2. General Design Guidance for VFS System Components

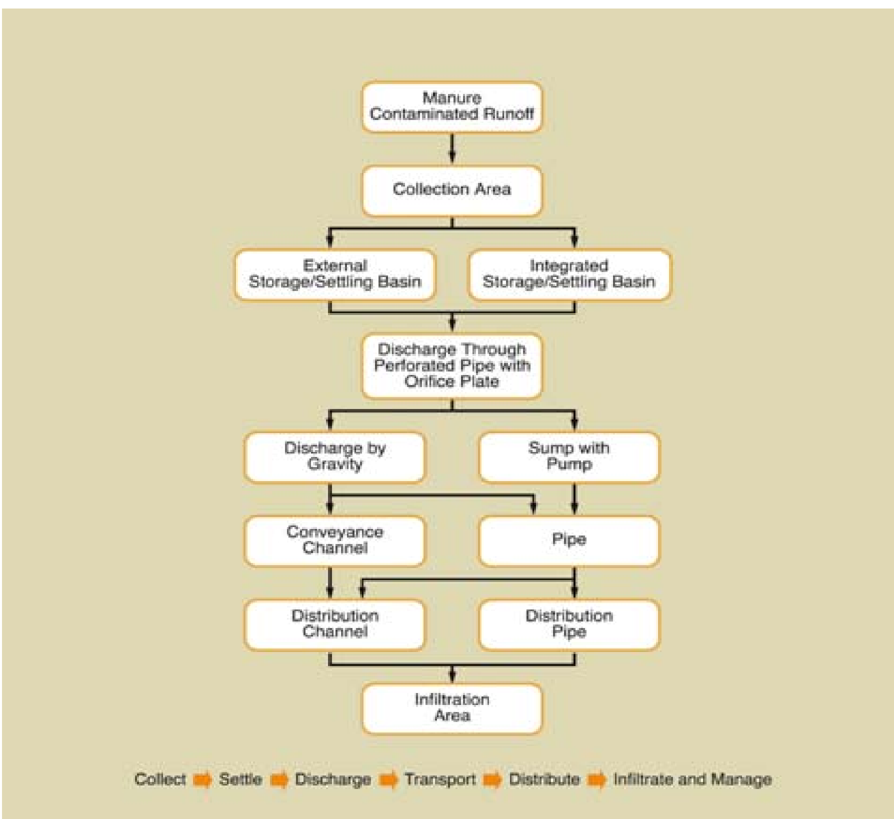
2.1 Description of VFS System Components

A VFS system consists of a series of components that collectively provide the following key functions:

- collect and temporarily store runoff
- screen or settle solids from runoff
- discharge runoff at a controlled rate
- convey runoff
- distribute runoff evenly across the infiltration area
- allow runoff to infiltrate within a defined vegetated area

An overview of the VFS system components and possible configuration variations are shown in Figure 2.1. A detailed description of the individual VFS system components is outlined in this section.

FIGURE 2.1
TYPICAL VFS SYSTEM COMPONENTS



2.1.1 Runoff Collection Area

The area from which runoff is generated and collected is called the "runoff collection area." Runoff is generated when rainwater comes into contact with and begins to convey dissolved or suspended nutrients and contaminants away from the manure storage or feedlot area. Runoff may also include other sources, such as water used to clean outdoor livestock yard/confinement areas. This design manual considers only runoff collection areas associated with livestock yards/confinement areas or permanent solid manure storage facilities that meet the following criteria. They are:

- situated outdoors
- uncovered (for example, no roof)
- consist of a non-porous surface (e.g., concrete)

The runoff collection area surface must be made of a non-porous surface (such as concrete) that is watertight. Runoff collection areas with imperfect non-porous surfaces will need to be corrected before being considered suitable as a runoff collection area. The existing surface may need cracks to be repaired using a polymer-based concrete sealing compound, or the surface sealed using a silicon based sealant. Runoff areas with soil-based surfaces will require the installation of a non-porous surface in order to be considered suitable for runoff management using a VFS system.

