SECTION 7

7.0 ON-SITE SEWAGE DISPOSAL SYSTEM REPAIR AND REHABILITATION

7.1 General

All repair or rehabilitation work carried out on an on-site system with the exception of a minor alteration as defined the regulations must have an approval from Nova Scotia Environment. All repair or rehabilitation work including a minor alteration must be carried out by a licensed installer with the exception that a septic tank cleaner may repair or modify a septic tank, holding tank, or vault privy. When the size of the lot permits, a replacement system selected or designed from Section 4 or 5 may be required. If the room available for a replacement system is very limited an option for *design* may be a sloping sand filter. It should be noted that in accordance with the Regulations, a Level II qualified person can only select a replacement system that meets all the requirements of the Regulations and Guidelines. If the replacement system cannot be selected, design of the system must be carried out by a Level I qualified person.

The remainder of this section is adapted from a report entitled *On-Site System Repair and Rehabilitation* prepared by the Centre for Water Resource Studies, Dal-Tech, Dalhousie University, Halifax.

7.2 Malfunction Causes

Some of the common reasons for system malfunction or failure are explained below.

7.2.1 Hydraulic Overload

Hydraulic overloading means that the household is using more water than the disposal field can dispose of. There can be numerous causes for hydraulic overload including:

- the addition of high water use fixtures such as hot tubs
- concentration of water use, example multiple laundry loads on one day
- population increase due to family size increase or parties
- water treatment backwash directed to system for which the system was not designed
- leaking plumbing fixtures
- surface water from roof, driveways, foundation drains directed to system
- overland or topographic related infiltration into the field
- the system design is too small to dispose of the anticipated flow.

7.2.2 Under Design / Poor Construction

Some on-site systems may be doomed to a limited lifetime of operation from the start due to improper design or construction. Causes of malfunctions of this type include:

- inadequately sized system for the flow or soil conditions
- system installed in a poor landscape position or in an area with a high groundwater table or flow restrictive surfaces which won't allow the escape of liquids from the lot

- installation in a area where the natural permeability of the soil has been destroyed due to being graded or cut and filled
- the use of improper or inferior materials
- construction during wet conditions leading to smearing and reduction of permeability on the infiltrative surfaces
- lack of grades or level which cause uneven distribution of effluent and overloading of a portion of the disposal field.

7.2.3 Physical Damage

Physical damage to an on-site system can result from:

- A loss of infiltrative capacity in the disposal field due to driving over the bed
- Paving or building or storage of objects on top of the field
- Tree roots.

7.2.4 Lack of Maintenance

One of the most common reasons for system failure is a lack of maintenance. If a system is not regularly inspected some of the things that can go unnoticed are:

- Lack of regular pumping can result in scum and solids carry over into the disposal field and a possible permanent reduction of the soils infiltrative capacity
- Baffles may degrade and break also resulting in scum and sludge carry over to the disposal field
- Frost heave or uneven soil settling may result in uneven distribution within the disposal field and the subsequent overloading and damage to a portion of the field.

7.3 Trouble Shooting Procedure

The following is a trouble-shooting procedure for someone faced with a system malfunction. While the point of view of this section is directed to the homeowner it is expected an on-site professional will carry out any repair or investigative work. The first step in any repair procedure is to inform Nova Scotia Environment and to contact a qualified person to see what advice they can provide and to make sure approval is obtained to carry out any necessary repairs.

STEP 1 Information

Gather as much information as you can about the system. If the homeowner has no written record of the system the first trouble shooting procedure should be to conduct an interview and gather information as listed in the form shown in Figure 7.A. A good practice for the homeowner is to keep a file folder with a diagram of the system, which locates the position of the septic tank, the pump chamber if present, and the disposal field. The file folder should also contain the name and number of the local tank pumper and a service record for the system. The next time the tank is being

serviced the exact location of the tank covers with reference to the corners of house should be measured and recorded. In Nova Scotia, the local environment office may have a copy of the approval to construct a septic system which will have approximate locations, tank size, and disposal field type.

