edge of the gravel layer, and

(d) sized in accordance with Table A.1.A.

8.2.7. The manifold pipe shall be connected to the pump discharge pipe and shall slope back toward the pump.

8.2.8. Sandy loam fill material shall be placed over the gravel layer or chambers to a depth of 300 mm (1 ft.) in the center of the mound and to a depth of 150 mm (6 in.) at the sides.

Intent: To provide an adequate slope on the top of the treatment mound to prevent storm water from standing on the top of the mound.

8.2.9. A minimum of 75 mm (3 in.) of top soil shall be placed on the fill material over the entire area of the mound.

8.2.10. A grass cover shall be established over the entire area of the mound.

Intent: A contractor meets the requirement of this Article by seeding the mound to grass, leaving the responsibility to water and maintain the grass cover to the owner. The grass cover is needed to prevent erosion of the mound and to assist in evaporating the effluent.

8.2.11. Shrubs shall not be planted on the top of the mound.

8.2.12. The side slopes on the mound shall not be steeper than 1:4 (one vertical to four horizontal).

8.3. Requirements for Materials

8.3.1. Piping materials used in the construction of *distribution laterals* for a *treatment mound* shall

(a) be smooth, rigid plastic piping, and

(b) be *certified* for a pressure application by a testing agency recognized by the Standards Council of Canada, or acceptable to an *Administrator*.

8.3.2. *Sand* used for the *sand* layer shall be a soil texture composed by weight of at least 85% soil particles varying in size from 2.0 mm to 0.05 mm, and containing not more than 10% *fines*.

8.3.3. Gravel used in the *treatment mound* shall be 12 mm (½ in.) to 40 mm (1½ in.) particle size containing not more than 5% *fines*, silt or clay.

9 Sand Filters - Intermittent Single Pass

9.1. Design Standards

9.1.1. A *sand filter* shall be of the open bottom or closed bottom type.

9.1.2. The movement of *effluent* from the *sand filter* to the final treatment and disposal component shall be by gravity or be pumped.

9.1.3. An open bottom *sand filter* shall be designed so that the entire bottom of the *sand filter* will provide an infiltrative soil surface.

9.1.4. A closed bottom *sand filter* container shall be water tight.

9.1.5. Where a soil cover is required, the soil cover over a *sand filter* and the area immediately around it shall be *graded* to shed water and prevent surface water from running into the sand filter.

9.1.6. A course *sand* intermittent *sand filter* shall
(a) not be loaded in excess of 120 L per square metre (2.4 gallon per sq. ft.) per day, and
(b) have an effective surface area of not less than 17 square metres (150 sq. ft.) when serving a single family *dwelling.*

9.1.7. A medium *sand* intermittent *sand filter* shall
(a) not be loaded in excess of 50 L per square metre (1 gallon per sq. ft.) per day, and
(b) have an effective surface area of not less than 34 square metres (360 sq. ft.) when serving a single family *dwelling.*

9.1.8. *Effluent* shall be distributed over the *sand filter* using an *effluent* pump capable of providing a sufficient volume of *effluent* at a pressure of not less than a 5 ft. *pressure head* at the ends of all *distribution laterals* in the pressure distribution system.

9.1.9. The ends of the *distribution laterals* shall be provided with an access opening and a means to perform flushing and mechanical cleaning of the piping.

9.1.10. The *diameters* of the manifold and *distribution laterals* shall be sized to provide relatively even distribution of *effluent* from the orifices.

9.1.11. A *sand filter* shall be provided with a volume per flush not exceeding 10 percent of the expected volume of *sewage* per day.

Intent: Numerous light applications of effluent provide better treatment conditions. A timing device to control the pump is desirable to provide a wait period between each volume per flush and also to provide volumes per flush evenly spaced over a 24 hour day.

9.1.12. Where the *effluent* from an intermittent *sand filter* is to be discharged by a pump, the design and construction of the *sand filter* shall include provisions for a pump vault, providing

(a) the location, design, and construction of the pump vault do not conflict with this Standard for the design, construction and operation of a *sand filter*,

(b) the pump and related apparatus are housed in a corrosion resistant vault designed to

(i) withstand the stresses placed upon it,

(ii) prevent the migration of *drain media*, *sand*, or *underdrain media* to its interior,

(iii) provide watertight access to finished landscape *grade* with a *diameter* equal to that of the vault, and

(iv) receive treated *effluent* from an elevation equal to that of a gravity discharging *sand filter*, and

(c) the depth of *underdrain media* and the operating level of the pump cycle and alarm does not allow *effluent* within two inches of the bottom of the *sand filter media*.

9.1.13. A *sand filter* using a pump for *effluent* discharge shall include a device capable of

(a) detecting a high *effluent* level condition, and

(b) delivering a visible and audible signal to alert the user of the system, the *effluent* level is above normal operating levels.

9.2. Installation Standards

9.2.1. An open bottom *sand filter* shall not be located within

(a) 1.5 m (5 ft.) from a *property* line measured from the foot of the *berm*,

(b) 15 m (50 ft.) from a *water source*,

(c) 15 m (50 ft.) from a *water course*,

(d) 9 m (30 ft.) from a basement or cellar, and

(e) 3 m (10 ft.) from a *building* without a basement.

9.2.2. A closed bottom *sand filter* shall not be located within

(a) 1 m (3.25 ft.) from a *property* line measured from the foot of the *berm*,

(b) 9 m (30 ft.) from a *water course*,

(c) 9 m (30 ft.) from a *water source*, and
(d) 1 m (3.25 ft.) from a *building*.

9.2.3. An intermittent *sand filter* shall be on a stable and level base.

9.2.4. A pump supplying *effluent* from other than a *packaged sewage treatment plant* to a *sand filter*, shall be provided with a screen to prevent particles greater than 3.2 mm (c in.) from being discharged to the *sand filter*.

9.2.5. An intermittent *sand filter* system shall contain

(a) an underdrain pipe to collect *effluent* which shall
  (i) be in the interior of the filter at the lowest elevation,
  (ii) be positioned with the saw cuts down, and
  (iii) be connected to a pump vault or extend beyond the edge of the *sand filter* using solid pipe to connect to a subsequent *effluent* disposal method,

Intent: An underdrain pipe laid in the centre of the sand filter along the long axis quickly collects effluent.

(b) a layer of media, containing the underdrain piping, to a minimum depth of 200 mm (8 in.) which shall be
  (i) drain media in the lower 150 mm (6 in.), and
  (ii) underdrain media in the upper 50 mm (2 in.),

Intent: The media immediately under the sand layer (underdrain media, which is pea gravel as specified in Article 9.3.7.) should be small enough to support the sand media. Below this supporting layer, the underdrain piping should be enveloped in a course drain media (larger sized rock, Article 9.3.6.) to provide less restriction of effluent flow into the underdrain piping. The layers below the sand must be well drained to ensure aerobic conditions in the sand above.

(c) a minimum of 600 mm (2 ft.) of *sand filter* media installed over the *underdrain media*,
  (i) where medium *sand* is used, the *sand* shall be damp at the time of installation, and
  (ii) the top surface of the media shall be level,
(d) a pressurized *distribution lateral* system above the sand layer
  (i) having *distribution laterals* installed in clean *drain media* that covers the orifice shields and extends a minimum of 75 mm (3 in.) below the *distribution laterals*, or
  (ii) installed in a chamber system,
(e) a light *filter fabric* covering the top of the media or chamber system in which the pressure *distribution lateral* system is installed, and
(f) a soil cover over the top of the intermittent *sand filter* area that is
  (i) a depth of between 150 mm (6 in.) and 300 mm (1 ft.)
  (ii) a textural class no finer than loamy sand, and
  (iii) planted to grass or covered with a sod.

Intent: *The soil covering the sand filter must be very course to allow a free flow of air into the sand filter.*

Note: *Grass cover must be established as soon as possible to prevent erosion of the soil cover.*

9.2.6. A pressurized *distribution lateral pipe* system used in a *sand filter* shall have *distribution laterals*

(a) not smaller in *diameter* than 19 mm (¾ in.),
(b) spaced at not more than 762 mm (30 in.) centre to centre, and
(c) where chambers are used, provided in each chamber of a chamber system that
  (ii) is installed in accordance with the manufacturer's instructions,
  (iii) covers a minimum of 90% of the s*and* area, and
  (iv) is set on a minimum of 50 mm (2 in.) of *drain media* covering the sand layer.

9.2.7. *Distribution laterals* in a *sand filter* shall have orifices

(a) not smaller than 3.2 mm (c in.),
(b) not exceeding the maximum number of orifices specified per pipe *size* in Table A.1.A.,
(c) sized to provide even distribution of *effluent* at a minimum of 1500 mm (5 ft.) *pressure head* supply pressure,
(d) pointing upwards,

Intent: *Locating the orifice on the upper half of the pipe can help prevent clogging of the orifice by accumulated biological growths. Wherever the orifices are located, the orifices must be protected from rocks setting on the orifice and there must be room for the effluent to escape. The spraying effluent must not cause any erosion of the soil or sand around it.*

(e) protected by a device intended to prevent gravel from plugging the orifice and to encourage the distribution of *effluent* over a larger area, and
(f) spaced such that there is one orifice for each
  (i) 0.55 square metre (6 sq. ft.) of *sand* surface area in a medium *sand filter*, or
  (ii) 0.18 square metres (2 sq. ft.) of *sand* surface area in a course *sand filter*.

Intent: *Fine, even distribution of the effluent over the sand surface should provide better treatment by using the entire sand surface area and minimizes saturated flow.*

9.2.8. Where a *sand filter* supplies *effluent* to a *disposal field* by gravity, the base of the *sand filter* shall be above the ground surface level at the *disposal field*.

Intent: *A vertical separation between the invert of the underdrain piping outlet and the disposal field trench must exist that will not allow effluent to back up into the sand filter base saturating the sand before surfacing over the disposal trench.*

9.2.9. A *sand filter* constructed above ground or partially above ground, shall be provided with a surrounding *berm* having a slope not steeper than 1 vertical to 4 horizontal.

9.3. Requirements for Materials

9.3.1. Underdrain piping shall be not smaller than NPS 4" pipe with saw cuts halfway through at approximately 50 mm (2 in.) spacing.

9.3.2. Piping used for *distribution laterals* shall be
- (a) smooth, rigid plastic piping, and
- (b) *certified* for a pressure application by a testing agency recognized by the Standards Council of Canada, or acceptable to an *Administrator*.

9.3.3. A closed bottom *sand filter* container shall be
- (a) a reinforced concrete container,
- (b) constructed of materials other than concrete when equivalent performance and water tightness can be expected, or
- (c) a flexible membrane liner having properties that are at least equivalent to 0.762 mm or 762 μm thick (30 mil) unreinforced polyvinyl chloride (PVC).

9.3.4. The *sand filter* media shall be tested to determine conformance with the criteria outlined in Article 9.3.5. by a sieve analysis test
- (a) in accordance with ASTM C-136, Standard Methods for Sieve Analysis of Fine and Coarse Aggregate, and in conjunction and accordance with ASTM C- 1 17, Standard Test Method for Materials Finer than No. 200 Sieve in Mineral Aggregates by Washing, and
- (b) performed by a qualified third party.

9.3.5. The *sand* used as *sand filter* media shall be
- (a) in a course *sand filter,* well washed *sand* consisting of the following particle size
  - (i) 100 percent passing the 3/8" sieve,
  - (ii) 77 to 100 percent passing the No. 4 sieve,
  - (iii) 53 to 100 percent passing the No. 8 sieve,
  - (iv) 15 to 80 percent passing the No. 16 sieve,
  - (v) 3 to 50 percent passing the No. 30 sieve, and
  - (vi) none passing the No. 50 sieve,
- (b) in a medium *sand filter,* well washed *sand* consisting of the following particle size
  - (i) 100 percent passing the 3/8 inch sieve,
  - (ii) 95 percent to 100 percent passing the No. 4 sieve,
  - (iii) 80 percent to 100 percent passing the No. 8 sieve,
  - (iv) 45 percent to 85 percent passing the No. 16 sieve,
  - (v) 15 percent to 60 percent passing the No. 30 sieve,
  - (vi) 3 percent to 15 percent passing the No. 50 sieve, and
  - (vii) 4 percent or less passing the No. 100 sieve, or
- (c) alternate media that is
  - (i) of equivalent durability,
  - (ii) has a particle size consistent with the size required for use in a course sand filter or medium *sand filter,*

(iii) inert so that it will maintain its integrity and not collapse or disintegrate with time, and
(iv) not be detrimental to the performance of the intermittent *sand filter*.

9.3.6. *Drain media* shall be clean, washed gravel; clean, crushed rock; or other equivalent media for distributing *effluent*, having a minimum particle size of 12 mm (½ in.) and a maximum particle size of 37 mm (1½ in.).

9.3.7. *Underdrain media* shall be clean, washed pea gravel with particle size of the following consistency

(a) 100 percent passing the ½ inch sieve,
(b) 18 to 100 percent passing the 1/4 inch sieve,
(c) 5 to 75 percent passing the No. 4 sieve,
(d) 24 percent or less passing the No. 10 sieve,
(e) 2 percent or less passing the No. 16 sieve, and
(f) 1 percent or less passing the No. 100 sieve.