Management of manure in the outdoor livestock yard/confinement area or permanent solid manure storage facility is critical to the success of the VFS system. In an outdoor livestock yard/confinement area, farmers must regularly clean the surface. In a permanent solid manure storage facility, it is important to properly place the solid manure in the runoff collection area so that the manure pile is concentrated upslope and outside the runoff storage area, whenever possible.

2.1.2 Runoff Storage/Settling Basin

This manual describes two options to accommodate storage of the runoff that is collected from the runoff collection area. The runoff storage basin can be either integrated into or external from the outdoor livestock yard/confinement area or permanent solid manure storage area as described in the following:

1. ***Integrated Storage.*** In this scenario, runoff is stored directly within the outdoor livestock yard/confinement area or permanent solid manure storage area by constructing a sufficiently high containment wall around all or a portion of the area, serving to retain the required storage volume. The runoff collection area must have sufficient slope (from the highest point to the lowest collection point) to generate the required storage volume if a containment wall is erected around it. The extent of the runoff collection area should be assessed to ensure that adjacent barns or other existing structures are not flooded during severe storm events. An additional 0.3 m (1 ft) of freeboard height (e.g., excess wall height above design requirement depth to serve as safety factor) is incorporated into the wall height to accommodate the required runoff storage volume plus an additional 0.15 m (0.5 ft) of height is added to accommodate the provision of an emergency overflow spillway.
2. ***External Storage.*** In this scenario runoff is stored in a concrete (or equivalent) chamber or basin, downslope of the runoff area that is large enough to accommodate

the required storage volume. External storage may be provided in a suitable existing (and modified if required) facility or in a purpose-built facility. An additional 0.3 m (1 ft) of freeboard height and another 0.15 m (0.5 ft) of spillway height must be added to the basin depth/height to contain the required runoff storage volume. The extent of the storage volume is equivalent to the usable (live storage) volume of the basin and excludes any standing water (dead storage). A minimum standing water depth (dead storage) of 1 m (3.3 ft) is required to allow for storage of settled solids and to minimize re-suspension of settled solids during storm events.

The runoff storage basin also serves to facilitate settling of coarse materials contained in the runoff. The settling is achieved by maintaining a minimum holding time of the runoff generated in the runoff storage area so that the solids can settle out of the water via gravity. In both integrated and external storage scenarios, a minimum 15-minute retention time during peak flow periods is required (for example, runoff must be contained in storage for at least 15 minutes before it is discharged, to allow solids to settle).

The storage volume in a permanent solid manure storage area must take into consideration the loss of water storage volume due to the presence of solid manure. If a significant portion of the permanent solid manure storage area contains solid manure, additional runoff storage volume must then be generated to compensate for the loss of runoff storage capacity. Regular cleaning of the manure storage area will be required to reduce the potential for overtopping the storage area with runoff due to an excessive buildup of manure. Overtopping the storage area would constitute a spill and could lead to action against the landowner by the regulators.

Farmers may achieve significant savings if the runoff storage basin is integrated into the outdoor livestock yard/confinement area or permanent solid manure storage area. The capital costs associated with the construction of an integrated containment wall is expected to be low compared to the capital costs associated with the construction of a new concrete or earthen external storage/settling basin. Either a concrete or earthen external storage/settling basin may be used provided that as part of a vegetated filter strip system, it is capable of minimizing the effect on surface and ground water. The use of existing storage facilities would make the external storage/settling basin scenario significantly more viable from a cost perspective, assuming that the existing facility is situated downstream of the runoff collection area, and is suitable for storage of runoff. One would not be able to enter an earthen storage basin with equipment for cleaning. Sludge is removed with a backhoe.

The integrated system is the more practical system to accommodate storage of the runoff.

