# Questions and answers regarding the guidance document for developments and subdivisions where onsite wastewater treatment systems are proposed




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# 1. General

### *1.1. What is a Subdivision Assessment Report?*

A Subdivision Assessment Report is a report that follows the "Guidance Document for Developments and Subdivisions where Onsite Wastewater Treatment Systems are Proposed" (Guidance Document). Generally, it is a hydrogeological study that will assist regulatory authorities in determining whether the proposed subdivision land is suitable for development with respect to wastewater management. The report shall consider two issues: 1) whether onsite wastewater treatment systems (OWTSs) can adequately perform on the subdivided area; 2) whether the proposed OWTSs may unacceptably impact the environment or human health. These issues must be resolved prior to the finalization of the subdivision design as mitigation methods may require changes to the subdivision design.

### *1.2. What is involved in a Subdivision Assessment?*

A subdivision assessment requires several activities to be completed. First, a desktop review of available information should be completed. Based on this review, a field program should be developed. Information collected from the field program is then analyzed (see 1.1). Depending upon the results of the analysis, the report submitted may be relatively short or quite detailed.

### *1.3. Can prior reports be used in the Subdivision Assessment?*

Use of prior hydrogeological, geotechnical and similar reports as part of the subdivision assessment submittal is acceptable and encouraged. Prior reports need not be up-to-date, provided supplemental information is provided to ensure the report meets the requirements of the guidance document.

The consultant will be expected to establish that the prior reports are relevant to the area under investigation.

### *1.4. When is a report considered complete?*

The regulatory authorities will determine that a report is complete when it is satisfied that the report adequately addresses all applicable items in the guidance document.

See Appendix A for a completeness checklist.

### *1.5. What is the scope of Subdivision Assessment?*

The subdivision assessment is not a detailed OWTS design report; instead the assessment should focus on the protection of public health and the environment.

### *1.6. How are the recommendations made in a report enforced?*

The subdivision assessment is used to inform two approval processes. First, the subdivision assessment is used by the Community Planning Branch for informing their

decision process. The recommendations and mitigation methods may be included in servicing requirements, approval conditions or other documents. Second, it is recommended that developers share the final subdivision assessment with homeowners in order to inform decision making with respect to installing private sewage systems.

### *1.7. What type of expertise is required to complete the Subdivision Assessment?*

The report contains geotechnical, hydrogeological and wastewater engineering aspects. It is required that the report is completed by engineer(s) or geoscientist(s) with knowledge in all three fields.

### *1.8. How is the report evaluated by the reviewers?*

The reviewers will compare the contents of the report to the guidance document. Where requirements of the guidance document have not been fulfilled or clarification is required, the report will be returned for revisions.

## 2. Report format

### *2.1. Is an executive summary required?*

There should be an executive summary for the general public and for OWTS contractors. This summary should include all information that could affect the location and design of an OWTS as well as summarizing the recommendations and concerns.

### *2.2. Required Format*

There is no required format provided that the report contains the information required in the guidance document.

### *2.3. Preparation and Submission of a Report*

Subdivision assessments are to be completed by a professional engineer or professional geoscientist or under the supervision of a professional engineer or professional geoscientist. The professional engineer/geoscientist shall sign and seal the final report.

The subdivision assessment will be a valuable resource for homeowners in support of the eventual installation of an OWTS on each parcel. Copies of the report should be made available to homeowners and their sewage contractors.

The report shall contain a signed declaration made by the engineer or geoscientist responsible for the report as follows:
"I, the undersigned, hereby declare that to the best of my knowledge, the information contained herein and the information in support of this submission as completed by me or under my supervision is complete and accurate in accordance with my obligations under The Engineering and Geoscience Professions Act (2000) and its regulations. I further declare that this submission has been prepared in accordance with the published guideline for this submission."

## 3. Technical Section

Consultants are encouraged to contact the health region at the start of the subdivision assessment study to foster an early discussion of problems, issues and challenges. Prior to doing so, the consultant should have reviewed the guidance document and be knowledgeable of all its requirements.

Any draft or final subdivision assessment reports may have addenda or errata sheet(s) as part of that draft or final report.