10 Open Discharge System

10.1. Design Standards

10.1.1. A system designed to discharge *effluent* to the surface of the ground shall contain the *effluent* on the *property*.

10.1.2. An *open discharge system* shall be designed to minimize *effluent* pooling on the ground surface during nonfreezing temperatures.

10.1.3. At the point of discharge of *effluent* to the surface, the soil the *effluent* is discharged onto shall be protected from erosion.

Intent: The design of the point of discharge must include landscaping to disperse the effluent allowing the quick evaporation and absorption of the effluent, and must protect the soil from erosion.

10.2. Installation Standards

10.2.1. An *effluent* discharge to the ground surface shall not be located within

(a) 45 m (150 ft.) of a *water source*,
(b) 45 m (150 ft.) of a *water course*,
(c) 45 m (150 ft.) of a *dwelling*, and
(d) 90 m (300 ft.) of a *property* line.

10.2.2. The soil receiving the *effluent* from an *open discharge system* shall have a percolation rate slower than 5 minutes per inch.

Intent: The soil the effluent is discharged onto must have a percolation rate slower than 5 minutes per inch as required in Article 7.1.5. The soil percolation rate may exceed 60 minutes per inch. Vertical separation distances of Article 7.1.6. must also be met.

10.3. Requirements for Materials

10.3.1. Piping used in an *open discharge system* shall be *certified* for that use or comply with Appendix A Piping Materials list for a pressure *effluent line*.

11 Sewage or Effluent Lagoons

11.1. Design Standards

11.1.1. A *lagoon* shall be designed to control seepage

(a) with a liner, consisting of porous material in which seepage is governed by Darcy's Law, that has a maximum hydraulic conductivity calculated by the following

Maximum~K SUB T~=~ { C~times~T } over { 2~+~T }

equation

where

K_T = maximum hydraulic conductivity of liner in the field, being at least one order of magnitude greater than the laboratory value, metres/second

T = required or proposed thickness of liner, metres

C = 5.2×10^{-9} metres/second,

or

(b) with a flexible polymeric membrane liner having a minimum thickness of .5 mm or 500 μm (20 mils) and

(i) membranes less than 1.5 mm or 1,500 μm (60 mils) thick are covered with a 300 mm layer of fine grained soil on the slopes to prevent liner damage, and

(ii) PVC and other membranes that are susceptible to weathering when exposed, shall be covered with soil on both the side slopes and bottom.

11.1.2. A *lagoon* shall be designed to provide for the evaporation of the *sewage* it receives.

11.1.3. A *lagoon* shall be designed to provide

(a) a *sewage* depth of not greater than 1500 mm (5 ft.),

(b) a 600mm (2 ft.) freeboard height above the design operating depth,

(c) a *berm* slope not steeper than 1 vertical to 3 horizontal,
(d) sufficient surface area to evaporate 125% of the expected annual volume of *sewage* discharged into it, and the design surface area shall
  (i) consider the net evaporation at the system location determined by the average annual precipitation and evaporation rates recorded by the Prairie Farm Rehabilitation Administration as reproduced in the Appendix A.2.A and Appendix A.2.B, and
  (ii) provide adequate storage to hold expected volumes of *sewage* during winter or other periods of low net evaporation, and

Note: Formulas to calculate the required size of the lagoon are included in Appendix A.2.C.

(e) provide a minimum 1800 mm (6 ft.) wide *berm* at the top.

Intent: Sewage lagoons for private systems built to this Standard are not meant to rely on periodic discharge and must be sized to evaporate all sewage. Annual precipitation and evaporative rates must be considered in the design.

11.1.4. The *sewage* shall enter the *lagoon* in a receiving pit, a minimum of 600 mm (2 ft.) below the bottom of the *lagoon*.

Intent: Entering the pipe in this pit should provide a constant 600 mm (2 ft.) cover of water over the pipe that should provide protection from frost. The pit should be approximately 1800 mm x 1800 mm x 1800 mm (6 ft. X 6 ft. X 6 ft.) deep with the pipe entering 1200 mm (4 ft.) above the bottom of the pit.

11.1.5. A *lagoon* serving other than a single family *dwelling* or duplex, shall be fenced.

Intent: The fence should be designed to preclude the entrance of children and to discourage trespassing. The fence should also serve to preclude the entrance of livestock. Fences should be located away from the outside toe of the berm to facilitate mowing and maintenance operations.

Where the lagoon is located near developed areas, a chain link fence may be required to prevent children from gaining entry. In addition, an access gate should be provided to allow entry of maintenance equipment, and this gate should be equipped with a lock to prevent entrance of unauthorized personnel. Signs should be posted to identify the lagoon and advise against trespassing.

11.2. Installation Standards

11.2.1.(1) A *lagoon* serving a single family *dwelling* or duplex shall not be located within
(a) 90 m (300 ft.) from a *water source*,
(b) 90 m (300 ft.) from a *water course*,
(c) 45 m (150 ft.) from a *dwelling*, and
(d) 30 m (100 ft.) from a *property* line.

(2) All measurements shall be taken from the outside of the *berm*, where the side slope of the *berm* intersects with the natural ground surface.

11.2.2.(1) A *lagoon* serving other than a single family *dwelling* or duplex shall not be located within
(a) 90 m (300 ft.) from a *dwelling* or *building* other than a farm *building*,

(b) 90 m (300 ft.) from a *water source*,
(c) 90 m (300 ft.) from a *water course*,
(d) 30 m (100 ft.) from a *property* line, and
(e) 90 m (300 ft.) from a numbered primary or secondary road.

(2) All measurements shall be taken from the outside of the *berm*, where the side slope of the *berm* intersects with the natural ground surface.

APPENDIX A

A.1. Pressure *Distribution Lateral Pipe* System Tables

A.1.A. Number of Orifices per *Distribution Lateral Pipe*

A.1.A. Number of Orifices in a *Distribution Lateral Pipe* *Suitable for 600 mm (2 ft.) to 1800 mm (6ft.) Pressure Head*

Orifice Diameter			*3.2mm (1/8")*					*4mm (5/32")*				
NPS Pipe Size of Distribution Lateral Pipe			*3/4" 19mm*	*1" 25mm*	*1-1/4" 32mm*	*1-1/2" 38mm*	*2" 51mm*	*3/4" 19mm*	*1" 25mm*	*1-1/4" 32mm*	*1-1/2" 38mm*	*2" 51mm*
***Distribution Lateral Pipe* Length**		***Minimum Number of Orifices***	***Maximum Number of Orifices***					***Maximum Number of Orifices***				
10 ft	*3 m*	***3***	*21*	*21*	*21*	*21*	*21*	*18*	*21*	*21*	*21*	*21*
15 ft	*4.6 m*	***4***	*23*	*31*	*31*	*31*	*31*	*15*	*31*	*31*	*31*	*31*
20 ft	*6.1 m*	***5***	*20*	*41*	*41*	*41*	*41*	*13*	*27*	*41*	*41*	*41*
25 ft	*7.6 m*	***6***	*17*	*37*	*51*	*51*	*51*	*11*	*24*	*43*	*51*	*51*
30 ft	*9.1 m*	***7***	*16*	*34*	*61*	*61*	*61*	*10*	*22*	*39*	*61*	*61*
35 ft	*10.7 m*	***8***	*15*	*31*	*56*	*71*	*71*	*9*	*20*	*36*	*58*	*71*
40 ft	*12.2 m*	***9***	*14*	*29*	*52*	*81*	*81*	*-*	*18*	*33*	*54*	*81*
45 ft	*13.7 m*	***10***	*13*	*27*	*49*	*79*	*91*	*-*	*17*	*31*	*50*	*91*
50 ft	*15.2 m*	***11***	*12*	*26*	*46*	*74*	*101*	*-*	*16*	*29*	*48*	*101*
55 ft	*16.8 m*	***12***	*-*	*24*	*44*	*71*	*111*	*-*	*16*	*28*	*45*	*96*
60 ft	*18.3 m*	***13***	*-*	*23*	*42*	*67*	*121*	*-*	*15*	*27*	*43*	*92*
65 ft	*19.8 m*	***14***	*-*	*22*	*40*	*64*	*131*	*-*	*-*	*26*	*41*	*88*
70 ft	*21.3 m*	***15***	*-*	*21*	*38*	*62*	*132*	*-*	*-*	*25*	*40*	*84*
75 ft	*22.9 m*	***16***	*-*	*21*	*37*	*60*	*127*	*-*	*-*	*24*	*38*	*81*
80 ft	*24.4 m*	***17***	*-*	*20*	*36*	*58*	*123*	*-*	*-*	*23*	*37*	*79*
85 ft	*25.9 m*	***18***	*-*	*19*	*35*	*56*	*119*	*-*	*-*	*22*	*36*	*76*
90 ft	*27.4 m*	***19***	*-*	*-*	*33*	*54*	*115*	*-*	*-*	*21*	*35*	*74*
95 ft	*29 m*	***20***	*-*	*-*	*32*	*52*	*112*	*-*	*-*	*21*	*34*	*72*
100 ft	*30.5 m*	***21***	*-*	*-*	*32*	*51*	*109*	*-*	*-*	*-*	*33*	*70*
105 ft	*32 m*	***22***	*-*	*-*	*31*	*50*	*106*	*-*	*-*	*-*	*32*	*68*
110 ft	*33.5 m*	***23***	*-*	*-*	*30*	*48*	*103*	*-*	*-*	*-*	*31*	*66*
115 ft	*35.1 m*	***24***	*-*	*-*	*29*	*47*	*101*	*-*	*-*	*-*	*30*	*65*
120 ft	*36.6 m*	***25***	*-*	*-*	*29*	*46*	*99*	*-*	*-*	*-*	*30*	*63*
125 ft	*38.1 m*	***26***	*-*	*-*	*28*	*45*	*96*	*-*	*-*	*-*	*29*	*62*
130 ft	*39.6 m*	***27***	*-*	*-*	*-*	*44*	*94*	*-*	*-*	*-*	*28*	*60*
135 ft	*41.1 m*	***28***	*-*	*-*	*-*	*43*	*92*	*-*	*-*	*-*	*-*	*59*
140 ft	*42.7 m*	***29***	*-*	*-*	*-*	*43*	*91*	*-*	*-*	*-*	*-*	*58*
145 ft	*44.2 m*	***30***	*-*	*-*	*-*	*42*	*89*	*-*	*-*	*-*	*-*	*57*
150 ft	*45.7 m*	***31***	*-*	*-*	*-*	*41*	*87*	*-*	*-*	*-*	*-*	*56*
160 ft	*48.8 m*	***33***	*-*	*-*	*-*	*40*	*84*	*-*	*-*	*-*	*-*	*54*
170 ft	*51.8 m*	***35***	*-*	*-*	*-*	*38*	*82*	*-*	*-*	*-*	*-*	*52*
180 ft	*54.9 m*	***37***	*-*	*-*	*-*	*-*	*79*	*-*	*-*	*-*	*-*	*51*
190 ft	*57.9 m*	***39***	*-*	*-*	*-*	*-*	*77*	*-*	*-*	*-*	*-*	*49*
200 ft	*61 m*	***41***	*-*	*-*	*-*	*-*	*75*	*-*	*-*	*-*	*-*	*48*
225 ft	*68.6 m*	***46***	*-*	*-*	*-*	*-*	*70*	*-*	*-*	*-*	*-*	*-*
250 ft	*76.2 m*	***51***	*-*	*-*	*-*	*-*	*66*	*-*	*-*	*-*	*-*	*-*

(continued)