2.1.3 Runoff Collection Discharge System

A runoff collection/discharge system, situated at the lowest point of the runoff collection area, is used as the principal discharge outlet. In an integrated storage/settling basin design, a discharge bay is integrated into the containment wall. The collection/discharge bay will contain an orifice plate and a drainpipe outlet that controls the rate of discharge of stored runoff into a sump. Typically, the collection/discharge bay will consist of four primary components:

- Screens are installed upstream of the drainpipe outlet to minimize the potential for clogging of downstream system components by debris and particles. Three screens are recommended, with an increased level of screening (reduced screen openings) as the runoff flows through them toward the drainpipe outlet. The bar spacing for each screen becomes smaller to progressively capture smaller particles. Typically, screens are installed in vertical channels to allow for easy removal and to facilitate cleaning. The material used to construct the screen may range from prefabricated metal screens (2 cm (0.75 in.)) or heavy quarry screens (with about 2.5–3.8 cm (1-1.5 in.) openings), to wooden picket fence–style screens. Screens may also be installed on an angle. Installing the screens on an angle and providing for a "beach" area along the top of the screens will allow for temporary storage of captured material that can be raked off the screens during the cleaning process.
- A vertical perforated riser pipe also acts as a screen.
- An orifice holder is able to accommodate a range of removable orifice plates, the opening size of which controls the rate of discharge from the runoff storage basin. The orifice plate is set flush with the surface of the downslope point of the runoff storage basin.
- A drainpipe transfers the runoff water to a sump.

In instances where the infiltration area is situated adjacent to an integrated storage/settling basin, one or more drainpipes may be installed directly through the containment wall. The drainpipe(s) would be located at the base of the containment wall, at the most down-slope collection point. Screening would be required upstream of the drainpipe(s). The drainpipe would directly discharge to a conveyance channel and be directed to a distribution channel at the head of the infiltration area.

In an external storage/settling basin design, the collected runoff needs to be transferred to the storage/settling basin first. The runoff collection area simply directs flow (via gravity) to a common low point and transfers the runoff to the external storage/settling basin. Runoff can be transferred through a pipe or conveyance channel system to the external storage. In all cases the transfer system must be designed to carry the peak discharge flow from the runoff collection area for a 25-year/5-minute duration storm event. Only a coarse screen, i.e., wood picket fence, would be installed at the runoff exit point of the collection area to prevent coarse materials from entering the external storage/settling basin. A standard curb-and-gutter approach, collection ditch, or containment berm would likely be required around all, or a portion of, the runoff collection area to ensure that all runoff is captured. The external storage/settling basin may be located downslope of the runoff collection area so that gravity can be utilized as the conveyance mechanism.

If there isn't enough slope, the runoff may need to be pumped from the collection point to the external storage/settling basin. In these cases, a sump will be required to accommodate a pump, and screening of solids will be required at the discharge point from the runoff collection area.

2.1.4 Sump

Water discharged through the drainpipe outlet from the runoff storage/settling basin will be directed into a sump. The sump will be installed adjacent to the low point of the storage basin and will be constructed below grade to facilitate year round operation. The sump will be large enough to accommodate a siphon or pump and permit easy access for maintenance purposes. A lockable access hatch must be provided to the sump, helping to restrict access. The pump will be one that can convey large size solids such as a wastewater sludge rated pump (for example, a screw-induced flow centrifugal pump).

There are several different types of pre-fabricated sumps available that are composed of various types of material (concrete, metal, plastic, fibreglass, etc.) that can be used.

2.1.5 Conveyance Pipe

The function of the conveyance pipe is to convey the runoff in the sump to the distribution pipe or distribution channel and eventually the infiltration area. The conveyance pipe will accomplish this either with a gravity system using a siphon, or by means of a pump.

Gravity System—Piped

The use of a gravity system will be dependent upon the change in grade that exists from the sump outlet elevation to the discharge elevation of the distribution pipe at the inflow end of the infiltration area. The change in grade must be sufficient enough to generate adequate flow velocities (minimum of 0.6 m/s (2.0 ft/s)) in the pipe during the conveyance of the runoff water to the infiltration area, to prevent deposition of solids in the conveyance pipe. If insufficient grade change exists, then a pumped system will need to be used. The vast majority of VFS system applications do not rely on gravity for flow, but rather on pumps to move runoff to the infiltration area, due to generally inadequate grade differentials.

Where grade changes significantly, a siphon-like piping arrangement is recommended to allow dosing of flow from the sump to the infiltration area. Siphons work using only air, water pressure, and gravity. Dosed flow will reduce the potential of solids settling in the pipe during low-intensity flow events and improve the distribution of the runoff water across the full width of the infiltration area to promote even sheet flow. There are several automatic dosing systems and floating outlet devices available for purchase for this specific application. These systems require regularly scheduled maintenance and monitoring to ensure the long-term reliability of their performance.