### *3.1. What is the difference between a "Private Sewage System" and an "Onsite Wastewater Treatment System"?*

A private sewage system includes septic tanks and soil treatment fields; package treatment plants; lagoons; holding tanks; and jets.

An onsite wastewater treatment system includes all the above systems with the exception of holding tanks as a holding tank is not intended to provide any treatment.

### *3.2. Is there an OWTS for any type of lot?*

No. Not every lot can accept a discharging onsite wastewater treatment system. In particular, on lots that are small or have clay soils, it may not be possible to have an OWTS installed due to the soils inability to accept effluent or the inability to meet necessary set-back distances from certain features.
Holding tanks should be considered an option of last resort when the study shows unacceptable impacts to the environment or when the soils are not suitable for the installation of an OWTS.

### *3.3. Is a lot by lot assessment required?*

Consultants are required to perform sufficient field work to characterize the conditions across the subdivision. A number of boreholes (a minimum of three) must be drilled and at least one test pit must be examined. The key requirement is to collect representative data considering the geologic variability of the site. The amount of work will vary on a site-specific basis but must be technically defensible. Consequently, the work requirements for similarly sized project may vary considerably. Based on the representative data and other field observations, it is expected that any lots with additional restrictions on the performance of an OWTS be discussed.

### *3.4. How do I consider different types of OWTS?*

Recommendations should be made regarding the design and selection of individual OWTS for each parcel of the subdivision. These recommendations should be based on:

1. Design information from the Saskatchewan Onsite Wastewater Disposal Guide (SOWDG).
2. Site specific environmental conditions of each lot.

### *3.5. What water quality parameters are required to be tested?*

At a minimum, the following parameters require testing:

- major ions (e.g. chloride);
- health and toxicity parameters (e.g. arsenic, selenium, etc); and,
- water quality (e.g. nitrate, total coliforms, E.Coli, dissolved oxygen, and reduced iron).

### *3.6. Why do I have to test for water quality parameters?*

Water quality tests are required to establish:

1. whether the water is of a sufficient quality for potable purposes;
2. whether the water is aesthetically acceptable; and,
3. whether the water, if used for domestic purposes, will impact on the operation of an OWTS.

### *3.7. How do I interpret the water quality analysis?*

Water quality analysis should, at a minimum, be discussed in the context of the information in the above question.

### *3.8. What is required for a "discussion" of a required topic?*

The following items are expected to form part of the report:

1. engineering analysis of field data;
2. technical data and calculations; and,
3. discussion and interpretation of the field data and engineering analysis with respect to impact on OWTS design and the impacts of the OWTS on the environment.

All three points are mandatory aspects of the report and any report not containing a detailed discussion and interpretation of the findings will be rejected as incomplete.

### *3.9. How do I assign risk by lot?*

A lot by lot assessment of risk may not be required. An overall assessment of the subdivision is required. This should include a general analysis as well as determining whether any specific lots contain further restrictions that affect the impact of OWTS on the environment or impact the design of OWTS's. Where conditions vary significantly a lot by lot assessment may be required.

### *3.10. How can I determine the level of the analysis and reporting required prior to field work?*

The field work and report level are based on lot density, activities adjacent to the proposed development and the geologic variability of the site. The level of analysis is detailed in the guidance document. Specifically, figure 2 provides the decision analysis required in order to submit a complete report. Each report may require a different level of analysis due to different environmental conditions or different proposed uses.

### *3.11. How can I determine historical high water levels?*

Historical high water levels can be determined by an experienced and knowledgeable soils expert. While current water levels must be measured, the information gathered from test pits and boreholes should be used to indicate the historical water levels in the soil.

### *3.12. How do I decide what type of OWTS's should be used or their orientation?*

There are specific soils or environmental conditions that affect the type of system that can be installed on a lot. The types of systems specified in the report should be based on these details. In addition, the type of system and its design or orientation is impacted by the assessment of nitrate impacts.

Training courses are available that will provide additional OWTS knowledge. One such organization offering training is the Saskatchewan Onsite Wastewater Management Association.

### *3.13. How do I calculate septic volumes?*

The wastewater effluent flow rates found in the Saskatchewan Onsite Wastewater Disposal Guide are generally maximum day flows. This is appropriate as the system has to be designed to treat the volume of water that will be discharged to it in any twenty-four hour period.

