# Appendix F

# *Trading With Subsurface Septic Systems*

## Contents

The reader of this appendix should first read the Point Source–Nonpoint Source Trading Scenario. This appendix provides a variation related to the type of nonpoint source trade only. The information provided in the Scenario also applies to this type of trade except as noted below.

Nonpoint source trading is not limited to agriculture. Subsurface septic systems are also nonpoint sources that can be involved in trading. Trading programs involving these systems would be similar to trading programs involving agriculture, as outlined in the Point Source–Nonpoint Source Trading Scenario; however, there are a few differences. This appendix discusses circumstances under which a point source or permitting authority might want to consider allowing offsets with subsurface septic systems. A hypothetical example of a septic system trading program is included.

The benefits of a permitted point source trading with subsurface septic systems could include increased nutrient and pathogen control, as well as overall improvement in septic system performance in the watershed. The credit buyer would benefit from finding a more economical option for meeting a new or more restrictive discharge permit limit. The benefit to the credit-selling homeowners would depend on the type of trading arrangement. In cases where a homeowner's subsurface septic system is repaired and enhanced or totally replaced by the credit buyer, and the credit buyer pays for maintenance under the trade agreement, the homeowner is potentially relieved of the cost of repairing and enhancing the system, as well as system maintenance. If the option is for the credit buyer to retire the septic system and connect the home to the municipal collection system, the advantage to the homeowner is less responsibility for maintenance. The homeowner, however, would then presumably have to pay a municipal sewer charge, although the economics of the trade might be so favorable to the credit-buying discharger that it is willing to pay for the individual home hookups. One caution is that, depending on how the trading program is structured, it could spur residential development where such development may not be wanted. In addition, additional hookups would add flow to the receiving publicly owned treatment works (POTW), which, depending on the number of existing hookups and the POTW's capacity, could affect performance at the treatment plant. As discussed below, this contingency should be considered in assessing the feasibility of the trade.

## Potential Conditions for Developing an Trading Program with Subsurface Septic Systems

Under what conditions would trading with subsurface septic systems be feasible or desirable? The most obvious case would be where subsurface septic systems already exist and a watershed analysis suggests that the systems are contributing to water quality impairment. Thus, a full analysis of the watershed might be completed through a watershed-based permitting approach or a total maximum daily load (TMDL). This analysis would

define the existing and potential sources of contamination and help to set the baseline for trading in that watershed.

A permittee considering trades with subsurface systems has a number of options, including (1) hooking up household septic systems to its collection system, (2) replacing the existing septic system(s) with an alternative system that controls nitrogen and phosphorus or (3) repairing the existing system(s) and adding enhancements to control nitrogen and phosphorus. For options (2) and (3), the trade agreement might require the credit buyer to maintain these more sophisticated septic systems. Thus, there would be a management/maintenance section in the trade agreement with the septic owner outlining the responsibilities of each party. Those responsibilities might include the credit buyer's notifying the homeowner or business when the credit buyer plans inspections, repair, or replacement. The homeowner's responsibilities might include performing some maintenance and notifying the credit buyer of any problems with the system.

The parties might wish to consider the following factors, among others, before pursuing trades with subsurface septic systems:

(1) *Source of contamination.* Consider doing an analysis of the watershed to assess whether subsurface septic systems contribute to water quality impairment.

(2) *Results of a buyer's cost-benefit analysis.* Consider doing an analysis, from the perspective of the buyer, of the costs and benefits of pursuing a trade. Such an analysis could include an evaluation of the amount of reduction expected based on an appropriate trade ratio. The analysis might also include the proximity to the waterbody of the subsurface septic systems, the density of development, the proximity of existing public sewer service to the septic systems, and the potential for growth.

(3) *Proximity to a waterbody.* Consider the possibility that the closer the subsurface system is to a waterbody, the faster and higher the rate of nutrient delivery to the waterbody.

(4) *Density of development.* Consider whether connecting low-density development to existing or satellite treatment plants is worth the cost. Choosing to replace, or repair and enhance, subsurface systems might be more cost-effective.

(5) *Proximity to public sewer.* Consider the cost-effectiveness of connecting septic systems to existing public sewers in light of the distance that public sewers would have to be extended to facilitate the hookups.

(6) *Potential for growth.* Keep in mind that hooking up subsurface systems to waste treatment plants may promote growth and development along the new collection line. Depending on the land use planning for the area, this could be a positive or negative outcome.