Gravity System—Channel

Where the following conditions can be met, a conveyance channel may be used to move flow from the runoff storage area to the infiltration area:

- infiltration area is situated within 20 m (65.6 ft) of the runoff area
- gravity discharge through the containment wall (from the low point in the runoff storage basin) is possible
- there is sufficient grade change between the runoff storage basin to the infiltration area, generating an adequate flow velocity

The use of a vegetated conveyance channel configuration has a few advantages that may significantly lower the costs associated with the construction of the VFS system. However, there are many more significant maintenance and operational considerations that need to be weighed against cost savings. The conveyance channel may need to be properly lined to prevent infiltration to ground water. The slope of the conveyance channel must be large enough to permit adequate surface flow; otherwise, deposition of solids will likely occur, requiring occasional removal. If the existing grade change is too large, significant effort may be required to protect the conveyance channel from erosion through the use of energy dissipation measures, e.g. rock riprap. Early and late winter operating conditions may render the channel unusable due to ice cover. A distribution channel would need to be used in conjunction with the conveyance channel (at the upstream end of the infiltration area) to promote sheet flow across its full width.

Pumped System

In a pumped system, the conveyance pipe will be flowing under pressure from the sump to the distribution pipe. Typically, pumps selected will be submersible pumps that are located in a sump of suitable depth to allow sufficient head (water height) above the pump for it to operate and to prevent freezing of the water in the sump well. Pumps should allow for passage of up to 5.0 cm (2 in.) solids, such as commonly available sewage pumps (for example, screw-induced flow, centrifugal pumps).

Size of the pump will depend on its ability to keep pipe velocities below 1.5 m/s (5 ft/s), and to match the required outflow rate from the storage basin and the head differential between the pump inlet elevation and the distribution pipe outlet elevation.

Winter freezing conditions must be accounted for in the design of either type of conveyance pipe system. The conveyance pipe must be installed below frost depth to ensure that flow through the pipe can be accommodated year round, if required.

2.1.6 Distribution Pipe

The function of the distribution pipe is to evenly distribute flow from the runoff collection basin across the full width of the inflow end of the infiltration area in order to promote sheet flow.

Flow from the conveyance pipe is directed into the distribution pipe situated along the full width of the infiltration area. The distribution pipe should be elevated above an erosion-proof pad. Flow from the conveyance pipe is accommodated through a series of orifice openings across the distribution pipe length. A gravel filled channel should be utilized at the upstream end of the infiltration area where there is insufficient slope to accommodate an elevated distribution pipe. This type of arrangement is appropriate when a containment wall runoff storage basin is located adjacent to the infiltration area.

2.1.7 Erosion-Proof Pad

An erosion-proof pad receives the water emitted from the distribution pipe orifice openings. The erosion-proof pad functions as an energy absorption device as well as to further distribute flow to reduce the potential of rills or gullies forming. Typically, a concrete slab (e.g., patio slab or silo stave) would be used to break the fall of the water exiting from the distribution pipe.

2.1.8 Infiltration Area

The infiltration area is a densely vegetated strip of land designed to accommodate infiltration of 100 per cent of the runoff generated from the runoff area during the design-storm event.

The minimum area required for the infiltration area is determined by the rate of flow to the infiltration area from the runoff collection area, and the saturated hydraulic conductivity of the soil.

Saturated hydraulic conductivity is a measure of the rate at which water infiltrates through the soil under saturated (wet) conditions.

The minimum size and dimensions of the infiltration area are also determined by the slope of the infiltration area and the depth of flow over the infiltration area.

As a final check, the size and dimensions of the infiltration area are also calculated based on permitted maximum weekly liquid loading levels.