However, when considering nitrate impacts or other groundwater impacts, the timescale considered is typically much longer and therefore, it may be appropriate to use average day flows from each OWTS.

Whether maximum day flow or average day flow is selected should be based on standard engineering assumptions.

### *3.14. What level of nitrate in groundwater is acceptable?*

The Guidelines for Canadian Drinking Water Quality lists the maximum acceptable concentration of nitrate in drinking water as 10 mg/L as nitrogen. There may be other influences that result in a lower number being considered acceptable. For example, additional developments or environmental concerns (e.g. surface water impacts) may result in a lower number being considered. It is the consultant's responsibility to determine when a lower number should be applied.

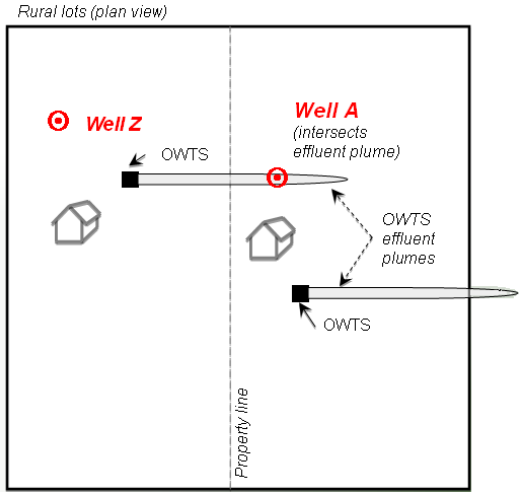
### *3.15. Why do I have to include, consider or discuss other lots/communities?*

If the impacts of nitrates have to be considered, background nitrate levels need to be determined as this influences the nitrate levels leaving the proposed development. In some cases, a cumulative nitrate assessment must be completed. The cumulative nitrate assessment is only required where there is greater than a 90% chance of

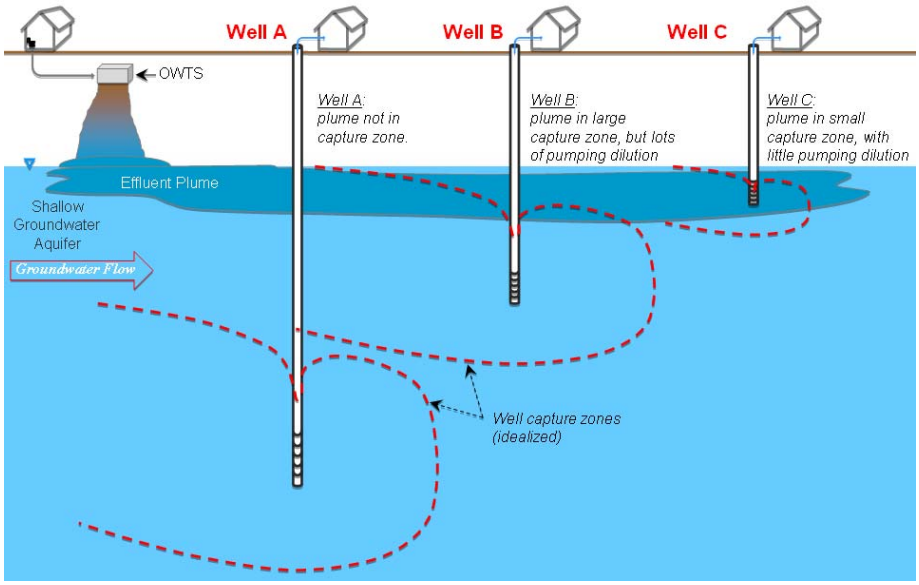
intersecting a plume at the down gradient boundary of the development. A cumulative nitrate assessment considers other local and regional nitrate sources.

### *3.16. What's the difference between intersecting and intercepting a plume?*

When a well sits over top of a plume in plan view, the well is located in the plume in a plan view as shown below.



