

NITREX™ State of Oregon Nitrogen Removal Filter

OPERATION & MAINTENANCE (O&M) MANUAL



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Environmental Engineers/Consultants

LOMBARDO ASSOCIATES, INC.

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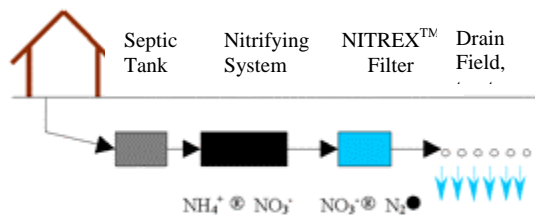
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1. Introduction

This Operation and Maintenance (O&M) Manual describes the procedures that should be followed for proper operation of the Nitrex™ Filter. The Nitrex™ Filter pre-treatment system, which needs to fully nitrify the wastewater must be operated and maintained in accordance with the manufacturer's and/or designer's recommendations.

2. Typical Nitrex™ Filter System Configuration

The Nitrex™ Filter is a component of a wastewater system and is usually configured as illustrated in Figure 1.



NITREX module in a septic system

Figure 1

Diagrams of single and multiple tanks with and without effluent filters are presented on Figures 2 – 6.

Figure 2.

Nitrex™ Denitrification System Schematic Diagram

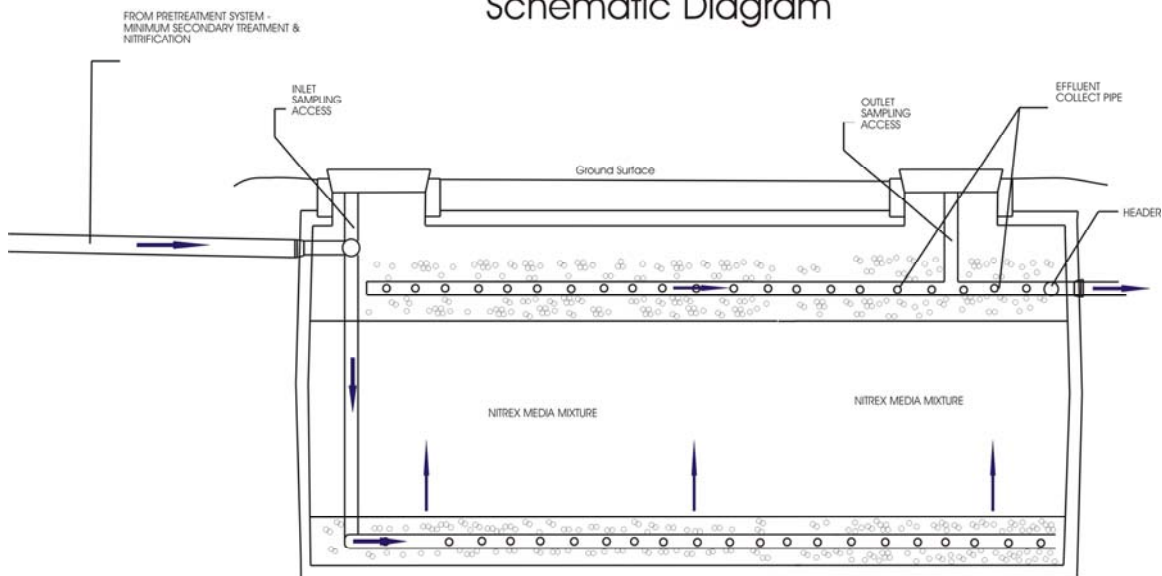
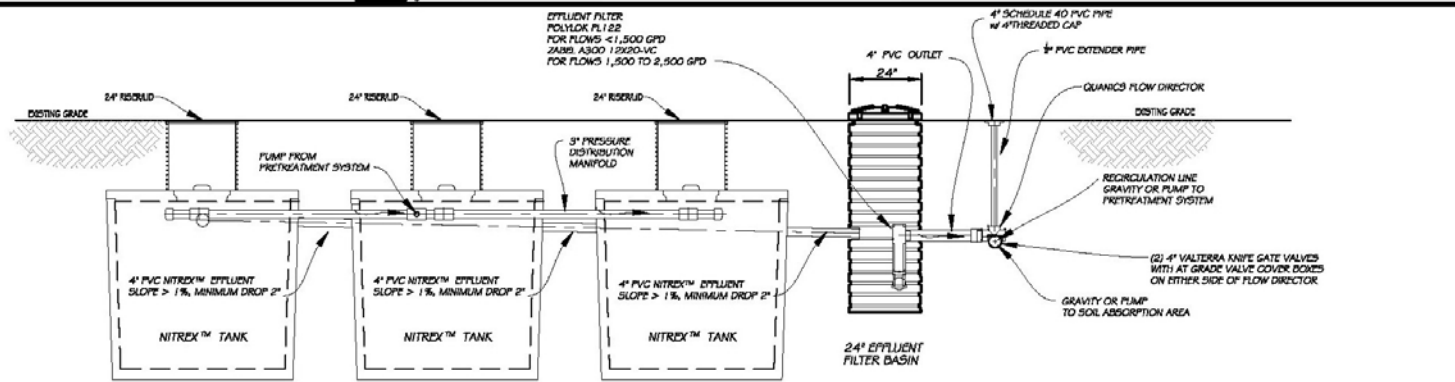
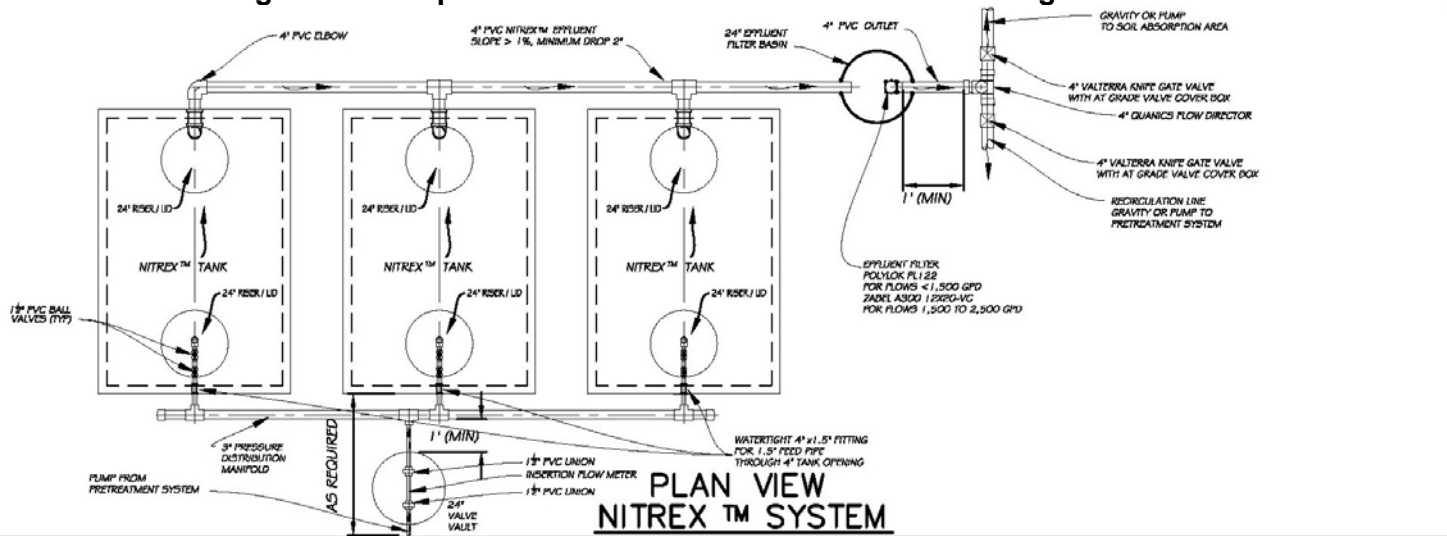
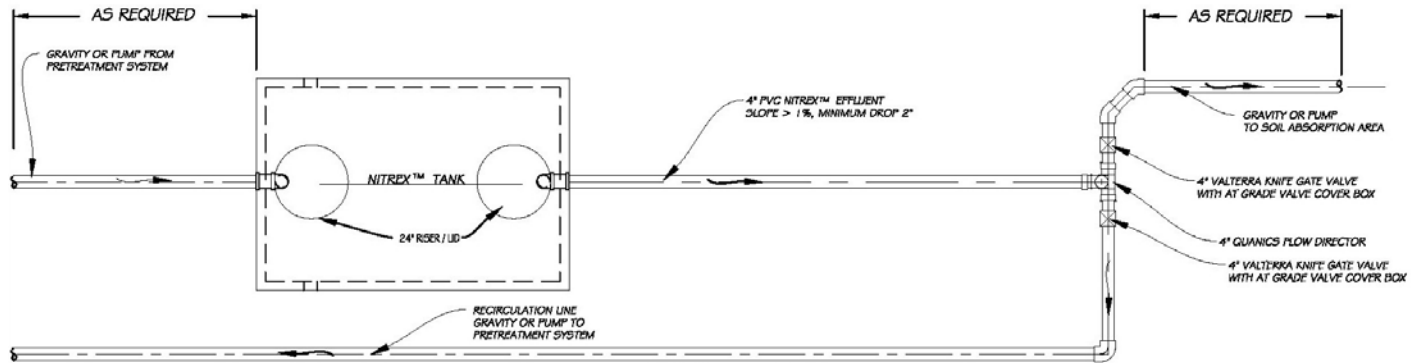