2.2 Assessment of Farmstead Site Conditions Related to Design of VFS System

The viability of a VFS system will depend upon each farmstead's individual site-specific characteristics. An assessment of those characteristics is required to define design parameters associated with certain components of the VFS system. This information related to the farmstead is required to define the configuration of the VFS system components. The following is a list of the information that needs to be collected:

- runoff collection area characteristics (establish extent of collection area)
- storage area characteristics (establish use of integrated or external storage/settling basin)
- topographical relief characteristics (establish whether system can operate via gravity or require a pump)
- infiltration area characteristics (establish suitable land area for infiltration area)

2.2.1 Runoff Collection Area Characteristics

An assessment of the area contributing runoff should be carried out. The assessment will involve the following:

- Establish Extent of Area Contributing Runoff to the VFS System—The dimensions of the outdoor portion of the livestock yard/containment area or solid manure storage facility contributing runoff must be measured to determine the total area contributing runoff.
- Identify Clean Water Contributions and Establish Potential Alternate Routes—Uncontaminated upslope water should be prevented from entering the runoff area. This includes roof water and overland flow that has not been in contact with livestock manure. This uncontaminated water does not require treatment.

- Redirect Other Wastewater Contributions to Appropriate Treatment Facilities—Milking centre washwater or wastewater from other sources must be excluded from the VFS system. These types of wastewater require collection and separate treatment and disposal to protect the environment.
- Collect Rainfall Data—Obtain rainfall Intensity-Duration-Frequency (IDF) tables and curves produced from historical rainfall data by Environment Canada for the geographical centre closest to the farmstead.

2.2.2 Storage Area Characteristics

An assessment of the existing outdoor livestock yard/containment area or permanent solid manure storage facility will establish whether an integrated or external runoff storage basin can be incorporated into the VFS system. The assessment will involve the following:

- Establish Structural Integrity of Containment Area Pad Surface—The pad surface must be of concrete or equivalent non-porous material. The integrity of the impervious material must not be compromised by any cracks or other imperfections. If the integrity of the floor is suspect, measures must be taken to ensure that the runoff will not be able to infiltrate through any portion of the pad. For example, farmers may have to pressure-wash, dry-fill joints with a high-strength polymer-based repair cement, and/or apply an epoxy-based liner to seal the surface of the impervious material. Containment walls must be constructed to be watertight, including the joint between the wall and runoff area floor.
- Assess Slope of Floor Surface—The slope of the outdoor livestock yard/containment area or permanent solid manure storage facility surface must be sufficient to direct flow to a low point and allow for sufficient runoff storage volume to be created with the construction of a containment wall. The slope of the surface must be established by:
  - measuring the vertical height of the surface between the lowest and highest point of the surface (rise)
  - measuring the corresponding horizontal distance as measured along a level plane (run) between the lowest and highest point of the surface
  - dividing the resulting rise by the run

  For example, if the rise is 0.5 m (1.6 ft) and the run is 20 m (65.6 ft), the slope is 0.5/20 = 0.025 m/m (0.025 ft/ft) or 2.5 per cent.
- Assess Primary Collection Point—The slope of the outdoor livestock yard/containment area or permanent solid manure storage facility surface must direct the runoff to a common collection point at the furthest downslope location. Establish the lowest point and determine if all runoff from the surface will eventually find its way to the low point.
- Assess Flood Potential of Adjacent Structures—Ensure that structures associated with the runoff collection area are not flooded as the water level increases within the outdoor livestock yard/containment area or permanent solid manure storage facility, helping to accommodate the runoff storage volume.

- Program Compatibility—Establish what impact flooding will have on the operation of outdoor livestock yard/containment area or permanent solid manure storage facility. In outdoor livestock yards/containment area, will feeding operation be interfered with during flooding? Can livestock maintain access to a sufficient portion of the yard?
- Operation and Maintenance Considerations—During the design of a VFS system, consideration must be given to accessibility of components that will require operation and maintenance activities. Examples of such components include solids settling area, screens, power source, sump, pump(s) and piping access, etc. Access should be sufficient for the appropriate activity and equipment required, and secured to prevent uncontrolled access, such as by children or animals.

2.2.3 Topographical Relief Characteristics

The topographical relief is an important landform characteristic that will determine whether a gravity flow system can be used or whether a pump will be required to convey runoff water collected in the runoff storage/settling basin to the top end of the infiltration area. The assessment will involve collecting the following information:

- Difference in Elevation—The discharge elevation of the runoff from the runoff storage/settling basin to the top end of the infiltration area will need to be determined.
- Linear Distance of Conveyance Pipe—Establish the distance the conveyance pipe will need to travel from the runoff storage basin to the top end of the infiltration area.