Table A.1A Continued

A.1.A. Number of Orifices in a Distribution Lateral Pipe Suitable for 600 mm (2 ft.) to 1800 mm (6ft.) Pressure Head													
Orifice Diameter			***4.8mm (3/16")***					***5.6mm (7/32")***					
NPS Pipe Size of Distribution Lateral Pipe			*3/4" 19mm*	*1" 25mm*	*1-1/4" 32mm*	*1-1/2" 38mm*	*2" 51mm*	*3/4" 19mm*	*1" 25mm*	*1-1/4" 32mm*	*1-1/2" 38mm*	*2" 51mm*	
***Distribution Lateral Pipe* Length**		***Minimum Number of Orifices***	***Maximum Number of Orifices***					***Maximum Number of Orifices***					
10 ft	*3 m*	***3***	*13*	*21*	*21*	*21*	*21*	*9*	*20*	*21*	*21*	*21*	
15 ft	*4.6 m*	***4***	*10*	*22*	*31*	*31*	*31*	*8*	*16*	*29*	*31*	*31*	
20 ft	*6.1 m*	***5***	*9*	*19*	*34*	*41*	*41*	*6*	*14*	*25*	*40*	*41*	
25 ft	*7.6 m*	***6***	*8*	*17*	*30*	*48*	*51*	-	*12*	*22*	*35*	*51*	
30 ft	*9.1 m*	***7***	-	*15*	*27*	*43*	*61*	-	*11*	*20*	*32*	*61*	
35 ft	*10.7 m*	***8***	-	*14*	*25*	*40*	*71*	-	*10*	*18*	*29*	*63*	
40 ft	*12.2 m*	***9***	-	*13*	*23*	*37*	*79*	-	-	*17*	*27*	*58*	
45 ft	*13.7 m*	***10***	-	*12*	*22*	*35*	*74*	-	-	*16*	*26*	*55*	
50 ft	*15.2 m*	***11***	-	-	*20*	*33*	*70*	-	-	*15*	*24*	*52*	
55 ft	*16.8 m*	***12***	-	-	*19*	*31*	*67*	-	-	*14*	*23*	*49*	
60 ft	*18.3 m*	***13***	-	-	*19*	*30*	*64*	-	-	*14*	*22*	*47*	
65 ft	*19.8 m*	***14***	-	-	*18*	*29*	*61*	-	-	-	*21*	*45*	
70 ft	*21.3 m*	***15***	-	-	*17*	*28*	*59*	-	-	-	*20*	*43*	
75 ft	*22.9 m*	***16***	-	-	-	*27*	*56*	-	-	-	*19*	*42*	
80 ft	*24.4 m*	***17***	-	-	-	*26*	*55*	-	-	-	*19*	*40*	
85 ft	*25.9 m*	***18***	-	-	-	*25*	*53*	-	-	-	-	*39*	
90 ft	*27.4 m*	***19***	-	-	-	*24*	*51*	-	-	-	-	*38*	
95 ft	*29 m*	***20***	-	-	-	*23*	*50*	-	-	-	-	*37*	
100 ft	*30.5 m*	***21***	-	-	-	*23*	*48*	-	-	-	-	*36*	
105 ft	*32 m*	***22***	-	-	-	-	*47*	-	-	-	-	*35*	
110 ft	*33.5 m*	***23***	-	-	-	-	*46*	-	-	-	-	*34*	
115 ft	*35.1 m*	***24***	-	-	-	-	*45*	-	-	-	-	*33*	
120 ft	*36.6 m*	***25***	-	-	-	-	*44*	-	-	-	-	*32*	
125 ft	*38.1 m*	***26***	-	-	-	-	*43*	-	-	-	-	*31*	
130 ft	*39.6 m*	***27***	-	-	-	-	*42*	-	-	-	-	*31*	
135 ft	*41.1 m*	***28***	-	-	-	-	*41*	-	-	-	-	*30*	
140 ft	*42.7 m*	***29***	-	-	-	-	*40*	-	-	-	-	*30*	
145 ft	*44.2 m*	***30***	-	-	-	-	*40*	-	-	-	-	-	
150 ft	*45.7 m*	***31***	-	-	-	-	*39*	-	-	-	-	-	
160 ft	*48.8 m*	***33***	-	-	-	-	*38*	-	-	-	-	-	
170 ft	*51.8 m*	***35***	-	-	-	-	*36*	-	-	-	-	-	
180 ft	*54.9 m*	***37***	-	-	-	-	-	-	-	-	-	-	
190 ft	*57.9 m*	***39***	-	-	-	-	-	-	-	-	-	-	
200 ft	*61 m*	***41***	-	-	-	-	-	-	-	-	-	-	
225 ft	*68.6 m*	***46***	-	-	-	-	-	-	-	-	-	-	
250 ft	*76.2 m*	***51***	-	-	-	-	-	-	-	-	-	-	

(continued)

Table A.1.A. Continued

A.1.A. Number of Orifices in a Distribution Lateral Pipe Suitable for 600 mm (2 ft.) to 1800 mm (6ft.) Pressure Head												
Orifice Diameter			***6.4mm (1/4")***					***7.1mm (9/32")***				
NPS Pipe Size of Distribution Lateral Pipe			*3/4" 19mm*	*1" 25mm*	*1-1/4" 32mm*	*1-1/2" 38mm*	*2" 51mm*	*3/4" 19mm*	*1" 25mm*	*1-1/4" 32mm*	*1-1/2" 38mm*	*2" 51mm*
***Distribution Lateral Pipe* Length**		***Minimum Number of Orifices***	***Maximum Number of Orifices***					***Maximum Number of Orifices***				
10 ft	*3 m*	***3***	*7*	*15*	*21*	*21*	*21*	*6*	*12*	*21*	*21*	*21*
15 ft	*4.6 m*	***4***	*6*	*12*	*22*	*31*	*31*	*5*	*10*	*17*	*28*	*31*
20 ft	*6.1 m*	***5***	*-*	*11*	*19*	*30*	*41*	*-*	*8*	*15*	*24*	*41*
25 ft	*7.6 m*	***6***	*-*	*9*	*17*	*27*	*51*	*-*	*7*	*13*	*21*	*45*
30 ft	*9.1 m*	***7***	*-*	*8*	*15*	*24*	*52*	*-*	*-*	*12*	*19*	*41*
35 ft	*10.7 m*	***8***	*-*	*-*	*14*	*23*	*48*	*-*	*-*	*11*	*18*	*38*
40 ft	*12.2 m*	***9***	*-*	*-*	*13*	*21*	*45*	*-*	*-*	*10*	*17*	*35*
45 ft	*13.7 m*	***10***	*-*	*-*	*12*	*20*	*42*	*-*	*-*	*-*	*16*	*33*
50 ft	*15.2 m*	***11***	*-*	*-*	*12*	*19*	*40*	*-*	*-*	*-*	*15*	*31*
55 ft	*16.8 m*	***12***	*-*	*-*	*-*	*18*	*38*	*-*	*-*	*-*	*14*	*30*
60 ft	*18.3 m*	***13***	*-*	*-*	*-*	*17*	*36*	*-*	*-*	*-*	*-*	*28*
65 ft	*19.8 m*	***14***	*-*	*-*	*-*	*16*	*34*	*-*	*-*	*-*	*-*	*27*
70 ft	*21.3 m*	***15***	*-*	*-*	*-*	*-*	*33*	*-*	*-*	*-*	*-*	*26*
75 ft	*22.9 m*	***16***	*-*	*-*	*-*	*-*	*32*	*-*	*-*	*-*	*-*	*25*
80 ft	*24.4 m*	***17***	*-*	*-*	*-*	*-*	*31*	*-*	*-*	*-*	*-*	*24*
85 ft	*25.9 m*	***18***	*-*	*-*	*-*	*-*	*30*	*-*	*-*	*-*	*-*	*23*
90 ft	*27.4 m*	***19***	*-*	*-*	*-*	*-*	*29*	*-*	*-*	*-*	*-*	*23*
95 ft	*29 m*	***20***	*-*	*-*	*-*	*-*	*28*	*-*	*-*	*-*	*-*	*22*
100 ft	*30.5 m*	***21***	*-*	*-*	*-*	*-*	*27*	*-*	*-*	*-*	*-*	*-*
105 ft	*32 m*	***22***	*-*	*-*	*-*	*-*	*26*	*-*	*-*	*-*	*-*	*-*
110 ft	*33.5 m*	***23***	*-*	*-*	*-*	*-*	*26*	*-*	*-*	*-*	*-*	*-*
115 ft	*35.1 m*	***24***	*-*	*-*	*-*	*-*	*25*	*-*	*-*	*-*	*-*	*-*
120 ft	*36.6 m*	***25***	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*
125 ft	*38.1 m*	***26***	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*
130 ft	*39.6 m*	***27***	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*
135 ft	*41.1 m*	***28***	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*
140 ft	*42.7 m*	***29***	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*
145 ft	*44.2 m*	***30***	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*
150 ft	*45.7 m*	***31***	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*
160 ft	*48.8 m*	***33***	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*
170 ft	*51.8 m*	***35***	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*
180 ft	*54.9 m*	***37***	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*
190 ft	*57.9 m*	***39***	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*
200 ft	*61 m*	***41***	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*
225 ft	*68.6 m*	***46***	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*
250 ft	*76.2 m*	***51***	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*

(continued)

Table A.1.A. Continued

A.1.A. Number Of Orifices In A Distribution Lateral Pipe Suitable for 600 mm (2ft.) to 1800 mm (6ft.) Pressure Head							
Orifice Diameter			***7.9mm (5/16")***				
NPS Pipe Size of Distribution Lateral Pipe			*3/4" 19mm*	*1" 25mm*	*1-1/4" 32mm*	*1-1/2" 38mm*	*2" 51mm*
***Distribution Lateral Pipe* Length**		***Minimum Number of***	***Maximum Number of Orifices***				
10 ft	*3 m*	***3***	*5*	*10*	*18*	*21*	*21*
15 ft	*4.6 m*	***4***	-	*8*	*14*	*23*	*31*
20 ft	*6.1 m*	***5***	-	*7*	*12*	*20*	*41*
25 ft	*7.6 m*	***6***	-	-	*11*	*17*	*37*
30 ft	*9.1 m*	***7***	-	-	*10*	*16*	*33*
35 ft	*10.7 m*	***8***	-	-	*9*	*14*	*31*
40 ft	*12.2 m*	***9***	-	-	-	*13*	*29*
45 ft	*13.7 m*	***10***	-	-	-	*13*	*27*
50 ft	*15.2 m*	***11***	-	-	-	*12*	*25*
55 ft	*16.8 m*	***12***	-	-	-	-	*24*
60 ft	*18.3 m*	***13***	-	-	-	-	*23*
65 ft	*19.8 m*	***14***	-	-	-	-	*22*
70 ft	*21.3 m*	***15***	-	-	-	-	*21*
75 ft	*22.9 m*	***16***	-	-	-	-	*20*
80 ft	*24.4 m*	***17***	-	-	-	-	*20*
85 ft	*25.9 m*	***18***	-	-	-	-	*19*
90 ft	*27.4 m*	***19***	-	-	-	-	-
95 ft	*29 m*	***20***	-	-	-	-	-
100 ft	*30.5 m*	***21***	-	-	-	-	-
105 ft	*32 m*	***22***	-	-	-	-	-
110 ft	*33.5 m*	***23***	-	-	-	-	-
115 ft	*35.1 m*	***24***	-	-	-	-	-
120 ft	*36.6 m*	***25***	-	-	-	-	-
125 ft	*38.1 m*	***26***	-	-	-	-	-
130 ft	*39.6 m*	***27***	-	-	-	-	-
135 ft	*41.1 m*	***28***	-	-	-	-	-
140 ft	*42.7 m*	***29***	-	-	-	-	-
145 ft	*44.2 m*	***30***	-	-	-	-	-
150 ft	*45.7 m*	***31***	-	-	-	-	-
160 ft	*48.8 m*	***33***	-	-	-	-	-
170 ft	*51.8 m*	***35***	-	-	-	-	-
180 ft	*54.9 m*	***37***	-	-	-	-	-
190 ft	*57.9 m*	***39***	-	-	-	-	-
200 ft	*61 m*	***41***	-	-	-	-	-
225 ft	*68.6 m*	***46***	-	-	-	-	-
250 ft	*76.2 m*	***51***	-	-	-	-	-

A.1.B. Orifice Discharges

A.1.B. Orifice Discharges in Litres per Minute

***Pressure Head* mm (ft.)**	***Orifice Diameter in mm (in.)***								
	3.2 mm (1/8")	*4.0 mm (5/32")*	*4.8 mm (3/16")*	*5.6 mm (7/32")*	*6.4 mm (1/4")*	*7.1 mm (9/32")*	*7.9 mm (5/16")*	*8.7 mm*	*9.5 mm*
600 mm	*0.98*	*1.54*	*2.22*	*3.02*	*3.94*	*4.97*	*6.16*	*7.45*	*8.86*
750 mm	*1.11*	*1.73*	*2.49*	*3.39*	*4.43*	*5.6*	*6.93*	*8.38*	*9.97*
900 mm	*1.21*	*1.9*	*2.73*	*3.72*	*4.86*	*6.13*	*7.59*	*9.18*	*10.92*
1050 mm	*1.31*	*2.04*	*2.94*	*4*	*5.23*	*6.6*	*8.17*	*9.88*	*11.76*
1200 mm	*1.39*	*2.18*	*3.13*	*4.26*	*5.57*	*7.03*	*8.7*	*10.53*	*12.53*
1350 mm	*1.48*	*2.31*	*3.32*	*4.52*	*5.91*	*7.46*	*9.23*	*11.17*	*13.3*
1500 mm	*1.56*	*2.44*	*3.52*	*4.79*	*6.25*	*7.89*	*9.77*	*11.82*	*14.06*
1800 mm	*1.71*	*2.67*	*3.86*	*5.25*	*6.85*	*8.64*	*10.7*	*12.95*	*15.4*

based on $q = 0.207Cd^2h^{1/2}$

where q = litres per minute flow rate

C = coefficient of discharge (0.60)

d = diameter in mm

h = *pressure head* in metres

Use A Minimum 600 mm (2 ft.) of *Pressure Head* .