Figure 4: Multiple Nitrex™ Tanks with Effluent Filter Configuration

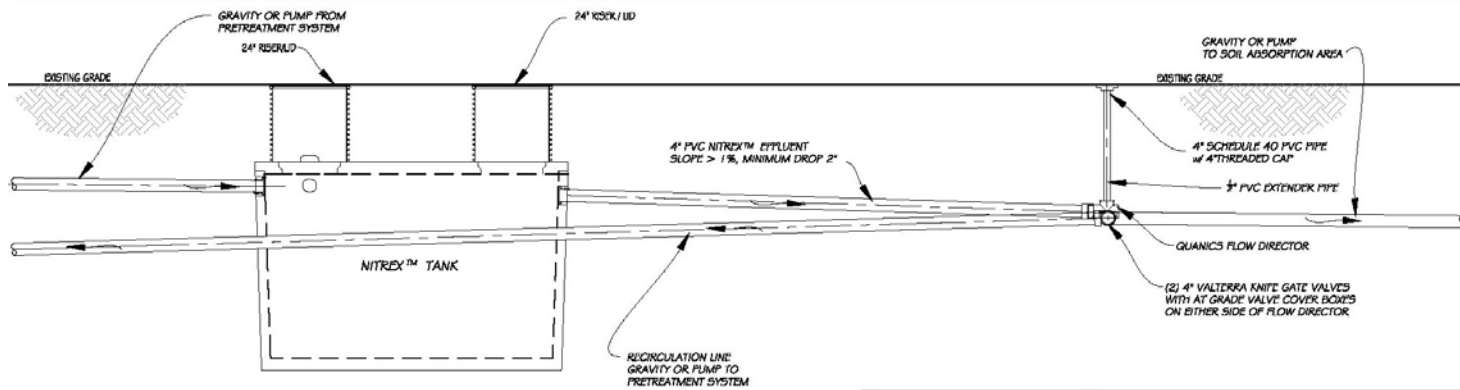


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NITREX™ - MULTIPLE TANKS WITH EFFLUENT FILTER NITREX NITROGEN REMOVAL TECHNOLOGY	
DATE: "Version 1.0", 01/29/2007 DATE: Rev. 1.01	DESIGNED BY: PSL DRAWN BY: PJP CHECKED BY: PSL SHEET: 2 OF 4