2.2.4 Infiltration Area Characteristics

The extent of the land suitable for the development of an infiltration area is established by applying a series of physical design parameters associated with specific site features of the farmstead. The evaluation will generate an opportunity and constraint map of the farmstead that will eliminate portions that are unsuitable for development of an infiltration area and define those portions of the land where an infiltration area may be viable. The site features to be considered and the associated design parameter requirements are outlined in Table 2.1.

TABLE 2.1
EVALUATION OF SUITABLE LAND TO ACCOMMODATE INFILTRATION AREA

Site Feature	Design Parameter Requirements
Soil—Texture and saturated hydraulic conductivity	The required infiltration area size is directly related to the saturated hydraulic conductivity of the existing soil and is based on the existing soil's ability to infiltrate all of the runoff directed to it during a defined period of time and for a specific intensity storm event, resulting in zero discharge for the maximum design storm event. The saturated hydraulic conductivity is assessed using soil texture measurements and on-site evaluation. In general, the finer the soil texture, the lower the saturated hydraulic conductivity, and the slower the infiltration rate, the larger the area of infiltration required to manage the runoff.

TABLE 2.1
EVALUATION OF SUITABLE LAND TO ACCOMMODATE INFILTRATION AREA

Site Feature	Design Parameter Requirements
Topography/Grade	The infiltration area requires sheet flow over the surface for even flow distribution. Therefore, the infiltration area must be flat across its width. Grading may be required to achieve the desired sheet flow across the infiltration area. The infiltration area requires utilization of the entire surface area to best manage and utilize the runoff that is directed to it. Slope along the length must be consistent and between 2% (minimum) and 12% (maximum). The steeper the slope of the infiltration area, the longer will be the minimum length required.
Overburden to Ground Water	The infiltration area requires percolation of the runoff through the soil depth before reaching saturated soil conditions (the water table) of at least 0.9 m (2.95 ft). The depth to ground water must therefore be greater than 0.9 m (2.95 ft). This depth to ground water must be ensured within a 10 m (32.8 ft) zone around the perimeter of the infiltration area. Measurement of distance to ground water, if not known, should be made during mid-spring, likely in May, to provide maximum protection of the ground water.
Overburden to Bedrock	The infiltration area requires percolation of the runoff through the soil depth of at least 0.5 m (1.6 ft). The depth to bedrock therefore must be greater than 0.5 m (1.6 ft). This depth to bedrock must be maintained within a 10 m (32.8 ft) zone around the perimeter of the infiltration area.
Distance from Wells	The infiltration area must be located to satisfy the following conditions: • at least 100 m (328.08 ft) from a municipal well • at least 15 m (49.2 ft) from a drilled well that has a depth of at least 15 m (49.2 ft) and a watertight casing to a depth of at least 6 m (19.7 ft) • at least 30 m (98.4 ft) from any other well not defined above
Distance from Surface Water	The infiltration area must be located to satisfy either (a) or (b) below: (a) A flow path of at least 50 m (164.0 ft) in length from the lower edge of the infiltration area to the top of the bank of the nearest surface water (includes vegetated buffer) or tile inlets **or** (b) A vegetated buffer zone adjacent to the top of the bank of the surface water with a minimum width as specified by the infiltration area slope below; **Infiltration Area Slope** — **Minimum Buffer Width** 2 to <4% — 10 m (32.8 ft) 4 to <6% — 20 m (65.6 ft) 6 to <8% — 30 m (98.4 ft) 8 to <10% — 40 m (131.2 ft) 10 to 12% — 50 m (164.0 ft)
Floodplain Boundary	The infiltration area must not be located in an area that is subject to flooding once or more every 100 years, according to floodplain mapping provided by a municipality or conservation authority having jurisdiction over the area. If floodplain mapping is not available, the farm operator must consult with the local conservation authority, the municipal office or local MNR office to determine the location of the 100-year floodplain boundary.
Tile Drained Land	The infiltration area must not be located within 3 m (9.8 ft) of field tile drains.
Buried Refuse	Any edge of the infiltration area must be located at least 20 m (65.6 ft) from an area with buried refuse.