Orifice Discharges in Imperial Gallons per Minute

***Pressure Head* Feet**	***Orifice Diameter* in Inches**								
	1/8 0.1250	5/32 0.1563	3/16 0.1875	7/32 0.2188	1/4 0.2500	9/32 0.2813	5/16 0.3125	11/32 0.3438	3/8 0.3750
2.0 ft.	0.22	0.34	0.49	0.66	0.87	1.09	1.35	1.64	1.95
2.5 ft.	0.24	0.38	0.55	0.75	0.98	1.23	1.52	1.84	2.19
3.0 ft.	0.27	0.42	0.6	0.82	1.07	1.35	1.67	2.02	2.4
3.5 ft.	0.29	0.45	0.65	0.88	1.15	1.45	1.8	2.17	2.59
4.0 ft.	0.31	0.48	0.69	0.94	1.23	1.55	1.91	2.32	2.76
4.5 ft.	0.33	0.51	0.73	1	1.3	1.64	2.03	2.46	2.93
5.0 ft.	0.34	0.54	0.77	1.05	1.38	1.74	2.15	2.6	3.09
6.0 ft	0.37	0.59	0.85	1.16	1.52	1.91	2.37	2.86	3.4

based on $q = 15.8Cd^2h^{1/2}$

where q = Imperial gallons per minute flow rate

C = coefficient of discharge (0.60)

d = *diameter* in inches

h = *pressure head* in feet

Use A Minimum 2.0 ft. Of *Pressure Head*

Note: Some pump manufacturers rate pump capacities in US gallons.
Pump ratings in US gallons must be converted to Imperial gallons.
US Gallons x 0.83 = Imperial Gallons

Note: This table is used to determine the flow rate of an orifice size at a selected pressure head. To determine the total flow, multiply the flow rate for an orifice by the number of orifices in the distribution lateral pipes.

A.1.C.1. Friction Loss in PVC Schedule 40 Pipe - Gallons

A.1.C.1. Friction Loss in Feet *Pressure Head* per 100 Feet in Schedule 40 PVC Pipe (C=150)													
Flow in Imp gpm	**Nominal Pipe Diameter (in.)**						**Nominal Pipe Diameter (in.)**						**Flow in US gpm**
	3/4	**1**	**1 1/4**	**1 ½**	**2**	**3**	**3/4**	**1**	**1 1/4**	**1 1/2**	**2**	**3**	
1	0.35	0.11	0.03	0.01	0.00	0.00	0.25	0.08	0.02	0.01	0.00	0.00	**1**
2	1.27	0.39	0.10	0.05	0.01	0.00	0.91	0.28	0.07	0.03	0.01	0.00	**2**
3	2.69	0.83	0.22	0.10	0.03	0.00	1.92	0.59	0.16	0.07	0.02	0.00	**3**
4	4.59	1.42	0.37	0.18	0.05	0.01	3.27	1.01	0.27	0.13	0.04	0.01	**4**
5	6.93	2.14	0.56	0.27	0.08	0.01	4.95	1.53	0.40	0.19	0.06	0.01	**5**
6	9.71	3.00	0.79	0.37	0.11	0.02	6.93	2.14	0.56	0.27	0.08	0.01	**6**
7	12.92	3.99	1.05	0.50	0.15	0.02	9.22	2.85	0.75	0.35	0.11	0.02	**7**
8	16.54	5.11	1.35	0.64	0.19	0.03	11.80	3.65	0.96	0.45	0.13	0.02	**8**
9	20.56	6.35	1.67	0.79	0.23	0.03	14.67	4.53	1.19	0.56	0.17	0.02	**9**
10	24.99	7.72	2.03	0.96	0.28	0.04	17.83	5.51	1.45	0.69	0.20	0.03	**10**
11	29.80	9.21	2.42	1.15	0.34	0.05	21.27	6.57	1.73	0.82	0.24	0.04	**11**
12	35.01	10.82	2.85	1.35	0.40	0.06	24.99	7.72	2.03	0.96	0.28	0.04	**12**
13	40.60	12.54	3.30	1.56	0.46	0.07	28.97	8.95	2.36	1.11	0.33	0.05	**13**
14		14.38	3.79	1.79	0.53	0.08	33.23	10.27	2.70	1.28	0.38	0.06	**14**
15		16.34	4.30	2.03	0.60	0.09	37.76	11.66	3.07	1.45	0.43	0.06	**15**
16		18.42	4.85	2.29	0.68	0.10	42.54	13.14	3.46	1.63	0.48	0.07	**16**
17		20.60	5.42	2.56	0.76	0.11		14.70	3.87	1.83	0.54	0.08	**17**
18		22.90	6.03	2.85	0.84	0.13		16.34	4.30	2.03	0.60	0.09	**18**
19		25.31	6.66	3.15	0.93	0.14		18.06	4.76	2.25	0.67	0.10	**19**
20		27.83	7.33	3.46	1.03	0.15		19.86	5.23	2.47	0.73	0.11	**20**
25		42.05	11.07	5.23	1.55	0.23		30.01	7.90	3.73	1.11	0.16	**25**
30			15.51	7.33	2.17	0.32		42.05	11.07	5.23	1.55	0.23	**30**
35			20.63	9.75	2.89	0.43			14.73	6.96	2.06	0.31	**35**
40			26.42	12.48	3.70	0.55			18.85	8.91	2.64	0.39	**40**
45			32.85	15.52	4.60	0.68			23.44	11.07	3.28	0.49	**45**
50			39.92	18.85	5.59	0.83			28.49	13.46	3.99	0.59	**50**
55				22.49	6.67	0.99			33.98	16.05	4.76	0.71	**55**
60				26.42	7.83	1.16			39.92	18.85	5.59	0.83	**60**
65				30.64	9.08	1.35				21.86	6.48	0.96	**65**
70				35.14	10.42	1.55				25.08	7.44	1.10	**70**
75				39.92	11.84	1.76				28.49	8.45	1.25	**75**
80					13.34	1.98				32.10	9.52	1.41	**80**
85					14.92	2.22				35.91	10.65	1.58	**85**
90					16.58	2.46				39.92	11.84	1.76	**90**
95					18.33	2.72					13.08	1.94	**95**
100					20.15	2.99					14.38	2.14	**100**
125					30.45	4.52					21.73	3.23	**125**
150					42.67	6.34					30.45	4.52	**150**
175						8.43					40.50	6.01	**175**
200						10.79						7.70	**200**

250						16.30						11.63	**250**
300						22.84						16.30	**300**

A.1.C.2. Friction Loss in PVC Schedule 40 Pipe - Metric

A.1.C.2. Friction Loss In mm *Pressure Head* per 30.5 Metres in Schedule 40 PVC Pipe

Flow	**Nominal Pipe Diameter (in.)**					
L/min	**3/4**	**1**	**1 1/4**	**1 1/2**	**2**	**3**
5	128	40	10	5	1	0
10	461	142	38	18	5	1
15	977	302	79	38	11	2
20	1,663	514	135	64	19	3
25	2,512	776	204	97	29	4
30	3,520	1,088	286	135	40	6
35	4,682	1,446	381	180	53	8
40	5,994	1,852	488	230	68	10
45	7,453	2,303	606	286	85	13
50	9,058	2,798	737	348	103	15
55	10,804	3,338	879	415	123	18
60	12,691	3,921	1,032	488	145	21
65	14,717	4,546	1,197	566	168	25
70		5,214	1,373	649	192	29
75		5,924	1,560	737	218	32
80		6,676	1,758	830	246	37
85		7,468	1,967	929	275	41
90		8,301	2,186	1,033	306	45
95		9,174	2,416	1,141	338	50
100		10,087	2,656	1,255	372	55
120		14,134	3,722	1,758	521	77
140			4,950	2,338	693	103
160			6,337	2,993	888	132
180			7,880	3,722	1,104	164
200			9,576	4,523	1,341	199
220			11,422	5,395	1,600	238
240				6,338	1,879	279
260				7,349	2,179	324
280				8,429	2,499	371
300				9,577	2,840	422
320				10,791	3,200	475
340					3,579	532
360					3,979	591
380					4,397	653
400					4,835	718
450					6,012	893
500					7,306	1,085
550					8,714	1,294
600						1,520
700						2,022
800						2,588

900						3,218

A.1.C.3. Friction Loss in Polyethylene Pipe - Gallons

A.1.C.3. Friction Loss in Feet *Pressure Head* Per 100 Feet in Polyethylene Pipe, "Carlon" (C=147)													
Flow	**Nominal Pipe Diameter (in.)**						**Nominal Pipe Diameter (in.)**						**Flow**
Imp	**3/4**	**1**	**1 1/4**	**1 1/2**	**2**	**3**	**3/4**	**1**	**1 1/4**	**1 1/2**	**2**	**3**	**US gpm**
1	0.37	0.11	0.03	0.01	0.00	0.00	0.26	0.08	0.02	0.01	0.00	0.00	**1**
2	1.32	0.41	0.11	0.05	0.02	0.00	0.94	0.29	0.08	0.04	0.01	0.00	**2**
3	2.80	0.86	0.23	0.11	0.03	0.00	2.00	0.62	0.16	0.08	0.02	0.00	**3**
4	4.76	1.47	0.39	0.18	0.05	0.01	3.40	1.05	0.28	0.13	0.04	0.01	**4**
5	7.19	2.22	0.59	0.28	0.08	0.01	5.13	1.59	0.42	0.20	0.06	0.01	**5**
6	10.08	3.11	0.82	0.39	0.11	0.02	7.19	2.22	0.59	0.28	0.08	0.01	**6**
7	13.41	4.14	1.09	0.52	0.15	0.02	9.57	2.96	0.78	0.37	0.11	0.02	**7**
8	17.17	5.30	1.40	0.66	0.20	0.03	12.25	3.78	1.00	0.47	0.14	0.02	**8**
9	21.34	6.59	1.74	0.82	0.24	0.04	15.23	4.71	1.24	0.59	0.17	0.03	**9**
10	25.94	8.01	2.11	1.00	0.30	0.04	18.51	5.72	1.51	0.71	0.21	0.03	**10**
11	30.94	9.56	2.52	1.19	0.35	0.05	22.08	6.82	1.80	0.85	0.25	0.04	**11**
12	36.34	11.23	2.96	1.40	0.41	0.06	25.94	8.01	2.11	1.00	0.30	0.04	**12**
13	42.14	13.02	3.43	1.62	0.48	0.07	30.08	9.29	2.45	1.16	0.34	0.05	**13**
14		14.93	3.93	1.86	0.55	0.08	34.50	10.66	2.81	1.33	0.39	0.06	**14**
15		16.97	4.47	2.11	0.63	0.09	39.19	12.11	3.19	1.51	0.45	0.07	**15**
16		19.12	5.03	2.38	0.71	0.10	44.16	13.64	3.59	1.70	0.50	0.07	**16**
17		21.39	5.63	2.66	0.79	0.12		15.26	4.02	1.90	0.56	0.08	**17**
18		23.77	6.26	2.96	0.88	0.13		16.97	4.47	2.11	0.63	0.09	**18**
19		26.27	6.92	3.27	0.97	0.14		18.75	4.94	2.33	0.69	0.10	**19**
20		28.89	7.61	3.59	1.07	0.16		20.62	5.43	2.56	0.76	0.11	**20**
25		43.65	11.49	5.43	1.61	0.24		31.15	8.20	3.87	1.15	0.17	**25**
30			16.11	7.61	2.26	0.33		43.65	11.49	5.43	1.61	0.24	**30**
35			21.42	10.12	3.00	0.45			15.29	7.22	2.14	0.32	**35**
40			27.42	12.95	3.84	0.57			19.57	9.24	2.74	0.41	**40**
45			34.10	16.11	4.78	0.71			24.34	11.50	3.41	0.51	**45**
50			41.44	19.57	5.80	0.86			29.57	13.97	4.14	0.62	**50**
55				23.35	6.92	1.03			35.28	16.66	4.94	0.73	**55**
60				27.42	8.13	1.21			41.44	19.57	5.80	0.86	**60**
65				31.80	9.43	1.40				22.70	6.73	1.00	**65**
70				36.47	10.81	1.61				26.03	7.72	1.15	**70**
75				41.44	12.29	1.82				29.58	8.77	1.30	**75**
80					13.85	2.06				33.33	9.88	1.47	**80**
85					15.49	2.30				37.28	11.05	1.64	**85**
90					17.22	2.56				41.44	12.29	1.82	**90**
95					19.03	2.83					13.58	2.02	**95**
100					20.92	3.11					14.93	2.22	**100**
125					31.61	4.69					22.56	3.35	**125**
150					44.29	6.58					31.61	4.69	**150**
175						8.75					42.05	6.24	**175**
200						11.20						7.99	**200**
250						16.92						12.08	**250**
300						23.71						16.92	**300**

A.1.C.4. Friction Loss in Polyethylene Pipe - Metric

A.1.C.4 Friction Loss in mm *Pressure Head* per 30.5 Metres in Polyethylene Pipe, Carlon =