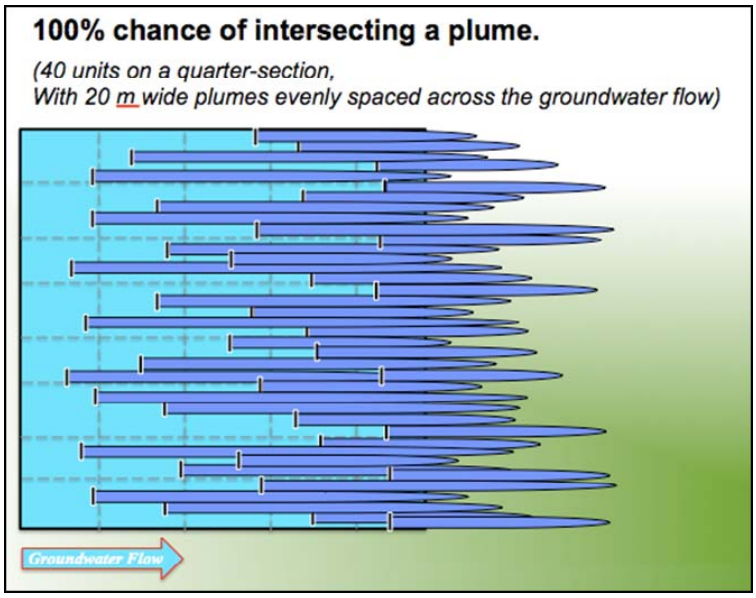

A well intercepting a plume occurs when treated effluent is drawn into the well as shown below for well B and well C. Well A in the diagram below intersects a plume but does not intercept it.

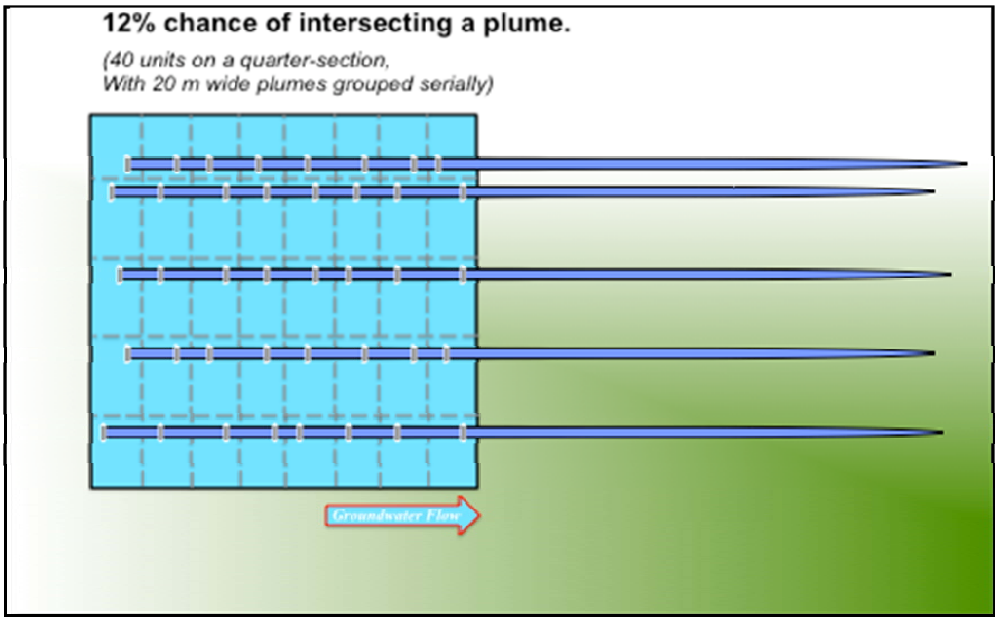



### *3.17. How do I calculate the chance of intersecting a plume?*

The chance of intersecting a plume is based on the plume geometry in relation to the subdivision alignment.

The two examples below are extreme examples to illustrate to possible outcomes both based on 40 OWTS's on a quarter section.




### *3.18. Does the location of septic systems and their respective setbacks to key features need to be included?*

The location and orientation of septic systems in relation to the groundwater flow direction is an important factor in determining the chance of intersecting a plume at the down gradient boundary. Therefore, proposed locations should be included based on best available information. Some consideration should be given to the effects of the location and orientation of the OWTS's on the environmental impacts and the outcome of the study.

### *3.19. Do stability concerns need to be discussed?*

Stability concerns should be addressed in instances where the addition of water to the subsurface environment will be detrimental to slopes or structures.

### *3.20. Does the vegetation need to be described and discussed?*

A description of the vegetation is a critical component of the study. Different vegetation can indicate moisture levels or soil characteristics.