TABLE 2.1
EVALUATION OF SUITABLE LAND TO ACCOMMODATE INFILTRATION AREA

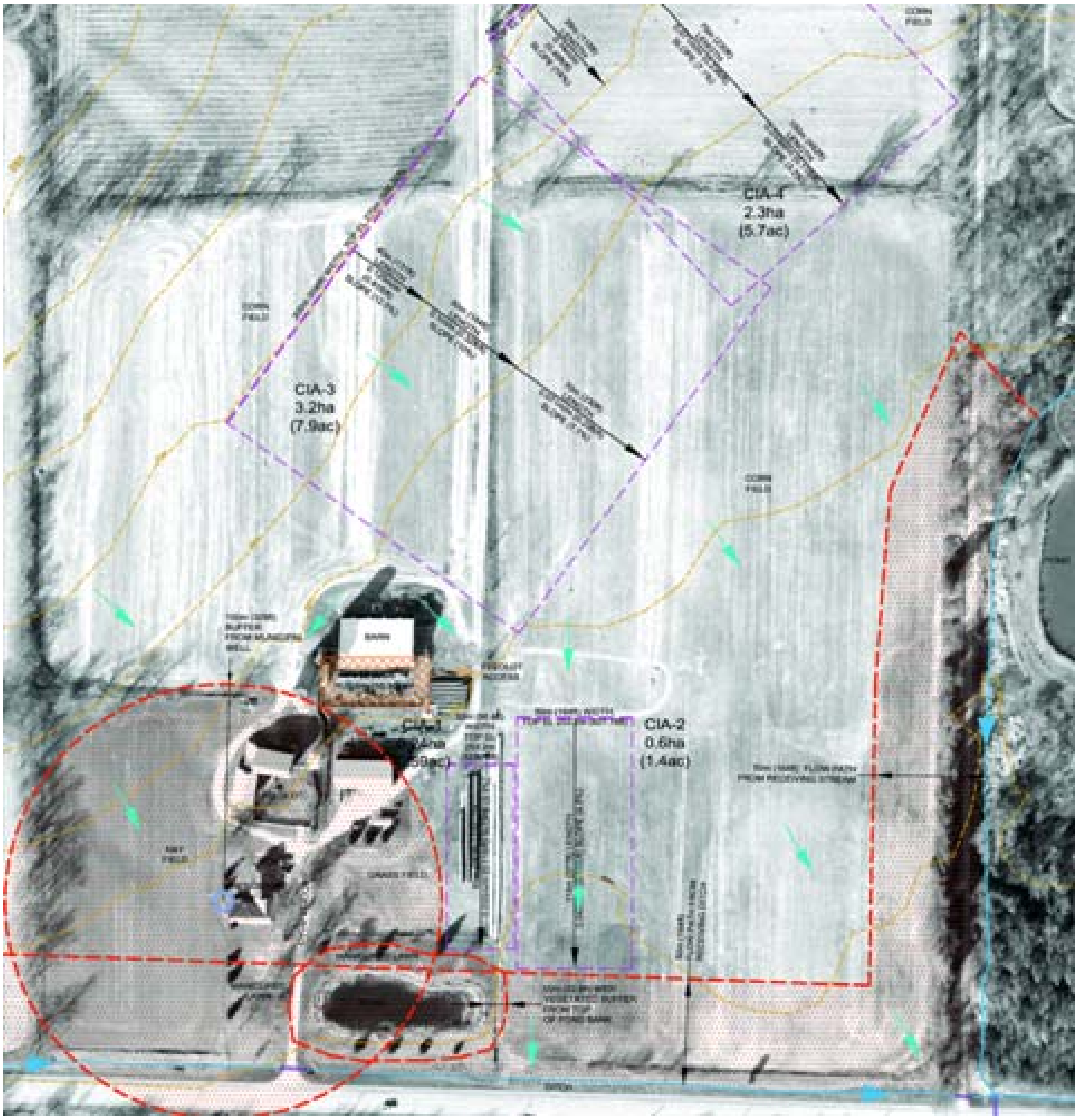
Site Feature	Design Parameter Requirements
Land Accessibility	Free access grazing is not permitted on the infiltration area. The ability to control livestock access by means of fencing is required. The infiltration area may be suitable for grazing only for a limited time during dry periods of the summer. Care must be taken to ensure animal access does not affect the surface of the infiltration area, which may impact the ability to maintain sheet flow across it and reduce infiltration as a result of compaction.
Woodlot	An existing woodlot is not suitable for an infiltration area.