Flow	*Nominal Pipe Diameter (in.)*					
L/min	*3/4*	*1*	*1 1/4*	*1 1/2*	*2*	*3*
5	*133*	*41*	*11*	*5*	*2*	*0*
10	*479*	*148*	*39*	*18*	*5*	*1*
15	*1,014*	*313*	*82*	*39*	*12*	*2*
20	*1,726*	*533*	*140*	*66*	*20*	*3*
25	*2,608*	*806*	*212*	*100*	*30*	*4*
30	*3,654*	*1,129*	*297*	*140*	*42*	*6*
35	*4,860*	*1,502*	*395*	*187*	*55*	*8*
40	*6,222*	*1,922*	*506*	*239*	*71*	*11*
45	*7,737*	*2,390*	*629*	*297*	*88*	*13*
50	*9,402*	*2,905*	*765*	*361*	*107*	*16*
55	*11,215*	*3,465*	*912*	*431*	*128*	*19*
60	*13,174*	*4,070*	*1,072*	*506*	*150*	*22*
65	*15,277*	*4,720*	*1,243*	*587*	*174*	*26*
70		*5,413*	*1,425*	*673*	*200*	*30*
75		*6,150*	*1,619*	*765*	*227*	*34*
80		*6,930*	*1,825*	*862*	*256*	*38*
85		*7,752*	*2,041*	*964*	*286*	*42*
90		*8,617*	*2,269*	*1,072*	*318*	*47*
95		*9,524*	*2,508*	*1,185*	*351*	*52*
100		*10,471*	*2,757*	*1,303*	*386*	*57*
120		*14,672*	*3,864*	*1,825*	*541*	*80*
140			*5,139*	*2,427*	*720*	*107*
160			*6,579*	*3,107*	*921*	*137*
180			*8,180*	*3,864*	*1,146*	*170*
200			*9,941*	*4,696*	*1,392*	*207*
220			*11,857*	*5,601*	*1,661*	*247*
240				*6,579*	*1,951*	*290*
260				*7,629*	*2,262*	*336*
280				*8,750*	*2,594*	*385*
300				*9,942*	*2,948*	*438*
320				*11,202*	*3,321*	*493*
340					*3,716*	*552*
360					*4,130*	*613*
380					*4,565*	*678*
400					*5,019*	*745*
450					*6,241*	*927*
500					*7,584*	*1,126*
550					*9,046*	*1,343*
600						*1,578*
700						*2,099*
800						*2,687*
900						*3,341*

A.1.C.5. Friction Loss for Insert Fittings

Exp
Pi Si (in
½
3/
1
1 1
1 1
2
3

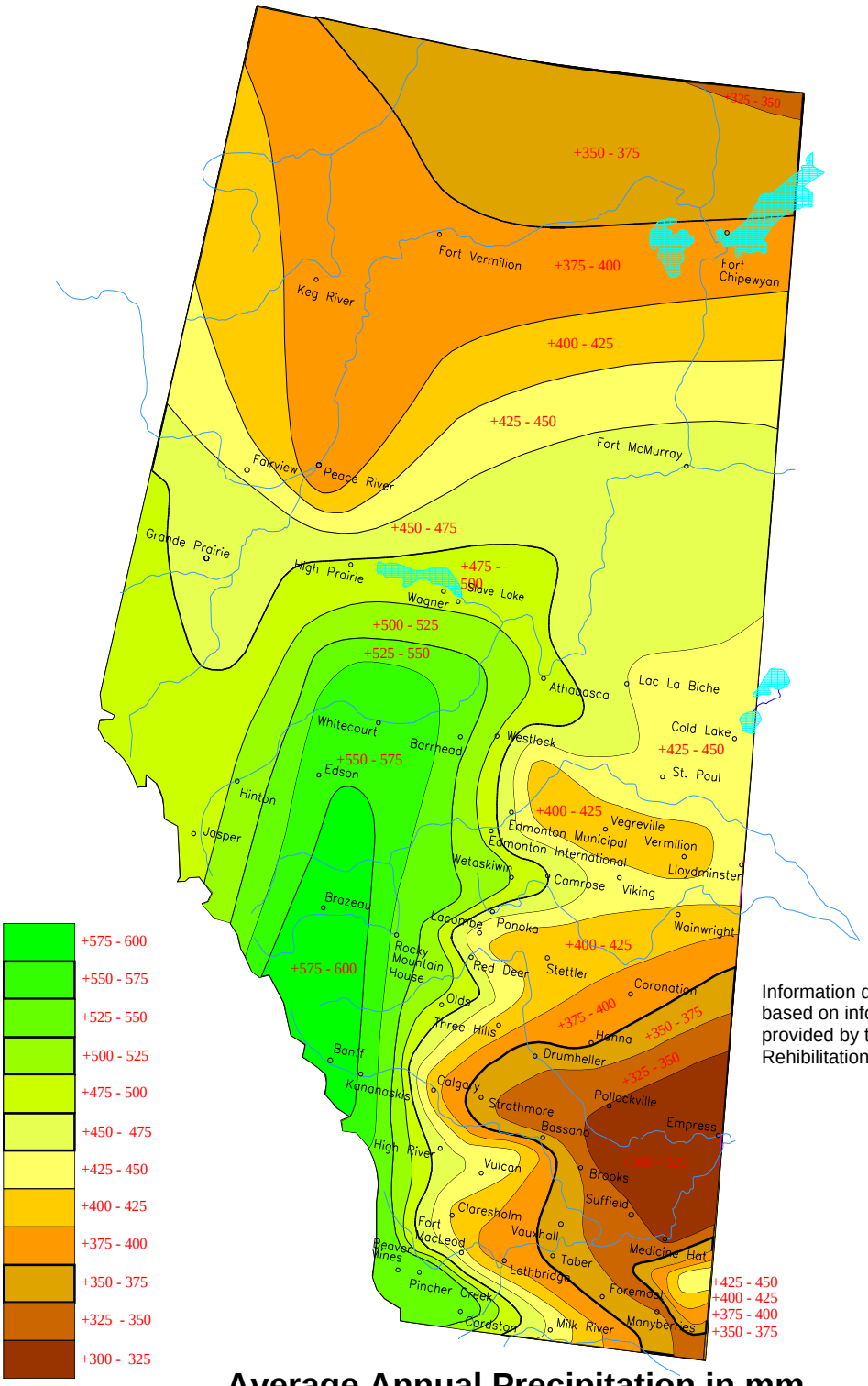
Note: The following formula was used to calculate pressure head loss in Tables A.1.C.1. to Table A.1.C.4.

Friction loss in feet of pressure head
= ~Length ~of~ pipe~ LEFT ({ 3.55 * (Imp~gpm~flow*1.2) } OVER { coefficient * dia. SUP { 2.63 } } RIGHT) SUP { 1.85 }
Coefficients:

PVC	150
Polyethylene	147

A.2. Lagoon System Design Data

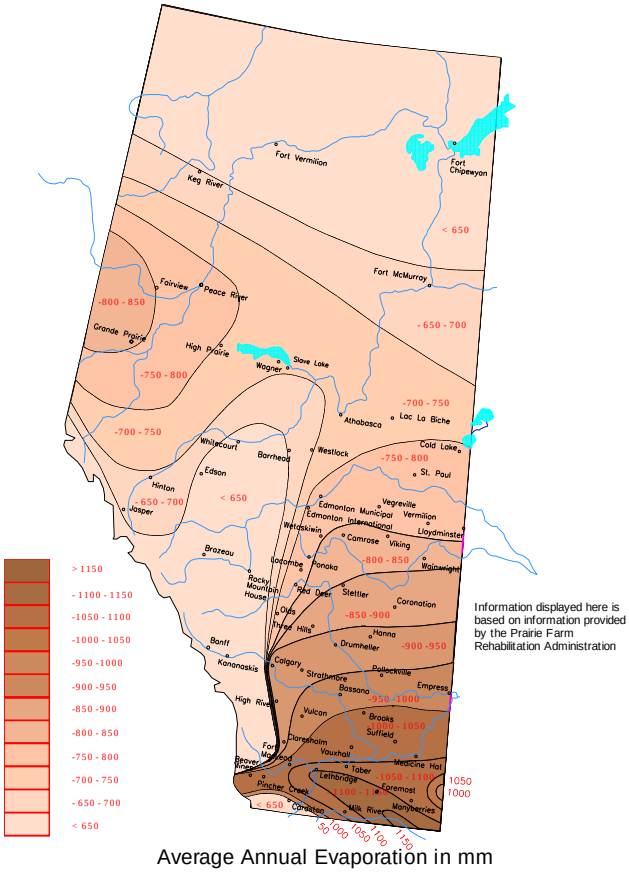
A.2.A. Precipitation Rates



Information displayed here is based on information provided by the Prairie Farm Rehibilitation Administration

Average Annual Precipitation in mm

A.2.B. Evaporation Rates



Average Annual Evaporation in mm

A.2.C. Calculation of *Lagoon* Surface Area Requirements for Evaporation

Note: The following formulas are used to determine the required surface area of a *lagoon* to accomplish the evaporation of 125% of the expected *sewage* per year based on average precipitation and evaporation rates (factor of safety = 1.25).

stack{Gallons~of~Evaporation#~per~Sq.~Ft.~per~Year}=~{
(inches~of~evaporation~per~year-inches~of~precipitation~per~year) TIMES 144 }OVER {
277 cubic inches per Imperial gallon }

stack{Litres~of~Evaporation#~per~Sq.~M.~per~Year}~=~
(mm~of~Evaporation~per~year~-~mm~of~Precipitation~per ~year)~TIMES ~1

Square~Feet~Required= { Gallons~of~Sewage~Per~Year~TIMES~1.25 } OVER {Gallons~Of~Evaporation~Per~Square~Foot~per~Year}

Square~Metres~Required= { Litres~of~Sewage~Per~Year~TIMES~1.25 } OVER {Liters~Of~Evaporation~Per~Square~Metre~per~Year}

A.2.D. *Lagoon* Sizes and Volumes

A.2.D. Calculation of *Sewage Lagoon* Volume

Approximate Volume in Litres (gal.)	Size at Base in Metres (ft.)	Size at Mid Depth 750 mm (2.5 ft.)	Size at Full Depth 1500 mm (5 ft.)	Size at Top of *Berm* 600 mm (2.0 ft.) Freeboard, (2100 mm (7.0 ft.) Above Bottom of *Lagoon*)
138,106 (30,420)	*4.57 x 4.57 (15 ft. x 15 ft.)*	*9.14 x 9.14 (30 ft. x 30 ft.)*	*13.72 x 13.72 (45 ft. x 45 ft.)*	*17.37 x 17.371 (57 ft. x 57 ft.)*
184,142 (40,560)	*6.10 x 6.10 (20 ft. x 20 ft.)*	*10.67 x 10.67 (35 ft. x 35 ft.)*	*15.24 x 15.24 (50 ft. x 50 ft.)*	*18.90 x 18.90 (62 ft. x 62 ft.)*
237,260 (52,260)	*7.62 x 7.62 (25 ft. x 25 ft.)*	*12.19 x 12.19 (40 ft. x 40 ft.)*	*16.76 x 16.76 (55 ft. x 55 ft.)*	*18.90 x 18.90 (67 ft. x 67 ft.)*
297,460 (62,520)	*9.14 x 9.14 (30 ft. x 30 ft.)*	*13.72 x 13.72 (45 ft. x 45 ft.)*	*18.29 x 18.29 (60 ft. x 60 ft.)*	*21.95 x 21.96 (72 ft. x 72 ft.)*
364,743 (80,340)	*10.67 x 10.67 (35 ft. x 35 ft.)*	*15.24 x 15.24 (50 ft. x 50 ft.)*	*19.81 x 19.81 (65 ft. x 65 ft.)*	*23.47 x 23.47 (77 ft. x 77 ft.)*
439,109 (96,720)	*12.19 x 12.19 (40 ft. x 40 ft.)*	*16.76 x 16.76 (55 ft. x 55 ft.)*	*21.34 x 21.34 (70 ft. x 70 ft.)*	*24.99 x 24.99 (82 ft. x 82 ft.)*
609,086 (134,160)	*15.24 x 15.24 (50 ft. x 50 ft.)*	*19.21 x 19.11 (65 ft. x 65 ft.)*	*24.38 x 24.38 (80 ft. x 80 ft.)*	*28.04 x 28.04 (92 ft. x 92 ft.)*
807,393 (177,840)	*18.29 x 18.29 (60 ft. x 60 ft.)*	*22.86 x 22.86 (75 ft. x 75 ft.)*	*27.43 x 27.43 (90 ft. x 90 ft.)*	*31.09 x 31.09 (102 ft. x 102 ft.)*
1034,030 (227,760)	*21.34 x 21.34 (70 ft. x 70 ft.)*	*25.91 x 25.91 (85 ft. x 85 ft.)*	*30.48 x 30.48 (100 ft. x 100 ft.)*	*34.14 x 34.14 (112 ft. x 112 ft.)*
1,883,918 (414,960)	*30.48 x 30.48 (100 ft. x 100 ft.)*	*35.05 x 35.05 (115 ft. x 115 ft.)*	*39.62 x 39.62 (130 ft. x 130 ft.)*	*43.28 x 43.28 (142 ft. x 142 ft.)*
2,592,158 (570,960)	*36.58 x 36.58 (120 ft. x 120 ft.)*	*41.15 x 41.15 (135 ft. x 135 ft.)*	*45.72 x 45.72 (150 ft. x 150 ft.)*	*49.38 x 49.38 (162 ft. x 162 ft.)*
3,866,990 (851,760)	*45.72 x 45.72 (150 ft. x 150 ft.)*	*50.29 x 58.21 (165 ft. x 165 ft.)*	*54.86 x 54.86 (180 ft. x 180 ft.)*	*58.52 x 58.52 (192 ft. x 192 ft.)*
4,514,694 (1,128,660)	*53.34 x 53.34 (175 ft. x 175 ft.)*	*57.91 x 57.91 (190 ft. x 190 ft.)*	*62.48 x 62.48 (205 ft. x 205 ft.)*	*66.14 x 66.14 (217 ft. x 217 ft.)*
6,558,302 (1,444,560)	*60.96 x 60.96 (200 ft. x 200 ft.)*	*65.53 x 65.53 (215 ft. x 215 ft.)*	*70.10 x 70.10 (230 ft. x 230 ft.)*	*73.76 x 73.76 (242 ft. x 242 ft.)*
9,957,854 (2,193,360)	*76.20 x 76.20 (250 ft. x 250 ft.)*	*80.77 x 80.77 (265 ft. x 265 ft.)*	*85.34 x 85.34 (280 ft. x 280 ft.)*	*89.0 x 89.0 (292 ft. x 292 ft.)*
14,065,646 (3,098,160)	*91.44 x 91.44 (300 ft. x 300 ft.)*	*96.01 x 96.01 (315 ft. x 315 ft.)*	*100.60 x 100.60 (330 ft. x 330 ft.)*	*104.3 x 104.3 (342 ft. x 342 ft.)*
24,405,905 (5,375,760)	*121.90 x 121.50 (400 ft. x 400 ft.)*	*126.50 x 126.50 (415 ft. x 415 ft.)*	*131.1 x 131.1 (430 ft. x 430 ft.)*	*134.7 x 134.7 (442 ft. x 442 ft.)*

Note: To calculate the volume of a square or rectangular lagoon of a size not listed above, the following formula may be used based on an inside *berm* slope of 3 horizontal to 1 vertical.