(7) *Effect of added flow to the POTW.* It is important to consider how much additional flow the POTW can accommodate without negative effects on the performance of the treatment plant.

Below is a hypothetical example of a trade agreement with a community of subsurface septic systems. The baseline and all other topics for trading with subsurface septic systems would be the same as those outlined in the Point Source–Nonpoint Source Trading Scenario.

## Maco Creek Example: Trade Agreements

*What You Need to Know…*

**Pollutant:** **Total Nitrogen (TN)**

**Driver:** Approved TMDL for Total Nitrogen for Maco Creek

**Credit Buyer:** ***Expanding Facility: Troy Manufacturing***

This industrial facility has a total nitrogen (TN) wasteload allocation under the TMDL of 3,044 lb/month. At its current design flow of 200,000 gpd, it must achieve a monthly average TN concentration of 5.00 mg/L to comply with the loading limit.

Troy Manufacturing now wishes to expand its operations and increase its discharge to 250,000 gpd. The facility could either upgrade its treatment process and reduce the concentration of nitrogen in its discharge to meet the monthly load limit or find TN offsets elsewhere in the watershed. The TMDL load allocation calls for reducing the existing septic nitrogen loads by 15 percent. Troy Manufacturing has determined that paying for a combination of connecting septic systems in Frog Town to the POTW and upgrading others to denitrifying capability would be less costly than upgrading Troy's wastewater treatment plant. The permitting authority has agreed that Troy Manufacturing could offset its proposed additional nitrogen load by connecting or upgrading septic systems in Frog Town that were identified in the TMDL as contributors to the nitrogen impairment in Maco Creek. Frog Town has agreed to accept the flow from the hookups at its POTW and has determined that the additional nitrogen load that would be discharged by the Frog Town plant could be easily accommodated within the plant's permitted load limit. Frog Town has also agreed to enter into agreements with owners of the upgraded septic systems that would ensure adequate operation and maintenance of the systems and allow annual inspections. The only additional requirement stipulated by the permitting authority in this example is that a portion of the nitrogen load reduction generated by retiring or upgrading the septic systems must be used to help achieve the TMDL goal of reducing septic loads in the watershed by 15 percent. Hence, 15 percent of any septic load reduction achieved must be used for that purpose and may not be used to offset the additional Troy Manufacturing nitrogen loads.

## Maco Creek Example: Trade Agreements *(continued)*

The Troy Manufacturing discharge is summarized in the Table 1.

**Table 1. Troy Manufacturing's Discharged Flows, Loads, and Permit Requirements**

| | Current | Proposed |
|---|---|---|
| Flow, gpd | 200,000 | 250,000 |
| TN Concentration, mg/L | 5.00 | 5.00 |
| TN Load, lbs/yr | 3,044 | 3,805 |
| TN Load Permit Limit, lbs/yr | 3,044 | 3,044 |
| Excess Load, lbs/yr | | 761 |

Troy Manufacturing must offset 761 pounds of additional nitrogen load per month.

Credit Seller: Frog Town has identified 14 households on old subsurface septic systems that have agreed to allow the town to remove their septic systems and connect the houses to Frog Town's municipal sewer system. Another five households have agreed to upgrade their systems to denitrifying capability. Frog Town will pay for all necessary construction and will be reimbursed by Troy Manufacturing.

To properly design the trade, an adequate analysis of septic pollutant loads is necessary. In this example, it is assumed that the TMDL included an assessment of septic loads and that the assessment is complete and robust enough to allow trades involving these loads. It is assumed that the TMDL has provided the following:

- GIS mapping of all the septic systems.
- The annual average nitrogen concentrations at the edge of the septic drain fields, based on monitoring and statistical analysis. These annual averages vary by septic system type, e.g., residential, commercial, type of commercial.
- The annual average nitrogen delivery ratio, based on soil type, slope, monitoring, groundwater and surface water modeling, and statistical analysis. The ratios of the discharged septic load to the septic load delivered to the Maco River impairment zone were determined. A zone system was developed based on zones with similar characteristics, and delivery ratios were assigned to individual septic systems based on zone. The delivery ratios were set conservatively, allowing a lower uncertainty ratio to be applied in the trade than would otherwise have been the case.