Establishing an Opportunity and Constraints Map for the Infiltration Area Assessment

The farmer must establish the preferred location of the infiltration area and the maximum area that can be dedicated to it. For design and record-keeping purposes, an aerial photograph and a map of the site at a specific scale should be obtained. Potential sources for mapping include an Ontario Base Map (OBM) that typically has a scale of 1:10,000 and 1:5,000 or a National Topographic Map (NTM) that has a scale of 1:50,000 and is available from Energy, Mines and Resources Canada. OBMs can be obtained from the Ministry of Natural Resources Store by calling 1-800-667-1940.

The map of the farmstead should be used to identify each specific site feature and subsequent setback requirements to eliminate unsuitable land. An example of an opportunity and constraints map is illustrated in Figure 2.2.

Figure 2.2
Example of an Opportunity and Constraints Map



OPPORTUNITY AND CONSTRAINTS MAP - EXAMPLE

VEGETATED FILTER STRIP (VFS) SYSTEM DESIGN MANUAL "BEEF FEEDLOT APPLICATION"

LEGEND

- EXISTING GRADES (5.0m INTERVAL)
- EXISTING RECEIVING WATER COURSES (WETLANDS, RIVERS, CREEKS, DITCHES,)
- EXISTING CULVERT
- EXISTING WELLS (DRINKING WATER)
- EXISTING SURFACE WATER DRAINAGE DIRECTION
- EXISTING RUNOFF COLLECTION AREA
- LP — EXISTING RUNOFF COLLECTION AREA LOW POINT
- IA-1 — CANDIDATE INFILTRATION AREA
- CANDIDATE INFILTRATION AREA SETBACK REQUIREMENTS
- ACCESS REQUIREMENT

IDENTIFY THE FOLLOWING OPPORTUNITY AND CONSTRAINT INFORMATION ON A SCALED MAP/AIRPHOTO

- EXTENT OF RUNOFF COLLECTION AREA
- LOW POINT OF RUNOFF COLLECTION AREA
- ALL EXISTING SLOPES THAT ARE BETWEEN 2 AND 12%
- ALL EXISTING WELL LOCATIONS
- POTENTIAL RECEIVING WATERS
- 100-YEAR FLOODPLAIN BOUNDARY
- SURFACE WATER DRAINAGE PATTERN
- EXTENT OF ANY TILE DRAINED LAND
- LOCATION OF ANY BURRIED REFUSE
- LAND USES ON FARMSTEAD (I.E. TYPE OF CROP)
- ANY WOODLOTS
- ACCESS REQUIREMENTS TO FARMSTEAD, LIVESTOCK BARN AND FEEDLOT/MANURE STORAGE FACILITY

ESTABLISH CANDIDATE INFILTRATION AREAS (CIA) AND ASSESS THE FOLLOWING:

	CIA-1	CIA-2	CIA-3	CIA-4
• SLOPE, LENGTH AND WIDTH, AND AREA	%	%	%	%
	m	m	m	m
	m	m	m	m
	m	m	m	m
	m²	m²	m²	m²
	m	m	m	m
• SOIL TEXTURE AND SATURATED HYDRAULIC CONDUCTIVITY				
	m/s	m/s	m/s	m/s
• OVERBURDEN TO GROUNDWATER DEPTH	m	m	m	m
• OVERBURDEN TO BEDROCK DEPTH	m	m	m	m
• WELL TYPE AND SETBACK REQUIREMENT				
	m	m	m	m
• RECEIVING WATER SETBACK AND/OR BUFFER REQUIREMENT	m	m	m	m