Figure 5: Single Nitrex™ Tank without Effluent Filter Configuration



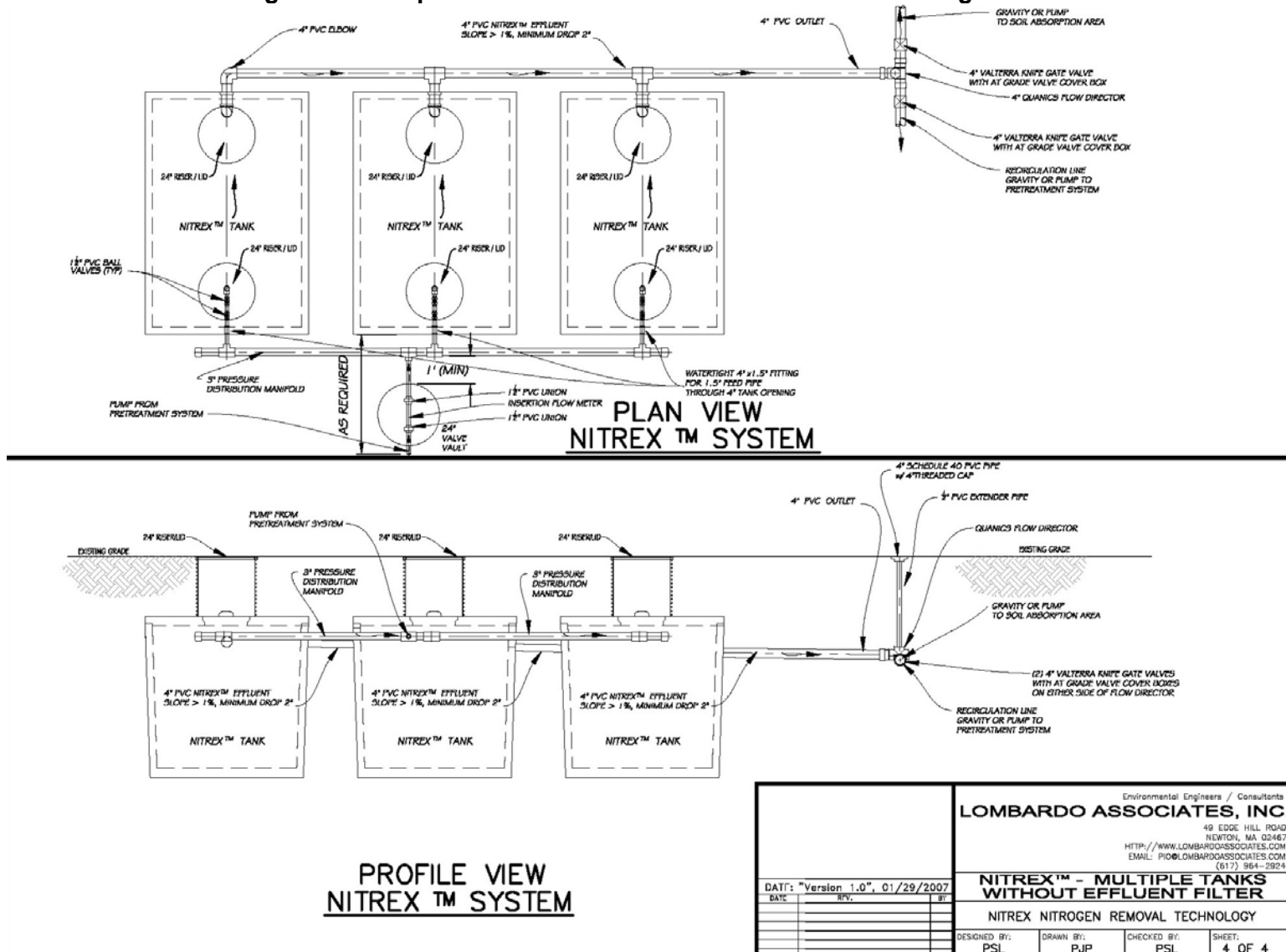
PLAN VIEW
NITREX™ SYSTEM



PROFILE VIEW
NITREX™ SYSTEM

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Figure 6: Multiple Nitrex™ Tanks without Effluent Filter Configuration



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3. List of Nitrex™ Filter Components

The Nitrex™ Filter system consists of:

- Nitrex™ Filter Denitrification Tank with internal piping for hydraulic control and recycle valving for start-up purposes;
- Nitrex™ Temperature Probe;
- If applicable, Nitrex™ Effluent Filters with alarm

4. Treatment Process and Performance Expectations

4.1 Pretreatment System – Nitrification Issue

For wastewater treatment applications, an oxidative pretreatment (nitrifying) step is required to convert organic nitrogen to ammonium (NH_4^+) to nitrate (NO_3^-) before the Nitrex™ filter can perform the reductive denitrification step. Pretreatment can be achieved with a number of the existing oxidative technologies used in wastewater treatment and approved by the State of Oregon. Currently approved pre-treatment systems include the intermittent sand filter, recirculating gravel filter and the Orenco Advantex. These systems are only approvable for use as the pre-treatment system when sufficient alkalinity exists in the raw wastewater to enable complete nitrification. For normal residential wastewater with TN values of 40-60 mg/l, respectively, minimum raw wastewater alkalinity concentrations of 280-420 mg/l for single pass media filters, respectively, are required to exist. Other technologies are acceptable only upon approval by Lombardo Associates, Inc. (LAI), based upon verifiable evidence that the pre-treatment system will meet the effluent requirements stated in Section 2.1. All applications must demonstrate that sufficient alkalinity exists in the raw wastewater, or that alkalinity is being added, or performance data provides