STEP 2 Inside the House or Between House and Septic Tank

If the sewage is backing up into the house you may have a physical blockage somewhere in the household plumbing system. If you have a flush that won't work or a drain that refuses to empty, the place to start trouble shooting is at that appliance. A plunger may start the toilet running again or a drain trap cleaning may restart your sink and in this case your work is done. If you have access to the Internet and excellent resource documents all aspects of toilet function and repair at http://www.toiletology.com/.

If liquid is not leaving your house a good first step is to hire a professional plumber. Have the plumber check for a physical blockage in the house plumbing and check the pipe between the house and the septic tank. If something has been flushed down the toilet, like a rag or a diaper (or a bewildering array of children's toys), it may have become lodged in the pipe preventing liquid from moving out to the septic tank. Another common culprit is a combination of congealed grease and lint from the washing machine, blocking the pipe.

Frost heave and soil settling may have altered the original slope on the sewer line between the house and the septic tank. It should have been installed with a slope of 2 percent so that the solids in the waste stream are carried along with the liquid. This pipe should also be checked to ensure it still has the correct slope all the way from the house to the tank. If it has low spots, liquid will puddle and during the winter months may freeze and block the flow to the tank. If there are not blockages this far the problem may lie in the septic tank.

STEP 3 The Tank

A typical septic tank schematic is shown in **Figure 3.A** . Before investigating the tank here are some important things to note.

Number one, NEVER get in the tank. Part of the process of breaking down sewage produces odorless poison gases that can very quickly render you unconscious. More than one person has entered a pumped out tank to make a repair that turned out to be their last. Nova Scotia Environment has strict requirements regarding the proper way to safely enter a confined space such as a septic tank.

Number two, the liquid in the tank should be treated with caution and respect. Sewage may contain disease causing bacteria, viruses or parasites which can be transmitted to someone coming in contact with the sewage.

The septic tank is watertight and designed to operate full of liquid. When 135 L come into the tank from a load of laundry, 135 L flow out to the disposal field. Because you have pulled the cover off and see that the tank is full does not mean you have a malfunctioning system. The tank is designed to have the outflow level approximately 75 mm below the inflow level. This gives a quick and easy check on the tank operation. If the distance between the bottom of the pipe coming from the house and the liquid level, not the scum level, is less than 75 mm, then either the septic tank outflow pipe, the disposal field pipe, or the disposal field are not draining properly. More about that later. One other possibility would be if ground water in the area of the system is high and is leaking into the tank or if the disposal field is not able to handle the volume of effluent.

Key trouble spots to examine in the tank are the inlet and outlet baffles or tees. If there is a blockage in the tank it will usually be at one or the other of these locations. Also, it is important to check that the tank still has baffles. In older metal tanks it is common for the baffles to deteriorate and fall into the tank. If your tank is in this condition it means that scum and solids have been allowed to exit to the disposal field which may have resulted in clogged soil pores.

If the difference between the inflow pipe and the liquid level is greater than 75 mm, then the liquid in the tank is finding its way out of the tank somewhere other than the pipe leading to the disposal field. A leak in the tank could be the result of a deteriorated portion of the tank. Most tanks in Nova Scotia are mid seam tanks. This means that the bottom half of the tank is lowered into place then a sealer is spread along the upper edge and the top half of the tank is lowered into place. This allows the installer to use a smaller boom truck to set the tank in place. If the liquid level in the tank is about half way down then this seam is most likely leaking.

The sludge level in the tank should be checked. This may help give some clues as to the condition of the disposal field. As the sludge level gets deeper, the flow of liquid through the tank is more likely to pick up and carry solids from the tank into the disposal field. If your tank is close to being full of sludge, solids may have been carried into the disposal field resulting in clogged pipes, soil pores or crushed rock .

Many tanks, but not all, will have a scum layer on the surface of the liquid. This is normally from 50-200 mm thick and can be quite solid looking.

If the system malfunction has not been located in the plumbing or the septic tank the next place to check is the disposal field.

STEP 4 The Field

The problems with the disposal field can be varied and involve overland water flow, subsurface water flow, household water use, or a clogging of the disposal systems pipes or soil pores. Some indication of the source of the problem can be determined from whether the malfunction is continuous or periodic. If the failure is constant it has several potential sources:

- too much water going into the system (same as system undersized for flow)
- the distribution pipes, crushed rock or soil have become clogged
- the system has been damaged by landscaping construction (smearing), or heavy traffic

The disposal field is likely either a trench or large bed filled with a layer of gravel. A pipe with no holes runs from the septic tank and delivers effluent to the perforated pipes situated in the gravel.