The zone delivery ratios are shown in Table 2. The load reductions achieved by the hookups and upgrades are shown in Tables 3 and 4, respectively.

**Table 2. Maco Creek TMDL Septic System Zones and Delivery Ratios**

| Zone | Delivery Ratio |
|---|---|
| 1 | 0.75 |
| 2 | 0.69 |
| 3 | 0.78 |

## Maco Creek Example: Trade Agreements *(continued)*

### Table 3. Load Reductions Attributed to Retired Frog Town Septic Systems

| Septic No. | Type | Flow (gal/day) | TN Conc Edge of Drain Field (mg/L) | TN Load Edge of Drain Field (lb/yr) | Delivery Ratio | TN Load to Maco Creek (lb/yr) |
|---|---|---|---|---|---|---|
| 1 | Residential | 250 | 45 | 34 | .75 | 26 |
| 2 | Residential | 250 | 45 | 34 | .75 | 26 |
| 3 | Commercial | 1,300 | 63 | 249 | .75 | 187 |
| 4 | Residential | 250 | 45 | 34 | .75 | 26 |
| 5 | Commercial | 950 | 70 | 202 | .75 | 152 |
| 6 | Residential | 250 | 45 | 34 | .75 | 26 |
| 7 | Residential | 250 | 45 | 34 | .69 | 24 |
| 8 | Commercial | 1,500 | 55 | 251 | .69 | 173 |
| 9 | Residential | 250 | 45 | 34 | .69 | 24 |
| 10 | Residential | 250 | 45 | 34 | .69 | 24 |
| 11 | Residential | 250 | 45 | 34 | .69 | 24 |
| 12 | Medical | 1,000 | 85 | 259 | .78 | 202 |
| 13 | Residential | 250 | 45 | 34 | .78 | 27 |
| 14 | Residential | 250 | 45 | 34 | .78 | 27 |
| **Total** | | | | **1,304** | | **965** |

### Table 4. Load Reductions Attributed to Upgraded Frog Town Septic Systems

| Septic No. | Type | Flow (gal/day) | TN Conc (mg/L) | TN Load (lb/yr) | Delivery Ratio | TN Load to Maco Creek (lb/yr) | New TN Conc (mg/L) | New TN Load to Maco Creek (lb/yr) | TN Reduction lbs/year |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Residential | 250 | 45 | 34 | 0.75 | 26 | 20 | 11 | 14 |
| 2 | Residential | 250 | 45 | 34 | 0.69 | 24 | 20 | 11 | 13 |
| 3 | Commercial | 450 | 65 | 89 | 0.69 | 61 | 20 | 19 | 43 |
| 4 | Residential | 250 | 45 | 34 | 0.69 | 24 | 20 | 11 | 13 |
| 5 | Commercial | 900 | 45 | 123 | 0.78 | 96 | 20 | 43 | 53 |
| **Total** | | | | **315** | | **231** | | **94** | **136** |

The calculation of the total load reduction needed for this trade is shown in Table 5 and the available reductions are shown in Table 6. A 10 percent uncertainty ratio has been applied, as shown in Table 5. The uncertainty is due mainly to uncertainty in the delivery ratios; however, because the TMDL set the ratios conservatively high, only a small uncertainty ratio is required in the trade.

## Maco Creek Example: Trade Agreements *(continued)*

### Table 5. Required Nitrogen Load Reductions

| Use | Required Reduction, lbs/yr |
|---|---|
| Satisfy TMDL Requirement (15 percent of existing septic load) | 180 |
| Offset Troy Manufacturing's Increase | 761 |
| **Subtotal** | **941** |
| 10 percent uncertainty ratio | 94 |
| **Total** | **1,035** |

### Table 6. Available Nitrogen Load Reductions

| Source | Required Reduction, lbs/yr |
|---|---|
| Septic System Connections | 965 |
| Septic System Upgrades | 137 |
| **Total** | **1,102** |

### Effluent Limitations

Troy Manufacturing needs 1,035 credits per year. It has applied for an NPDES permit modification for the increased flow and load and plans to begin construction after the permit is approved. Troy Manufacturing expects that building the added capacity will take one year. Therefore, the permitting authority will authorize the discharge beginning one year after permit modification, provided that all 19 septic system connections or upgrades have been accomplished by that time. This approach ensures that the load reduction needed to offset the additional discharge will be available when the additional discharge begins.