evidence otherwise with the guidelines that recirculating media filters, raw wastewater has at least 218 – 312 mg/l as CaCO_3 , for wastewater with TN values of 40-60 mg/l. For non-residential wastewater, alkalinity requirements are prorated based on raw wastewater TN values. With insufficient alkalinity, the pretreatment unit will not be able to achieve complete nitrification and therefore will interfere with the ability of the Nitrex™ Filter to achieve its TN effluent requirements. For a complete list of LAI approved pre-treatment systems visit <http://www.lombardoassociates.com>. Pre-treatment systems must also be approved for use in the State of Oregon by the Department of Environmental Quality.

4.2 Nitrex™ Start-Up & Treatment performance

The nitrate reduced effluent from the Nitrex™ filter is discharged to a soil absorption area. Typical Nitrex™ filter effluent quality of < 5 ppm Total Nitrogen has been achieved, even with intermittent use.

During the first 3 – 12 months of operation of the Nitrex™ Filter, to address initial high levels of BOD_5 , hydraulic management through opening and closing valves for Nitrex™ filter recycle to the pre-treatment unit or discharge to the soil absorption area/subsequent treatment unit will be necessary. The Nitrex™ filter is typically supplied with modular sections to minimize start-up effluent BOD_5 and to be able to address low flow use conditions. Additionally, where feasible, Nitrex™ effluent will be recycled to the pre-treatment unit during low flow start-up periods to reduce the length of the start-up period. Nitrex™ filter effluent BOD_5 levels are < 20 ppm after

start-up. Nitrex™ filter effluent polishing is required if the Nitrex™ filter effluent is required to be < 10 ppm BOD₅.

4.3 Maintenance and Monitoring

The Nitrex™ filter is passive and requires little maintenance. Performance verification and monitoring should be performed routinely, as required by LAI, State and local permitting agencies.