A schematic of a typical field is shown in **Figure 1.A** . One cause of system failure can be that the perforations in the pipe have become blocked and there is no flow to the gravel. If an end or a corner of the disposal field is exposed and the gravel is dry and clean with no standing liquid, it may be the pipes that are clogged. In this case an end of the pipe may be uncapped and the pipe cleaned with a high pressure jet washer by an on-site professional. Often this will unclog the pipe and or the perforations. This will not help much if the crushed rock or soil pores are plugged.

If there is a distribution device, such as a distribution box, pump, or siphon it should be checked to determine if effluent is being sent to all sections of the field evenly.

If a portion of the disposal field is exposed and it is found full of standing liquid then the soil below the system is either refusing to, or very slowly, accepting effluent. Soil clogging is usually the result of the development of a thick biological mat on the soil below the system. The soil pores become physically clogged with solid matter carried out of the tank, and the proliferation of biological growth in this layer. A clogging mat develops at the gravel soil boundary, to some extent, in all systems. If the disposal field has been undersized with respect to the flow from the house, or fed with high organic strength effluent, as from a garbage grinder, this mat may have become very thick and resistant to flow.

In many cases once the natural soil has become clogged it will remain clogged requiring either an entire or a partial new field. The addition of extra trench, if space is available, is one of the most common field repairs. In cases where no new area for a field is available the old field may be removed and replaced with a lateral sand filter. Details on the sloping sand filter are shown in Section 5.9.

The combination of having the disposal field pipe cleaned and the tank pumped, will give the field a rest. This, and a reduction in water use in the household, and preventing further solids migration to the disposal field with a septic tank effluent filter, may result in a slow re-establishment of a portion of the original capacity of the system.

Settling over the trenches may have caused long linear depressions along the trench which accumulate surface water and can contribute to hydraulic overloading.

The field may have become damaged through compaction from landscaping or traffic. The use of imported sand fill that does not meet the specifications may cause effluent to pond in the crushed rock field. The permeability of the imported sand fill can be checked and if it is too slow it must be removed and replaced with suitable material.

7.4 The Failure Analysis for Trouble Shooting Septic Systems (FACTSS)

There is a computer program available, called FACTSS that may help evaluate and track system failures.

The FACTS program is based on work completed in North Carolina on the development of a failure analysis chart reported in FACTSS:Failure Analysis Chart for Trouble Shooting Septic Systems (Adams, et al., 1998. ASAE;Proceedings of the 8th National Symposium on Individual and Small Community Sewage Systems).

The developers note that the flow chart was prepared in response to the need for a systematic method to evaluate the cause of failure for on-site systems and to identify repair solutions that are appropriate to correct the problems. The flowchart was developed for analyzing gravity distribution systems. It does not address systems that use advance pretreatment such as sand filters, peat filters, or pressure-dosed systems such as C3's or mounds. The chart was also developed primarily for typical residential systems. The program and chart are not aimed at the homeowner, instead it is expected that the primary audience will be either a private sector or government on-site professional who is faced with a failing system.

The flow chart guides the user through a process for trouble shooting a system and arriving at appropriate malfunction solutions. These steps include:

- determining the type of system
- determining the location of the malfunction
- determining the frequency and duration of the malfunction
- evaluating the water use in the home
- evaluating the site and soil conditions
- evaluating the functionality of the drain field and distribution system
- evaluating the likelihood of a biomat-induced malfunction
- summarizing the factors contributing to the failure
- developing and implementing appropriate repair options to solve the problem

Potential contributing factors to the system failure are considered “flags”. When the failure analysis is complete the user will have identified a list of flags. In the computer program these potential causes have been listed in red text.

One of the first steps in the trouble shooting process is to gather as much information as possible concerning the system. The main screen of the program contains the Homeowner Information Form. This information can be collected during the field assessment or during a telephone interview and can be saved and recalled as a file. In the event that a large number of files are to be saved it is recommended that a consistent nomenclature be used to facilitate the search and retrieval process.