### *3.21. The developer is proposing holding tanks. Do I have to do a study?*

One of the intents of the study is to determine whether OWTS's can be successfully installed within the development. A commitment to using holding tanks does not alleviate the need to consider the impact of discharging OWTS as discharging systems may be installed in the future.

## 4. Nitrate modeling

### *4.1. The developer is proposing holding tanks. Do I have to do the nitrate assessment or can I assume that holding tanks are the only system used?*

The nitrate assessment is only required in certain instances (see figure 2). However, whether one uses holding tanks or another method of sewage disposal, the nitrate assessment should consider the impact of contaminants of concern (e.g. nitrate) on receptors as if a typical OWTS has been installed.

### *4.2. If the developer is proposing holding tanks, is the nitrate assessment based on no discharge from the tanks?*

No. Where holding tanks are proposed and a subdivision assessment is requested, the nitrate assessment should be based on all lots utilizing a discharging OWTS. This approach is the most conservative as future homeowners may wish to convert from a holding tank to a discharging OWTS.

### *4.3. What type of model should I pick or how do I pick a model for nitrate.*

There are a number of simple dilution models that can be used. Simple dilution models can be used to support a finding of no significant adverse impact.

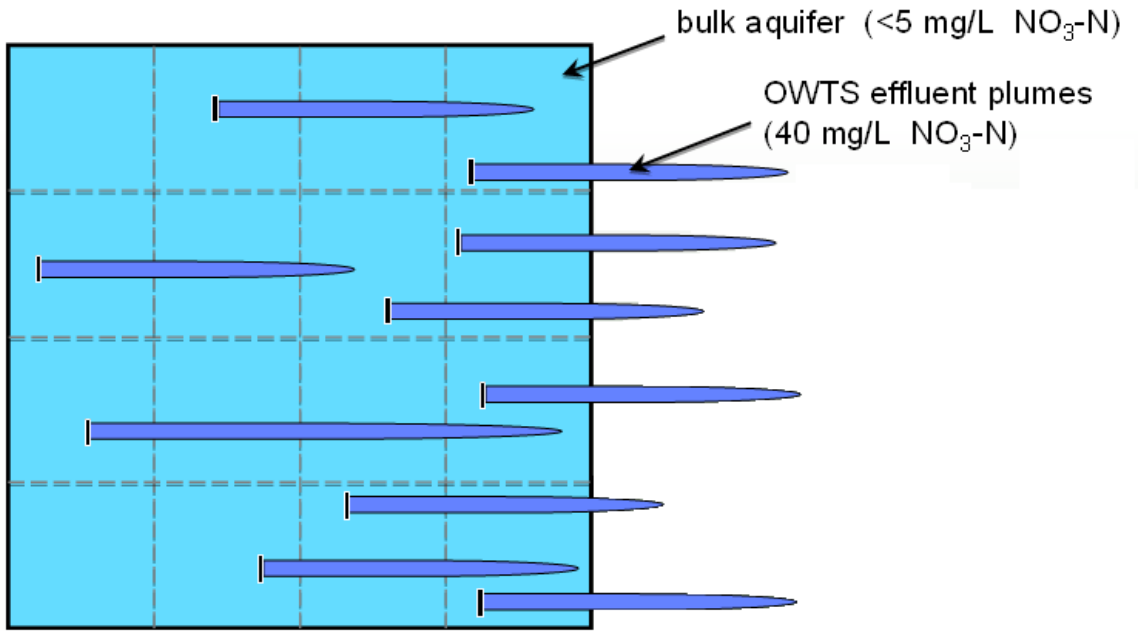
Dilution models generally assume:

- Nitrate is conservative and is not modified in the subsurface.
- The nitrate from the OWTS is fully mixed with on-site groundwater recharge.
- No other on-site or upgradient nitrate sources.
- Only on-site groundwater recharge is available to dilute the nitrate from the OWTS.
- The monitoring point is at a sufficient distance downgradient that temporal fluctuations in nitrate loading and groundwater recharge have averaged out.