The Nitrex™ reactive media is eventually consumed and must be replaced, currently estimated in 20+ years of operation. Media replacement can be easily performed through the access manholes as illustrated in Figures 1 - 4 using septic tank pumping equipment. New media would be installed via the access manholes.

4.4 Flow Monitoring

Flow Monitoring can be achieved by one of the following techniques:

- a. In-line flow meter properly calibrated
- b. Running time meter of Nitrex™ Filter feed pumps
- c. Other flow monitoring techniques as approved by LAI

4.5 Temperature Monitoring

Temperature monitoring is achieved by an electronic temperature probe connected to the Nitrex™ instrument panel, or, if accepted by LAI, manually with a temperature probe.

4.6 NITREX™ Inspection Checklist

Following is a checklist of information that should be gathered during Nitrex™ filter system inspection. Also attached is a monitoring program that must be followed to demonstrate compliance with LAI, State and local requirements.

Nitrex™ FILTER CHECKLIST

Observer: _____

Site/Address: _____

Date: _____

Time: _____

Previous Inspection Date: _____

Time: _____

System

Comments

- | | |
|---|-------|
| 1. Water Meter Reading _____
Water use since last reading _____ (gpd) | _____ |
| 2. Nitrex™ Flow Meter Reading _____
Water use since last reading _____ (gpd) | _____ |
| 3. Pump Running Time Meter _____
Water use since last reading _____ (gpd) | _____ |

Pretreatment System

Comments

- | | |
|--|-------|
| Technology Type _____ | _____ |
| 1. Observe discharge effluent to NITREX™
system for solids carryover | _____ |
| 2. Review treatment performance records
- complete nitrification? _____ | _____ |
| 3. Measure effluent temperature _____ °F | _____ |

Nitrex™ System

Comments

- | | |
|--|-------|
| 1. Observe inlet sampling port - confirm no blockage | _____ |
| 2. Observe and comment on media - color _____
- other _____ | _____ |
| 3. Measure influent temperature _____ °F | _____ |
| 4. Observe outlet sampling port - confirm no blockage
- is ponding occurring? _____ | _____ |
| 5. Describe odor if any _____ | _____ |
| 6. Measure effluent temperature _____ °F | _____ |
| 7. Measure NO ₃ (ppm) in
effluent with field kit _____ ppm | _____ |

General Notes and Comments: _____

4.7 Monitoring Requirements

Monitoring of the Nitrex™ Filter needs only to be performed for start-up, performance assurances and to determine any needed adjustments based upon hydraulic loadings and wastewater temperature conditions. The sampling locations and frequency is dependent upon the specific Nitrex™ Filter application as described below, as well as on State and local regulatory requirements. Field kits can be used along with laboratory analysis to reduce monitoring costs.

During start-up, Nitrex™ Filter effluent is monitored for BOD₅ every two weeks until BOD₅ levels are < 20mg/l, after which the sampling program described below is followed.

	Design Flows - Residential <2,000 gpd
	Locations: Nitrex™ Filter Effluent*
Constituents	
pH	<p>Quarterly for the first 2 years, then annually</p> <p>* Sampling locations of septic tank effluent and Pre-treatment System effluent are performed if Nitrex™ effluent does not meet BOD₅ and TSS <20 mg and TN <10 mg/l</p>
BOD ₅	
TSS	
Alkalinity	
TKN	
NO ₃ - N	
NO ₂ - N	
Temperature	
BOD ₅	
TSS	
Alkalinity	
TKN	
NO ₃ - N	
NO ₂ - N	
Temperature	

Design Flows – Non- Residential	
Constituents	Locations: Septic Tank Effluent, Pre-Treatment System Effluent & Nitrex™ Filter Effluent
pH	Monthly for first 6 months, then quarterly
BOD₅	
TSS	
Alkalinity	
TKN	
NO₃ - N	
NO₂ - N	
Temperature	