The flow chart developers strongly recommend that the most senor environmental health specialists work with repairs. A list of repair options is shown in the table below. It takes experience, judgement and openness to innovation to determine the correct course of action while protecting the public health and environment. Cost, appearance, feasibility, longevity and function are all criteria that the specialist and the homeowner must consider when designing a repair system. Particular water use characteristics or lifestyles of the users will influence the repair solution.

This flow sheet provides a logical and systematic approach to system repair. The developers believe that this will:

- increase the rate of success for repairing systems
- minimizes repeat trouble shooting on the same system by logically eliminating problem
- improves the ability of environmental health specialists and other trouble shooters to design effective repairs for failing systems
- redistributes field staff workload by improving their ability to logically trouble shoot a system in a timely manner
- provides a legally defensive approach to repair work efforts.

TABLE 7.1

REPAIR OPTIONS

Repair Options (Adams, 1998)	
Malfunction/Solution Option Table	
MALFUNCTION	SOLUTION OPTION
Leaking plumbing fixtures	Repair/replace fixture
Running faucets to prevent freezing of pipes	Insulate pipes/use heat tape
Dishwashers, jacuzzis, hot tubs, spas, excess laundry	Spread flow out over time using timed dosing with a pump tank; spread out laundry and dishwashing over the week, full loads only, use water saving machines, use off site facilities
Parties, visitors	Expand system; timed dose system; have septic tank pumped before arrival of guests
Water treatment system discharges to septic system	Remove discharge from septic system unless the system has been designed by a level 1 Qualified Person to include the discharge.
Flow exceeds design	Use of water conservation; expand drain field; use of off-site laundry facilities
Surface water intrusion	Landscape to divert surface water away from system; fill depressions over system; collect and divert roof and gutter water.
Poor landscape position	Move system, divert ground and surface water away from system; fill depressions
Blockage in plumbing	Call plumber to remove blockage
Ground water entering system	Install drainage upslope of system and outlet drainage below system; install system above limiting horizon
Unsuitable soil conditions	Move system to a suitable area; install system above limiting horizon.
Short circuiting of effluent between trenches in drain field	Locate short circuit and correct
Biomat formation	Replace system; use alternating valve to rest sub-fields
Undersized drain field	Increase to proper size; use water conservation to reduce flow into system
Unequal distribution from distribution device	Level device; adjust or install flow leveling device

Figure 7.A

ON-SITE SEWAGE DISPOSAL SYSTEM MALFUNCTIONING INSPECTION FORM

Owners Name:	**Date of Complaint:**
Address:	**Telephone:**
Subdivision:	**Lot #:**
Installer of System:	**Date System Installed:**
Approval #:	**Selector/ Designer of System:**
Date of Certificate of Installation:	

If there is no record of an approval being issued and it is obvious the existing system is using an outdated technology or is grossly undersized, skip to the comment section, otherwise, complete the following form where pertinent.

- LOT CATEGORY _____ FIELD TYPE _____ LENGTH/SIZE _____PRESSURIZED _____
- SEPTIC TANK SIZE _____ NUMBER OF CHAMBERS _____ TYPE _____
- INTERCEPTOR DITCH/SWALE _____
- FILL USED _____ QUALITY _____ DEPTH _____ WIDTH _____LENGTH ___
  PERMEABILITY _____ N/A _____
- TYPE OF PIPE_____ BARRIER MATERIAL _____

DATE TANK PUMPED _____OTHER PREVIOUS PUMPED DATE(S) _____

NATURE OF PROBLEM : BACK-UP _____ BREAKOUT _____ SLOW DRAINING _____

ODOUR _____ OTHER _____

PROBLEM FIRST OBSERVED: DATE: _____

LIST ANY SITE WORK DONE TO HOUSE SINCE OCCUPANCY, such as underground roof drains, basement foundation drains, landscaping, etc: _____

_____

_____

_____

FREQUENCY OF PROBLEM: CONTINUOUS _____ OCCASIONAL _____ SEASONAL _____

_____

_____ AFTER RAINS _____ AFTER HEAVY USE _____

COLD PERIODS _____ OTHER _____

HAS A MALFUNCTION BEEN CORRECTED PREVIOUSLY? _____

HOUSEHOLD DISPOSAL PRACTICES:

DIAPERS_____

_____CIGARETTES_____

_____HOUSEHOLD AND OTHER CHEMICALS_____

_____TYPE(S)_____

_____

_____

SEPTIC TANK CLEANERS UTILIZED_____ HOW OFTEN_____

WERE NEW FIXTURES ADDED SINCE THE SYSTEM WAS INSTALLED ?:_____

_____

_____TYPES_____

_____LIST PLUMBING FIXTURES such as spas, whirlpools etc, other than sinks, lavatories, baths/showers and toilets _____

_____

_____

OBSERVED PROBLEMS:

- PIPE PROBLEM : BUILDING SEWER _____ EFFLUENT LINE _____ BED _____ N/A _____

  PIPE: BROKEN _____ SAGGED _____CLOGGED _____ HOLES PLUGGED ____ N/A _____

- CLOGGING MATERIAL: SOLID_____GEL_____SEMI-LIQUID _____ OTHER _____ N/A ____
  COLOR OF CLOGGING MATERIAL: BLACK _____GREY _____ OTHER _____ N/A _____

- FLOODED BED _____ BREAK OUT _____

  EXTENT OF BREAK OUT _____

OTHER OBSERVATIONS

- TANK CONDITION _____ BAFFLES _____ LEAKING _____
  ____CONTENTS OF TANK: DEPTH OF SCUM LAYER _____ SCUM ABOVE BAFFLE _____

DEPTH OF SLUDGE LAYER _____ NEAR BASE OF BAFFLE _____

SCUM LAYER: SEMI-SOLID _____ GEL ____ LIQUID _____ COLOR _____

DEPTH TO TANK TOP_____

IS TOP BELOW HIGH WATER LEVEL? _____

- DEPTH OF DISPOSAL PIPES _____
- SURFACE DRAINAGE TOWARDS FIELD/TANK _____
- ROOF DRAINAGE TOWARD FIELD/TANK _____
- DOES BED FOLLOW THE CONTOUR OF THE LOT? _____
- WHEN WAS SEEDING OR SODDING COMPLETED AFTER FINAL INSPECTION _____
- CONDITION OF INTERCEPTOR DITCHES _____N/A _____

TRAFFIC OVER: TANK _____ BED _____ PIPES _____

WATER SUPPLY: MUNICIPAL _____ DRILLED WELL _____ DUG WELL _____

WATER QUALITY: HARDNESS _____ pH _____ IRON _____ MANGANESE _____

IN HOME WATER TREATMENT: SOFTENER _____ GREEN SAND FILTER _____ OTHER _____

BACKWASH WATER DISCHARGED TO _____

IS SEWAGE PUMPED INTO TANK ? YES _____ NO _____

WASHER: AUTOMATIC _____ MAKE _____ LINT TRAP _____ WASH DAY _____

NO. OF WASHES/WEEK _____

DISHWASHER _____ GARBAGE GRINDER _____ LARGE TUBS _____ HOT TUBS _____

AVERAGE DAILY WATER USAGE:_____

NUMBER OF HOUSING UNITS ON THE SYSTEM _____

NUMBER OF PEOPLE ON THE SYSTEM: NORMAL _____ PEAK _____

LEAKING PLUMBING FIXTURES? _____

COMMENTS: _____

_____

_____

BASED ON THE INFORMATION AVAILABLE, THE PROBABLE CAUSE OF THE MALFUNCTION:

CAN BE DETERMINED_____ CANNOT BE DETERMINED_____
(Provide details below)

DETAILS: _____
_____
_____
_____

_____ _____
COMPLETED BY DATE

All repair or rehabilitation work carried out on an on-site system with the exception of a minor alteration must have an approval from Nova Scotia Environment and must be carried out by a licensed installer.

A Level II qualified person can only **select** a replacement system that meets all the requirements of the Regulations and Guidelines. If the replacement system cannot be selected, **design** of the system must be carried out by a Level I qualified person. Refer to On-site Sewage Disposal System Interpretation Bulletin - *Replacing Malfunctioning Systems* and *The On-site Sewage Disposal Systems Technical Guidelines.*