The permit writer for Troy Manufacturing will include water quality based effluent limitations (WQBEL) for nitrogen and the trading provisions in the permit, particularly the septic system connections and upgrades required to offset Troy Manufacturing's additional load. The permit fact sheet will include the information shown in Tables 1 through 6.

### Permit Language (after modification):

#### Table 7. Monthly Average Mass Loading Effluent Limitations for Total Nitrogen

| Facility | Units | WQBEL prior to expansion | WQBEL after expansion |
|---|---|---|---|
| Troy Manufacturing | lbs/yr | 3,044 | 4,805 |

A. Troy Manufacturing is authorized to discharge total nitrogen from Outfall 001 to Maco Creek provided the discharge meets the limitations set forth herein. Provision X of this permit authorizes the permittee to purchase water quality trading credits for total nitrogen from nonpoint sources within the Maco Creek watershed that meet the baseline requirements prior to trading.

B. Prior to {insert date 12 months after permit effective date}, the discharge from Outfall 001 shall comply with the yearly mass loading of total nitrogen established by the WQBEL prior to

## Maco Creek Example: Trade Agreements *(continued)*

expansion set forth in Table 7. After {insert date 12 months after permit effective date}, the discharge from Outfall 001 shall comply with the yearly mass loading of total nitrogen established by the WQBEL after expansion set forth in Table 7.

C. The permittee shall complete connection or upgrade of the 19 septic systems in Frog Town as shown in Tables 3 and 4 prior to increasing its discharge. The permittee shall maintain the upgraded septic systems shown in Table 4 for the duration of this permit.

### Pollutant Form, Units of Measure, and Timing

#### *Pollutant Form*

The TMDL indicates an impairment in Maco Creek for total nitrogen. Because both Troy Manufacturing and the Frog Town septic systems are discharging the same form of nitrogen, no equivalency factor is needed.

#### *Units of Measure*

The WQBELs are expressed in pounds per year as an annual average to correspond with the units and averaging period in the TMDL. The nitrogen load reductions assumed in the trading agreements for the septic systems will be calculated and expressed in pounds per year as an annual average to correspond with the offset needed by Troy Manufacturing.

#### *Timing of Credits*

Credits are available beginning 12 months after permit issuance. This allows 12 months for Troy Manufacturing to enter into trade agreements with the five homeowners in Frog Town to upgrade their septic systems and complete the upgrades. These agreements are not part of the NPDES permit and the homeowners are not subject to NPDES permit requirements or penalties. The agreement may contain other potential actions, such as actions to be taken if the homeowner violates the agreement, that are outside NPDES. The permit authorizes the Troy Manufacturing discharge expansion beginning one year after issuance of the permit, so Troy Manufacturing will not expand its discharge before the required offset has been obtained and is performing. Trades will occur annually to correspond with the annual average effluent limitation. The ability of the upgraded septic systems to continue to generate credits will be assessed during the renewal of Troy Manufacturing's permit every five years. Upgraded septic system owners, the POTW, or a third party must verify credits annually.

### Monitoring

- In the new permit, Troy Manufacturing will be required to monitor for total nitrogen weekly and to submit monthly discharge monitoring reports (DMRs) to the permitting authority year-round by the 15th of the second month following monitoring in order to gauge compliance. The DMR shall include monthly total nitrogen loads and cumulative annual total nitrogen load to date. Annual inspections of septic systems are also required to ensure proper maintenance.

### Permit Language:

- The permittee shall monitor effluent total nitrogen at least once a week. The permittee shall determine the average monthly mass loading based on actual monthly average flow. Flow monitoring shall be continuous.

## Maco Creek Example: Trade Agreements *(continued)*

### Reporting

The permit requires, in addition to monitoring reports, regular reporting of any changes to the trade agreement, as well as reports for tracking trades. The facility's individual permit will contain annual average effluent limitations for total nitrogen; therefore, annual trade transactions for the upgraded septic systems will be necessary to maintain compliance. The trade agreement between the dischargers indicates that Troy Manufacturing will track the trades. Troy Manufacturing will maintain maintenance records for these systems. The trade-tracking system will generate annual trading summaries for the entire program.