Volume={H} over {0.167} times (A+4B+C) times 28.33

V = Volume in litres

H = Depth of liquid (maximum of 1.5 metres)

A = Area of bottom of *lagoon* in square metres

B = Area at mid-depth in square metres

C = Area at the high water level in square metres (maximum 1.5 metre depth)

A.3. Alberta Design Data

A.3.A. Alberta Climate Design Data (Reproduced from the Alberta Building Code - Appendix C.)

Table A.3.A. Alberta Climate Design Data

		Design Temperature							
	Altitude	January		July 2 1/2%		Degree days below 18ºC	15 min rain (mm)	24 hr rain (mm)	Annual total precipitation (mm)
Location Name	m	2 1/2%	1%	Dry	Wet				
Acadia Valley	716	-33	-36	31	20	5,500	18	75	310
Airdrie	1098	-32	-34	28	18	5,200	17	95	440
Athabasca	515	-35	-38	28	19	6,000	18	80	480
Banff	1400	-30	-32	27	17	5,500	18	60	500
Barrhead	645	-34	-37	28	19	6,000	20	80	475
Bashaw	793	-36	-39	27	19	5,600	21	85	460
Bassano	792	-32	-34	28	18	5,350	17	85	340
Beaumont	735	-37	-40	27	19	5,700	20	90	475
Beaver Lodge	730	-35	-38	28	18	5,900	25	85	470
Berwyn	643	-40	-42	27	18	6,350	14	80	395
Black Diamond	1159	-32	-34	28	18	5,300	16	90	495
Blackfalds	880	-34	-38	28	19	5,700	19	95	475
Bon Accord	625	-37	-40	27	19	5,750	19	85	485
Bonnyville	564	-36	-39	28	20	6,100	21	75	430
Bow Island	799	-32	-36	32	20	4,800	17	80	340
Bowden	991	-34	-38	28	19	5,700	17	95	480
Brooks	760	-32	-34	32	19	5,200	18	80	340
Bruderheim	637	-37	-40	27	19	5,800	19	95	480
Calgary	1045	-31	-33	29	17	5,200	23	95	425
Calmar	730	-35	-38	27	19	5,600	20	95	490
Campsie	660	-34	-37	28	19	6,000	20	80	475
Camrose	740	-33	-35	29	19	5,700	20	85	470
Cardston	1130	-30	-33	29	18	4,750	20	100	550
Carstairs	1060	-33	-36	28	18	5,600	17	105	475
Castor	816	-33	-36	29	20	5,600	21	85	405
Claresholm	1030	-31	-34	29	18	4,800	15	95	440
Coaldale	863	-31	-35	31	19	4,700	17	85	390
Cochrane	1159	-32	-34	28	18	5,400	17	75	500
Cold Lake	540	-36	-38	28	20	6,100	15	75	430
Coleman	1320	-31	-34	28	18	5,300	15	70	550
Coronation	790	-31	-33	30	19	5,800	20	85	400
Cowley	1175	-31	-34	29	18	5,100	15	75	525
Crossfield	1113	-32	-34	28	18	5,500	17	105	485
Daysland	708	-36	-39	28	19	5,700	21	85	455
Devon	709	-37	-40	27	19	5,600	20	90	490
Didsbury	1037	-33	-36	28	18	5,600	17	100	480
Drayton Valley	869	-35	-37	27	19	5,700	20	85	525
Drumheller	685	-31	-33	29	18	5,300	20	80	375
Eckville	930	-34	-37	27	19	5,700	17	105	540

Table A.3.A. Alberta Climate Design Data

Location Name	Altitude m	Design Temperature January 2 1/2%	January 1%	July 2 1/2% Dry	July 2 1/2% Wet	Degree days below 18°C	15 min rain (mm)	24 hr rain (mm)	Annual total precipitation (mm)
Edmonton	645	-32	-34	28	19	5,400	23	90	460
Edson	920	-34	-37	28	18	5,900	18	75	570
Elk Point	598	-38	-40	28	20	6,200	21	75	440
Embarras Portage	220	-41	-44	27	19	7,100	10	80	390
Fairview	670	-38	-40	27	18	6,050	15	80	450
Falher	587	-40	-42	27	18	5,900	15	55	420
Foremost	889	-32	-36	32	20	4,800	14	70	360
Fort Chipewayan	221	-43	-46	26	19	7,400	12	70	381
Fort MacLeod	945	-31	-33	31	18	4,600	16	90	425
Fort McMurray	255	-39	-41	28	19	6,550	13	85	460
Fort Saskatchewan	610	-32	-35	28	19	5,700	20	80	425
Fort Vermilion	270	-41	-43	28	18	6,900	13	60	380
Fox Creek	808	-36	-40	27	19	5,900	17	90	550
Gibbons	643	-37	-40	27	19	5,800	19	85	485
Gliechen	903	-32	-34	28	18	5,300	17	90	360
Grand Center	541	-36	-39	28	20	6,100	21	75	435
Grande Cache	1220	-35	-38	27	15	5,700	14	70	605
Grande Prairie	650	-36	-39	27	18	6,000	23	80	450
Granum	991	-33	-36	30	18	4,800	17	95	440
Grimshaw	603	-40	-42	27	18	6,350	14	80	390
Habay	335	-41	-43	28	18	7,150	13	65	425
Hanna	785	-33	-36	29	20	5,700	19	90	390
Hardisty	615	-33	-35	30	19	5,900	20	70	425
High Level	320	-46	-47	26	18	7,200	11	75	420
High Prairie	595	-38	-40	25	19	6,000	15	75	470
High River	1040	-31	-33	28	17	5,300	18	95	425
Hinton	990	-34	-38	27	17	5,700	13	75	500
Innisfail	945	-34	-38	28	19	5,700	18	95	480
Irvine	763	-32	-36	32	20	4,900	17	75	360
Jasper	1060	-32	-35	28	18	5,500	10	70	400
Keg River	420	-40	-42	28	18	6,800	13	60	450
Killam	680	-35	-38	29	20	5,700	21	90	445
Kitscoty	670	-35	-38	29	20	6,150	22	80	430
Lac La Biche	560	-35	-38	28	19	6,150	15	80	475
Lacombe	855	-33	-35	29	18	5,700	23	85	450
Lake Louise	1600	-33	-34	27	14	6,700	11	55	580
Lamont	653	-37	-40	27	19	5,800	19	90	460
Leduc	730	-35	-38	27	19	5,600	20	90	485
Lethbridge	910	-30	-33	31	18	4,650	20	90	390
Lloydminster	645	-35	-38	29	20	6,100	18	70	430
Magrath	983	-31	-35	31	19	4,800	17	80	430
Manning	465	-39	-41	27	18	6,700	13	75	390
Mayerthorpe	712	-36	-40	27	19	5,950	15	90	555

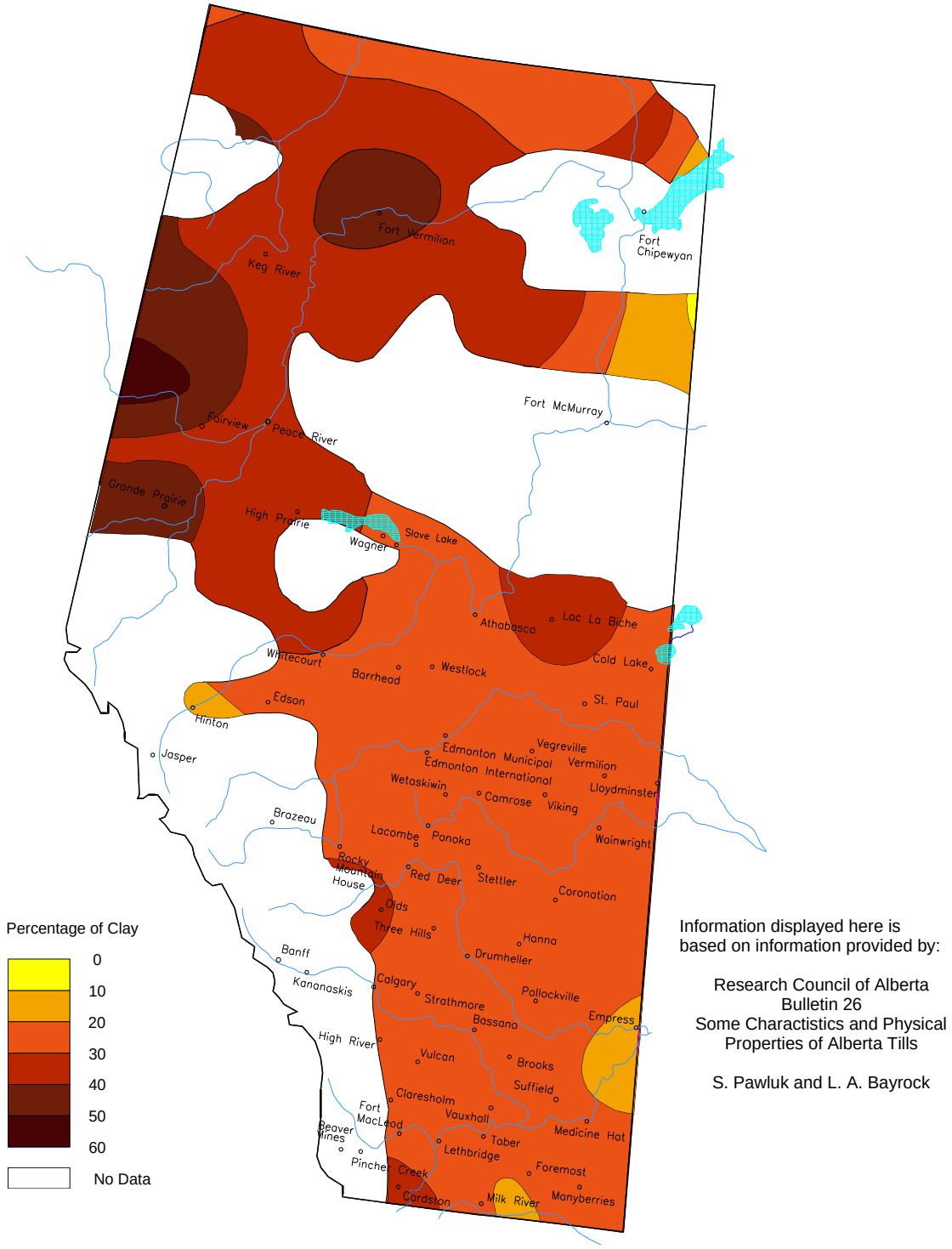
Table A.3.A. Alberta Climate Design Data