Therefore:

- The assumptions of the dilution model are appropriate for protecting groundwater from nitrate originating in residential OWTS's.
- The dilution model is not appropriate for near-field applications (protection of individual wells).
- The dilution model is not appropriate for protection of surface water except in certain local situations where the surface water quality is closely coupled to groundwater.
- Nitrate is not suitable as a surrogate for other pollutants transmitted from treated effluent to surface water via OWTS.
- The dilution model has potential for assessing the potential for impacts from pollutants that pass unmediated from OWTS to the groundwater.

It is important to note that dilution models do not model effluent plumes in the near-field. In the immediate vicinity of the well, the effluent will usually travel in long narrow shallow plumes (below).




Dilution modeling approaches

1. New Jersey method

Hoffman, J.L. and Canace, R.J., 2004, A recharge-based nitrate-dilution model for New Jersey: N.J. Geological Survey Open-File Report OFR 04-1, 27p.

2. Hantzsche method

Hantzsche, N, Finnemore, E.J. (1992). Predicting Ground-Water Nitrate Nitrogen Impacts. Ground Water. 30(4).

3. New Jersey method

Rogers; Golden and Halpern, Inc. (1988). Development of Nitrate Dilution Model for Land Use Planning in the State of New Jersey. New Jersey Office of State Planning,Technical Document #32, 24 pp. http://www.water-research.net/Waterlibrary/groundwater/nitratemodel120788.pdf

4. Pennsylvania method

Taylor, J.R. (2003). Evaluating Groundwater Nitrates from On-Lot Septic Systems, A Guidance Model for Land Planning in Pennsylvania.
http://www.taylorgeoservices.com/papers/nitratereport.PDF

5. Montana method

How To Perform A Nondegradation Analysis For Subsurface Wastewater Treatment Facilities and Appendixes (2007)
http://www.deq.mt.gov/wqinfo/Nondeg/HowToNonDeReg.mcpx
http://www.deq.mt.gov/wqinfo/Sub/NonDeg%202009/Appendix%20E_(2)_rev2007.xls

6. New South Wales method

On-site Sewage Management Risk Assessment System: Appendix E
http://www.dlg.nsw.gov.au/dlg/dlghome/dlg_osras.asp

7. Other methods

More complicated modeling methods can be used if the consultant prefers. In addition, they may be required for situations where an adverse impact is likely. Any modeling method must be fully described in the report including:

- Assumptions
- Inputs
- Results
- Uncertainty

The report must discuss whether the underlying model assumptions are valid in this particular case and justify the selection of inputs.

The report must include a sensitivity analysis that provides a range of potential results.

### *4.4. Can I include denitrification in the model?*

Denitrification can only be included in the model when site specific supporting information that indicate the current presence of denitrification or a significant potential for future denitrification. A significant amount of site specific support is required for any argument that denitrification in OWTS effluent.

### *4.5. Can Darcy's Law be used to calculate nitrate movement?*

The underlying assumptions of any modeling or calculation approach must be evaluated to ensure that the underlying assumptions are valid for the particular usage. In this case, the migration of nitrate from an OWTS is being evaluated.

In order to use this calculation in the context of OWTS's one has to include the effect of groundwater mounding due to the addition of effluent from the OWTS.

### *4.6. Do I have to provide calculations or assumptions?*

Yes. All calculations and assumptions should be described and justified. All values selected for calculations should be included in the report.

## 5. Risk management actions

In the case that the analysis shows an unacceptable risk, the consultant is responsible for making recommendations that will manage the risk. The report entitled "On-site Wastewater Treatment in Subdivisions" (Report) contains a number of recommendations on methods to manage risk. The application of risk management strategies should be specific to the risks present for the subdivision proposal being considered.

The risk management strategies listed below may be appropriate. This list is not exhaustive and other options may be available. A strategy listed below may not be acceptable to regulatory authorities. It is the responsibility of the proponent/consultant to justify the selection of a risk management strategy.

- Network of groundwater monitoring wells at the up-gradient and down-gradient boundaries of the subdivision. Groundwater monitoring must account for potential vertical stratification of nitrate plumes.
- Septic field placement (location and orientation) and coordinated well placement within the subdivision accounting for downstream wells.
- Nitrate accounting on a regional scale and land use planning.
- Alternatives to individually owned and operated OWTS's.
    - Eg. A responsible management entity involved in the oversight of OWTS.
- Obtain drinking water from deeper aquifer.
- Require treated and piped water to affected well users.
- Optimize locations and draw depth for new wells & replace old wells if necessary.
- Ongoing water quality monitoring of wells.
- Education of regional groundwater users.
- Point-of-use filters to remove nitrate.
- Engineered barriers.
- Increased lot size.
- Installation of a communal sewage works.
- Employing technologies that enhance denitrification in OWTS's.