### Permit Language:

- No trade is valid unless it is recorded in the permittee's electronic trade-tracking system or an equivalent system that records all trades and generates an annual summary of all trades in substantially the same format as forms approved by the state. *Trade-tracking information must be submitted to [the Permitting Authority] by March 1 of each year.*

### Special Conditions

The NPDES permit writer has reviewed the signed trade agreements for total nitrogen trading between Troy Manufacturing, Frog Town, and homeowners in Frog Town. The agreements describe how Troy Manufacturing will offset its discharge through trading with Frog Town and homeowners in Frog Town. The NPDES permit writer has developed the appropriate effluent limitations, monitoring, and reporting requirements for Troy Manufacturing. The special conditions in the NPDES permit focus on general authority, credit definition, notification of amendment to the trade agreement, notification of unavailability of credits, permit reopeners and modification provisions, compliance schedule, and enforcement liability.

### Permit Language:

***General Authority***

The permittee is authorized to participate in water quality trading with Frog Town and homeowners in Frog Town as specified in the written signed trade agreements, for the purposes of complying with the TMDL-related requirements of this permit. The authority to use trading for compliance with these limits is derived from **{insert state law where applicable}** and section 402 of the Federal Clean Water Act (33 U.S.C.§ 1342). USEPA's policies on Water Quality Trading (1/13/03) and Watershed-Based NPDES Permitting (1/7/03) endorse water quality trading. In addition, the Maco Creek Nitrogen TMDL authorizes water quality trading as a means of achieving the allocations established by the TMDL.

***Credit Definition***

Credits will be measured in pounds of total nitrogen per year on an annual basis. One trading credit will be defined as one unit of pollutant reduction (pound of total nitrogen) delivered to Maco Creek. All pollutant load reductions purchased by the permittee will be in the form of equivalent nitrogen credits that represent pollutant load reductions with the appropriate uncertainty, delivery, and retirement ratios applied as detailed in the trade agreement between the permittee and point and nonpoint source trading partners. All valid credits are tradable. The permittee is

## Maco Creek Example: Trade Agreements *(continued)*

required to offset its load by complying with the schedule for annual inspections and maintenance of the upgraded septic systems in Frog Town and providing pollutant reductions beyond the load allocation, established in the Maco Creek Nitrogen TMDL. All septic systems generating credits must be certified as having been properly installed.

***Notification of Amendment to the Trade Agreement***

The permittee is required to notify the permitting authority in writing within 7 days of the trade agreement's being amended, modified, or revoked. This notification must include the details of any amendment or modification in addition to the justification for the change(s).

***Notification of Unavailability of Credits***

The permittee is required to notify the permitting authority in writing within 7 days of becoming aware that credits used or intended for use by the permittee to comply with the terms of this permit are unavailable or determined to be invalid. This notification must include an explanation of how the permittee will ensure compliance with the offset provisions established in this permit, either by implementing on-site controls or by conducting an approved emergency nitrogen offset project approved by the NPDES permit writer.

***Permit Reopeners and Modification Provisions***

The permitting authority may, for any reason provided by law, summary proceedings, or otherwise, revoke or suspend this permit or modify it to establish any appropriate conditions, schedules of compliance, or other provisions that may be necessary to protect human health or the environment or to implement the Maco Creek Nitrogen TMDL.

***Compliance Schedule***

This permit includes both interim and final effluent limitations for the discharge of total nitrogen from Outfall 001. Compliance with the final effluent limitations is required on **{insert date 12 months after permit effective date}**.

By March 1 of each year, the permittee shall submit a Compliance Plan Annual Report to describe the progress of actions undertaken to purchase credits and to achieve compliance with the final effluent limitations for the discharge of total nitrogen from Outfall 001 by **{insert date 12 months after permit effective date}**.

***Enforcement Liability***

The permittee is ultimately responsible for meeting its respective effluent limitations. No liability clauses contained in other legal documents (e.g., trade agreements, contracts) established between the permittee and other authorized buyers and sellers are enforceable under this permit.

## References

U.S. Environmental Protection Agency. 2002. *Onsite Wastewater Treatment Systems Manual*, EPA/625/R-00/008. U.S. Environmental Protection Agency, Office of Water and Office of Research and Development, Washington, DC. Page 3-29.

U.S. Environmental Protection Agency and Massachusetts Department of Environmental Protection. 1998. Authorization to Discharge under the National Pollutant Discharge Elimination System, Town of Wayland, MA. NPDES Permit No. MA0039853.

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