Location Name	Altitude m	Design Temperature January 2 1/2%	January 1%	July 2 1/2% Dry	July 2 1/2% Wet	Degree days below 18°C	15 min rain (mm)	24 hr rain (mm)	Annual total precipitation (mm)
McLennan	625	-40	-42	27	18	5,900	15	65	425
Medicine Hat	705	-31	-34	33	19	4,750	23	85	325
Milk River	1059	-31	-35	31	19	4,800	16	70	375
Millet	755	-35	-38	27	19	5,600	21	95	475
Morinville	700	-37	-40	27	19	5,700	19	90	480
Morrin	832	-34	-38	28	19	5,500	19	75	390
Mundare	678	-37	-40	27	19	6,100	20	90	450
Nanton	1024	-32	-34	28	18	5,000	17	95	440
Okotoks	1051	-32	-34	28	18	5,300	17	95	470
Olds	1041	-33	-36	28	18	5,600	17	95	485
Oyen	770	-33	-36	29	20	5,600	19	75	330
Peace River	330	-37	-40	27	18	6,350	15	60	390
Penhold	871	-34	-38	28	19	5,750	18	95	470
Picture Butte	905	-31	-35	31	19	4,700	17	85	400
Pincher Creek	1130	-32	-34	29	18	5,000	18	100	575
Ponoka	807	-34	-37	27	19	5,600	21	80	480
Provost	668	-33	-36	29	20	5,900	21	80	415
Rainbow Lake	534	-46	-47	26	18	7,200	16	75	450
Ranfurly	670	-34	-37	29	19	5,950	18	85	420
Raymond	960	-31	-35	31	19	4,750	17	75	420
Red Deer	855	-32	-35	29	18	5,750	23	90	475
Redcliff	745	-32	-36	32	20	4,800	17	85	325
Redwater	625	-37	-40	27	19	5,900	19	80	470
Rimbey	930	-34	-37	27	19	5,700	20	100	505
Rocky Mountain House	985	-31	-33	28	18	5,700	20	80	550
Ryley	693	-35	-38	27	19	5,800	21	90	465
Sangudo	680	-36	-40	27	19	5,900	17	95	555
Sedgewick	663	-35	-38	29	20	5,700	21	95	440
Sexsmith	724	-38	-41	27	18	6,000	18	85	445
Sherwood Park	729	-37	-40	27	19	5,500	20	90	480
Slave Lake	590	-36	-39	27	19	6,000	15	75	500
Smoky Lake	623	-39	-42	27	20	6,000	19	75	480
Spirit River	640	-38	-41	27	18	6,200	18	75	440
Spruce Grove	709	-37	-40	27	19	5,600	19	90	500
Stavely	1044	-33	-36	30	18	4,800	17	95	440
Stettler	820	-32	-34	30	19	5,700	20	90	450
Stony Plain	710	-32	-35	28	19	5,500	23	90	540
Strathmore	973	-32	-34	28	18	5,300	17	80	430
St. Albert	689	-37	-40	27	19	5,600	20	95	480
St. Paul	646	-37	-40	28	20	6,100	21	75	440
Suffield	755	-32	-34	33	19	4,900	20	80	325
Sundre	1093	-34	-37	27	19	5,700	15	95	530

Table A.3.A. Alberta Climate Design Data

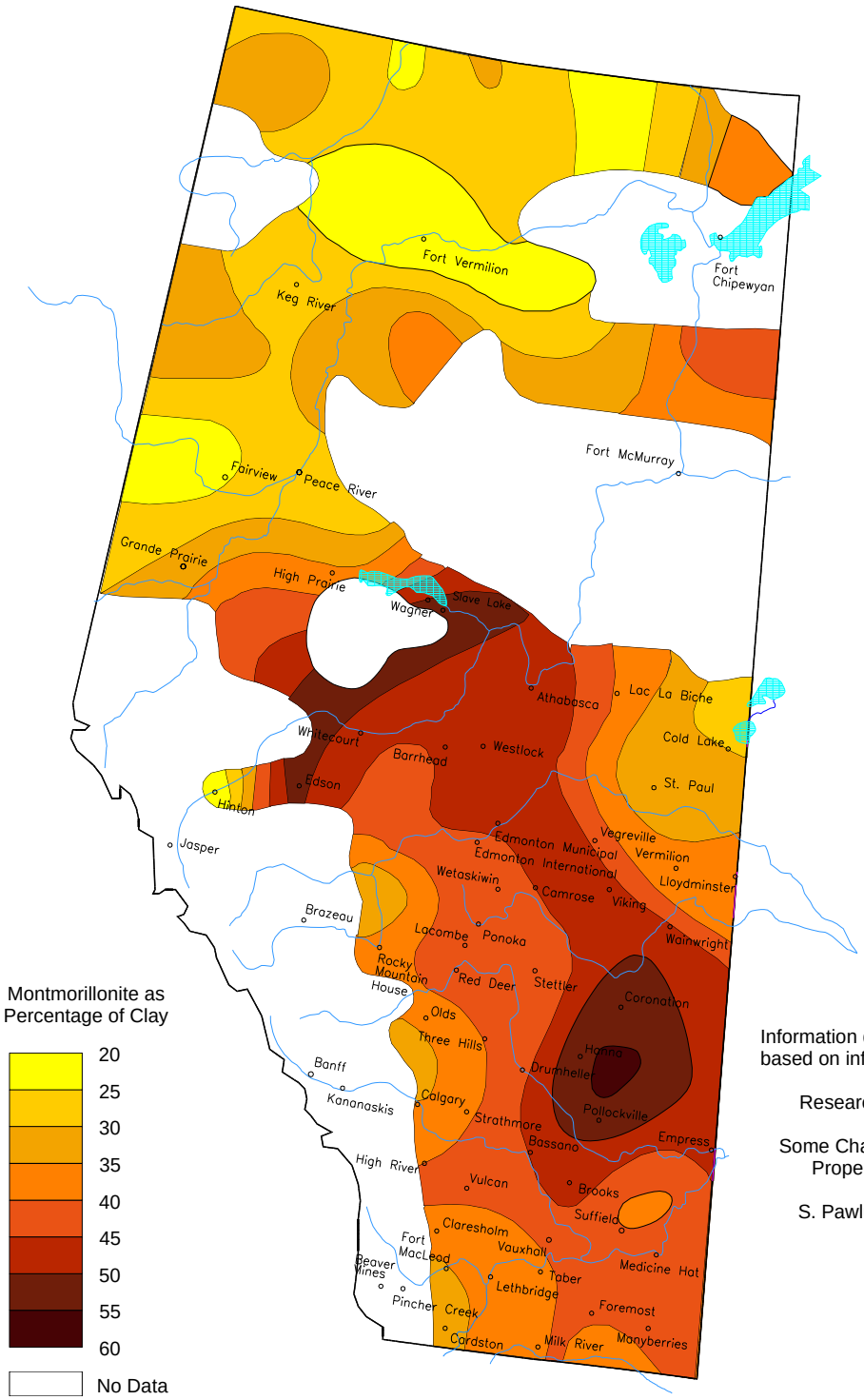
Location Name	Altitude m	Design Temperature January 2 1/2%	Design Temperature January 1%	Design Temperature July 2 1/2% Dry	Design Temperature July 2 1/2% Wet	Degree days below 18°C	15 min rain (mm)	24 hr rain (mm)	Annual total precipitation (mm)
Swan Hills	1113	-36	-40	27	19	6,100	15	95	500
Sylvan Lake	945	-34	-37	27	19	5,700	18	95	545
Taber	815	-31	-33	31	19	4,800	20	85	370
Thorhild	649	-37	-40	27	19	6,000	17	75	480
Three Hills	896	-34	-38	28	19	5,450	19	80	400
Tofield	700	-37	-40	27	19	5,800	21	95	465
Trochu	872	-34	-38	28	19	5,450	18	75	405
Turner Valley	1215	-31	-33	28	17	5,600	20	90	600
Two Hills	603	-38	-40	28	20	6,000	21	80	450
Valleyview	700	-37	-40	27	18	5,900	18	80	490
Vauxhall	779	-31	-35	31	19	4,850	17	85	335
Vegreville	635	-34	-36	29	19	6,100	18	80	410
Vermilion	580	-35	-38	29	20	6,150	18	80	410
Viking	691	-38	-40	28	20	5,750	21	65	445
Vulcan	1049	-31	-34	30	18	5,000	17	90	410
Wagner	585	-36	-39	27	19	6,000	15	70	500
Wainwright	675	-33	-36	29	19	6,000	20	75	425
Warner	1021	-31	-35	31	19	4,750	16	75	375
Wembley	724	-38	-41	27	18	5,900	18	85	470
Westlock	648	-37	-40	27	19	5,900	17	75	490
Wetaskiwin	760	-33	-35	29	19	5,800	23	80	500
Whitecourt	690	-35	-38	27	18	6,000	20	90	550
Wimborne	975	-31	-34	29	18	5,650	23	85	450

A.3.B. Soil Clay Content Map



Distribution of Clay

A.3.C. Soil Montmorillonite Content Map



Montmorillonite as Percentage of Clay

20
25
30
35
40
45
50
55
60
No Data

Information displayed here is based on information provided by:

Research Council of Alberta
Bulletin 26
Some Charactistics and Physical Properties of Alberta Tills

S. Pawluk and L. A. Bayrock

Distribution of Montmorillonite

A.4. *Disposal Field* Design Data

A.4.A. *Disposal Field* Loading Rates Per Day and Sizes

Table A.4.A.				2 Bedrooms		3 Bedrooms		4 Bedrooms		5 Bedrooms		6 Bedrooms	
Perc Rate	SQRT of Perc Rate	**Loading rate L/m2**	Loading rate Gal/sq.ft.	**Square Metres 2 BR = 340x2x2**	Sq.ft. Reqd 2 bedrooms= 75x2x2	**Square Metres 3 BR = 340x1.5x3**	Sq.ft. Reqd. 3 Bedrooms = 75x1.5x3	**Square Metres 4 BR = 340x1.5x4**	Sq.ft. Reqd. 4 bedrooms= 75x1.5x4	**Square Metres 5 BR = 340x1.5 x5**	Sq.ft. Reqd. 5 bedrooms= 75x1.5x5	**Square Metres 6 BR = 340x1.5 x6**	Sq.ft. Reqd 6 bedrooms= 75x1.5x6
		per day		**1360 L**	300 gal	**1530 L**	337.5 gal	**2040 L**	450 gal	**2550 L**	562.5 gal	**3060 L**	675 gal
5	2.236	**36.46**	**0.75**	**37.05**	399.30	**41.68**	449.21	**55.57**	598.95	**69.47**	748.68	**83.36**	898.42
6	2.449	**33.28**	**0.69**	**40.59**	437.41	**45.66**	492.09	**60.88**	656.11	**76.10**	820.14	**91.32**	984.17
7	2.646	**30.82**	**0.64**	**43.84**	472.46	**49.32**	531.51	**65.76**	708.68	**82.20**	885.85	**98.64**	1063.03
8	2.828	**28.83**	**0.59**	**46.86**	505.08	**52.72**	568.21	**70.30**	757.61	**87.87**	947.02	**105.45**	1136.42
9	3.000	**27.18**	**0.56**	**49.71**	535.71	**55.92**	602.68	**74.56**	803.57	**93.20**	1004.46	**111.84**	1205.36
10	3.162	**25.78**	**0.53**	**52.40**	564.69	**58.95**	635.28	**78.59**	847.04	**98.24**	1058.80	**117.89**	1270.56
11	3.317	**24.58**	**0.51**	**54.95**	592.25	**61.82**	666.29	**82.43**	888.38	**103.04**	1110.48	**123.65**	1332.57
12	3.464	**23.54**	**0.49**	**57.40**	618.59	**64.57**	695.91	**86.10**	927.88	**107.62**	1159.86	**129.14**	1391.83
13	3.606	**22.61**	**0.47**	**59.74**	643.85	**67.21**	724.33	**89.61**	965.77	**112.01**	1207.22	**134.42**	1448.66
14	3.742	**21.79**	**0.45**	**62.00**	668.15	**69.75**	751.67	**92.99**	1002.23	**116.24**	1252.79	**139.49**	1503.34
15	3.873	**21.05**	**0.43**	**64.17**	691.60	**72.19**	778.05	**96.26**	1037.41	**120.32**	1296.76	**144.39**	1556.11
16	4.000	**20.38**	**0.42**	**66.28**	714.29	**74.56**	803.57	**99.42**	1071.43	**124.27**	1339.29	**149.12**	1607.14
17	4.123	**19.77**	**0.41**	**68.32**	736.27	**76.86**	828.30	**102.47**	1104.40	**128.09**	1380.50	**153.71**	1656.60
18	4.243	**19.22**	**0.40**	**70.30**	757.61	**79.08**	852.32	**105.45**	1136.42	**131.81**	1420.53	**158.17**	1704.63
19	4.359	**18.70**	**0.39**	**72.22**	778.37	**81.25**	875.67	**108.34**	1167.56	**135.42**	1459.45	**162.50**	1751.34
20	4.472	**18.23**	**0.38**	**74.10**	798.60	**83.36**	898.42	**111.15**	1197.89	**138.94**	1497.37	**166.72**	1796.84
21	4.583	**17.79**	**0.37**	**75.93**	818.32	**85.42**	920.61	**113.89**	1227.48	**142.37**	1534.34	**170.84**	1841.21
22	4.690	**17.38**	**0.36**	**77.72**	837.57	**87.43**	942.27	**116.57**	1256.36	**145.72**	1570.45	**174.86**	1884.54
23	4.796	**17.00**	**0.35**	**79.46**	856.40	**89.40**	963.45	**119.19**	1284.60	**148.99**	1605.75	**178.79**	1926.90
24	4.899	**16.64**	**0.34**	**81.17**	874.82	**91.32**	984.17	**121.76**	1312.23	**152.20**	1640.28	**182.64**	1968.34
25	5.000	**16.31**	**0.34**	**82.85**	892.86	**93.20**	1004.46	**124.27**	1339.29	**155.34**	1674.11	**186.40**	2008.93
26	5.099	**15.99**	**0.33**	**84.49**	910.54	**95.05**	1024.36	**126.73**	1365.81	**158.41**	1707.26	**190.10**	2048.71
27	5.196	**15.69**	**0.32**	**86.10**	927.88	**96.86**	1043.87	**129.14**	1391.83	**161.43**	1739.78	**193.72**	2087.74
28	5.292	**15.41**	**0.32**	**87.68**	944.91	**98.64**	1063.03	**131.51**	1417.37	**164.39**	1771.71	**197.27**	2126.05
29	5.385	**15.14**	**0.31**	**89.23**	961.64	**100.38**	1081.84	**133.84**	1442.45	**167.30**	1803.07	**200.76**	2163.68
30	5.477	**14.89**	**0.31**	**90.75**	978.08	**102.10**	1100.34	**136.13**	1467.11	**170.16**	1833.89	**204.19**	2200.67
31	5.568	**14.64**	**0.30**	**92.25**	994.24	**103.79**	1118.52	**138.38**	1491.37	**172.98**	1864.21	**207.57**	2237.05
32	5.657	**14.41**	**0.30**	**93.73**	1010.15	**105.45**	1136.42	**140.59**	1515.23	**175.74**	1894.04	**210.89**	2272.84
33	5.745	**14.19**	**0.29**	**95.18**	1025.81	**107.08**	1154.04	**142.77**	1538.72	**178.47**	1923.40	**214.16**	2308.08
34	5.831	**13.98**	**0.29**	**96.61**	1041.24	**108.69**	1171.40	**144.92**	1561.86	**181.15**	1952.33	**217.38**	2342.79
35	5.916	**13.78**	**0.28**	**98.02**	1056.44	**110.28**	1188.50	**147.04**	1584.66	**183.80**	1980.83	**220.56**	2377.00