An alternative to implementing risk management actions that are specified above is always to redesign subdivision to reduce the risk to acceptable levels.

## Appendix A – Completeness Checklist

| Assessment elements | Element Included? |
|---|---|
| General | |
| 1. Executive summary included | Yes / No |
| 2. Inclusion criteria described | Yes / No |
| 3. Density determined | Yes / No |
| 4. Desktop review described | Yes / No |
| 5. Field program described | Yes / No |
| | |
| Are the following questions answered explicitly? (See Figure 2) | |
| 1. Is the OWTS effluent isolated from a supply aquifer? | Yes / No |
| 2. Is there sufficient vadose zone retention time? | Yes / No |
| 3. >90% chance of intersecting a plume | Yes / No / NR* |
| 4. <10% chance of intersecting a plume | Yes / No / NR* |
| 5. Are there any down-gradient wells where >10 mg/L nitrate nitrogen is predicted? | Yes / No / NR* |
| | |
| Are the following elements included in the report | |
| 1. Details about the proposed subdivision | |
| • Development/Subdivision area, including all lots | Yes / No |
| • Number of existing or proposed parcels on surrounding quarters | Yes / No |
| • Description of proposed land use and type of development | Yes / No |
| • Proposed and existing sewage systems and their set-backs | Yes / No |
| • Existing and proposed water supplies | Yes / No |
| • Reserve or contingency areas | Yes / No |
| • Surface drainage details | Yes / No |
| • Identification of features that may cause stability concerns | Yes / No |
| • Identification of vegetation indicative of soil moisture | Yes / No |
| • Description of type of OWTS and typical installation & design | Yes / No |
| • Estimation of anticipated or typical sewage volumes generation | Yes / No |
| • A preliminary conceptual hydrogeological model | |
| • Regional and local hydrogeology and geology information, including the presence of any aquifers or shallow sand/gravel units that could be impacted by the project. This information shall include normal hydrogeology information such as lithology, hydraulic conductivities, etc. as well as adequate interpretation of this information. | Yes / No |
| • Springs, dugouts and water wells | Yes / No |
| • Temporary or permanent surface water bodies | Yes / No |
| • Existing or planned drainage courses | Yes / No |
| • Topographic contour lines | Yes / No |

| | |
|---|---|
| • Water table or piezometric surface contours for individual hydrogeological units, including estimated flow directions and gradients. | Yes / No |
| • At least one vertical cross section (illustrating ground water systems, aquifers, plume locations) | Yes / No |
| • Climatic conditions (precipitation, evapotranspiration, groundwater recharge) | Yes / No |
| • Soils information | |
| • Predominant soil series or mapping unit | Yes / No |
| • Soil profile (texture, structure and indicators of soil moisture) | Yes / No |
| • Permeability and drainage classifications | Yes / No |
| • Identify soil characteristics that might affect soil suitability, system design and location of the system | Yes / No |
| • Identify soil moisture conditions that may adversely affect suitability for onsite systems | Yes / No |
| • Evidence of seasonally high water table. | Yes / No |
| • A preliminary assessment of the fate of the OWTS effluent and a comparison of this with proposed and existing water supply aquifers | Yes / No |
| • Classify the subdivision/Development's suitability for OWTS. | Yes / No |
| • Are the additional Level 2 Report elements included? | Yes / No / NR* |
| • Additional well information | |
| • OWTS's within 1 km | |
| • Representative field hydraulic conductivity values | |
| • Field measured hydraulic gradients | |
| • Storm water management features | |
| • Two geological cross sections | |
| • Consideration of water supply characteristics on the functioning of an OWTS | |
| • Cumulative Nitrate Assessment | Yes / No / NR* |
| • Risk characterization and risk mitigation | Yes / No / NR* |

* Not Required – See the Guidance document (specifically figure 2) for required subdivision assessment elements.