Table A.4.A. continued	**2 Bedrooms**	**3 Bedrooms**	**4 Bedrooms**	**5 Bedrooms**	**6 Bedrooms**

Perc Rate	SQRT of Perc Rate	**Loading rate L/m2**	Loading rate Gal/sq.ft.	**Square Metres 2 BR = 340x2x2**	Sq.ft. Reqd 2 bedrooms= 75x2x2	**Square Metres 3 BR = 340x1.5x3**	Sq.ft. Reqd. 3 Bedrooms = 75x1.5x3	**Square Metres 4 BR = 340x1.5x4**	Sq.ft. Reqd. 4 bedrooms= 75x1.5x4	**Square Metres 5 BR = 340x1.5 x5**	Sq.ft. Reqd. 5 bedrooms= 75x1.5x5	**Square Metres 6 BR = 340x1.5 x6**	Sq.ft. Reqd 6 bedrooms= 75x1.5x6
		per day		**1360 L**	300 gal	**1530 L**	337.5 gal	**2040 L**	450 gal	**2550 L**	562.5 gal	**3060 L**	675 gal
36	6.000	**13.59**	**0.61**	**99.42**	1071.43	**111.84**	1205.36	**149.12**	1607.14	**186.40**	2008.93	**223.68**	2410.71
37	6.083	**13.40**	**0.60**	**100.79**	1086.21	**113.38**	1221.98	**151.18**	1629.31	**188.97**	2036.64	**226.77**	2443.97
38	6.164	**13.23**	**0.60**	**102.14**	1100.79	**114.91**	1238.39	**153.21**	1651.18	**191.51**	2063.98	**229.81**	2476.77
39	6.245	**13.06**	**0.59**	**103.47**	1115.18	**116.41**	1254.58	**155.21**	1672.77	**194.01**	2090.96	**232.82**	2509.15
40	6.325	**12.89**	**0.58**	**104.79**	1129.38	**117.89**	1270.56	**157.19**	1694.08	**196.49**	2117.60	**235.78**	2541.12
41	6.403	**12.73**	**0.57**	**106.09**	1143.42	**119.36**	1286.34	**159.14**	1715.12	**198.93**	2143.90	**238.71**	2572.68
42	6.481	**12.58**	**0.57**	**107.38**	1157.28	**120.80**	1301.93	**161.07**	1735.91	**201.34**	2169.89	**241.61**	2603.87
43	6.557	**12.43**	**0.56**	**108.65**	1170.97	**122.23**	1317.34	**162.98**	1756.46	**203.72**	2195.57	**244.47**	2634.69
44	6.633	**12.29**	**0.55**	**109.91**	1184.51	**123.65**	1332.57	**164.86**	1776.76	**206.08**	2220.95	**247.29**	2665.14
45	6.708	**12.15**	**0.55**	**111.15**	1197.89	**125.04**	1347.63	**166.72**	1796.84	**208.41**	2246.05	**250.09**	2695.26
46	6.782	**12.02**	**0.54**	**112.38**	1211.13	**126.43**	1362.52	**168.57**	1816.70	**210.71**	2270.87	**252.85**	2725.04
47	6.856	**11.89**	**0.54**	**113.59**	1224.22	**127.79**	1377.25	**170.39**	1836.34	**212.99**	2295.42	**255.58**	2754.50
48	6.928	**11.77**	**0.53**	**114.79**	1237.18	**129.14**	1391.83	**172.19**	1855.77	**215.24**	2319.71	**258.29**	2783.65
49	7.000	**11.65**	**0.52**	**115.98**	1250.00	**130.48**	1406.25	**173.98**	1875.00	**217.47**	2343.75	**260.96**	2812.50
50	7.071	**11.53**	**0.52**	**117.16**	1262.69	**131.81**	1420.53	**175.74**	1894.04	**219.68**	2367.55	**263.61**	2841.05
51	7.141	**11.42**	**0.51**	**118.33**	1275.26	**133.12**	1434.66	**177.49**	1912.88	**221.86**	2391.10	**266.24**	2869.32
52	7.211	**11.31**	**0.51**	**119.48**	1287.70	**134.42**	1448.66	**179.22**	1931.55	**224.03**	2414.43	**268.84**	2897.32
53	7.280	**11.20**	**0.50**	**120.63**	1300.02	**135.70**	1462.52	**180.94**	1950.03	**226.17**	2437.54	**271.41**	2925.04
54	7.348	**11.09**	**0.50**	**121.76**	1312.23	**136.98**	1476.26	**182.64**	1968.34	**228.30**	2460.43	**273.96**	2952.51
55	7.416	**10.99**	**0.50**	**122.88**	1324.32	**138.24**	1489.86	**184.32**	1986.48	**230.40**	2483.10	**276.48**	2979.72
56	7.483	**10.90**	**0.49**	**123.99**	1336.31	**139.49**	1503.34	**185.99**	2004.46	**232.49**	2505.57	**278.98**	3006.69
57	7.550	**10.80**	**0.49**	**125.09**	1348.18	**140.73**	1516.71	**187.64**	2022.28	**234.55**	2527.85	**281.46**	3033.42
58	7.616	**10.71**	**0.48**	**126.19**	1359.96	**141.96**	1529.95	**189.28**	2039.94	**236.60**	2549.92	**283.92**	3059.91
59	7.681	**10.61**	**0.48**	**127.27**	1371.63	**143.18**	1543.09	**190.91**	2057.45	**238.63**	2571.81	**286.36**	3086.17
60	7.746	**10.53**	**0.47**	**128.34**	1383.21	**144.39**	1556.11	**192.52**	2074.81	**240.65**	2593.52	**288.78**	3112.22

A.5. Materials Data

A.5.A. Piping Materials

Type of Piping	**Standard Reference**	**Gravity *Sewage* or *Effluent* Piping**	***Pressure Effluent Line***	***Weeping Lateral* Piping**	***Pressure Effluent Distribution Lateral***
Polyethylene water pipe and tubing *Series 160 sizes* with compression fittings Series 50, 75, 100 and 125	CAN3-B137.1-M	N	P	N	N
Poly vinyl chloride (PVC) water pipe Series 60, 100, 125, 160 and 200	CAN3-B137.3-M	P	P	P	P
Chlorinated poly vinyl chloride (CPVC) water pipe	CAN3-B137.6-M	N	N	N	P
Polybutylene water pipe	CAN3-B137.8-M	N	P	N	N
Plastic Sewer Pipe perforated non perforated	CAN/CSA-B182.1-M92	 N P	 N N	 P N	 N N
Corrugated Polyethylene perforated non-perforated	CGSB 41-GP-31	 N P	 N N	 P N	 N N
Acrylonitnle-butadiene-styrene (ABS) *DWV pipe*	CAN/CSA-B181.1-M90	P	N	N	N
Poly (vinyl chloride) (PVC) *DWV pipe*	CAN/CSA-B181.2-M90	P	N	N	N
Type PSM PVC sewer pipe > 35 SDR	CAN/CSA-B182.2-M90	P	N	N	N
Profile poly (vinyl chloride) (PVC) sewer pipe PS 320 kPa	CAN/CSA-B182.6-M	P	N	N	N
Profile polyethylene sewer pipe PS 320 kPa	CAN/CSA-182.6-M	P	N	N	N
Cast iron soil pipe	CAN3-B70-M	P	N	N	N

P = Permitted
N = Not Permitted

A.6. Percolation Test Procedure

A.6. (1) A *percolation test* shall be carried out such that

(a) a minimum of two (2) *percolation tests* shall be conducted at test locations within the proposed *effluent* disposal area that are

(i) widely spaced, and

(ii) representative of typical soil conditions,

(b) a round hole shall be excavated and prepared to a depth of 900 mm (36 in.), and

(i) the surface of the wall of the hole shall be carefully picked off so no glazing or packing on the wall surface can affect the percolation of the water through the soil to water interface,

(c) the finished diameter of the test hole shall be 200 mm (8 in.),

(d) an initial soaking period of not less than 15 hours and not more than 30 hours is provided in which a minimum depth of 450 mm (18 in.) of water is admitted to the hole slowly and carefully, so as not to disturb the soil,

(e) after the initial soaking period of not less than 15 hours and not more than 30 hours, a minimum depth of 450 mm (18 in.) of water is maintained in the test hole for a minimum of 4 hours before starting measurement of the percolation rate,

(f) the water level in the hole is adjusted to 450 mm (18 in.),

(g) immediately after adjustment, the water is measured from a fixed reference point at 30 minute intervals,

(h) after each measurement, the water level is readjusted to 450 mm (18 in.),

(i) except as provided in Sentence A.6.(2), the test is continued until two successive water level drops do not vary by more than 3.2 mm (1/8 in.), and

(i) a minimum of three measurements are made,

(ii) the last water level drop is used for measurement and the rate of drop of the water in the test hole is determined and recorded in minutes per 25 mm (per 1 in.) of water level drop,

(iii) the percolation rate is considered as provided in Sentence A.6.(3).

(2) In soils in which the first 150 mm (6 in.) of water added after the 4 hour soaking period seeps away in less than 30 minutes

(a) the water level measurements shall be made at 10 minute intervals for a period of one hour,

(b) the last water level drop shall be used to calculate the percolation rate, and

(c) the percolation rate shall be considered as provided in Sentence A.6.(3).

(3) The percolation rate shall be considered to be a rate not faster than the slowest percolation rate of the *percolation test* holes.

Note: The percolation tests form only part of an acceptable site evaluation. Additional evaluation of the soil type, Sodium Adsorption Ratio (S.A.R.), depth to impervious layer or water table, terrain, and other factors, must also be conducted.

A.7. Conversion Factors

1 pound = 0.45359 kilograms

1 inch = 2.540 centimetres

1 foot = 0.3048 metres

1 yard = 0.9144 metres
1 yard = 36.00 inches

1 mile = 1.609 kilometres

1 square inch = 6.452 square centimetres

1 square foot = 0.093 square metres

1 square yard = 0.836 square metres

1 acre = 0.405 hectares

1 square mile = 259 hectares
1 square mile = 2.59 square kilometres

1 cubic inch = 16.387 cubic centimetres

1 cubic foot = 28,317 cubic centimetres
1 cubic foot = 6.23 Imperial gal.
1 cubic foot = 28.3 litres

1 cubic yard = 0.765 cubic metres

1 cubic yard = 168 Imp gal.
1 cubic yard = 765 litres

1 Imperial gal. = 4.546 litres
1 Imperial gal. = 277.42 cubic inches
1 Imperial gal. of water = 10 lbs.
1 U.S. gal. = 3.785 litres
1 U.S. gal. = 231 cubic inches

1 Imperial gal. per sq. ft. = 49 litres per square metre

1 Imperial gal. = 1.20 U.S. gal.
1 U.S. gal. = 0.83 Imperial gal.

1 foot *pressure head* = 304.8 mm *pressure head*

1 foot *pressure head* = 0.434 psi
1 psi = 2.301 ft. *pressure head*
1 psi = 6.894757 kPa

1 kilogram = 2.2046 pounds

1 centimetre = 0.3937 inches

1 metre = 3.281 ft.

1 metre = 1.094 yards
1 metre = 39.37 inches

1 kilometre = 0.6214 miles

1 square centimetre = 0.155 sq. inches

1 square metre = 10.765 square ft.

1 square metre = 1.196 square yards

1 hectare = 2.471 acres
1 hectare = 10,000 square metres

1 square kilometre = 0.386 square miles

1 cubic centimetre = 0.06102 cubic inches
1 cubic decimeter = 0.0353 cubic ft.

1 litre = 0.0353 cubic ft.

1 cubic metre = 1.308 cubic yards
1 cubic metre = 35.3 cubic ft.
1 cubic metre = 220 Imperial gal.
1 cubic metre = 1000 litres

1 litre = 0.220 Imperial gal.

1 litre = 0.264 U.S. gal.

1 litre per sq. metre = 0.020 Imperial gal. per square foot

1 kPa = 0.145037 psi
1,000 mm *pressure head* = 9.807 kPa
1 kPa = 102 mm *pressure head*
1 kPa = 0.335 feet *pressure head*