

NITREX™ State of Oregon Nitrogen Removal Filter

INSTALLATION MANUAL



January 29, 2007

Environmental Engineers/Consultants

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1. INTRODUCTION

This Nitrex™ Nitrogen Removal Filter Installation Manual is presented in the format as a specification that a Certified Installer can use. It defines the responsibility of the Installation Certified Installer and those of the Nitrex™ Filter Equipment provider, Lombardo Associates, Inc. (LAI).

Tables A-1 – A-4 in the Appendix show the sizing of the Nitrex™ tankage associated with flows of 2,500 gpd or less. The Nitrex™ tank size for a specific flow rate varies depending on the facility it is serving, the geographic location (either normal or cold climate as defined herein) and the Oregon DEQ approved pretreatment system used. Cold climate is defined as any Oregon location with an elevation above 5,000 feet MSL.

Table A-1 lists the Nitrex™ tank sizing for the following configurations:

1. Single family or multiple dwellings with shower and laundry facilities, Advantex™ or Recirculating Gravel Filter pretreatment, located in a normal Oregon climate.
2. Single family or multiple dwellings with shower and laundry facilities, Advantex™ or Recirculating Gravel Filter pretreatment, located in a cold Oregon climate.

Table A-2 lists Nitrex™ tank sizing for the following configurations:

1. Non-residential facilities or facilities with non-residential components, Advantex™ or Recirculating Gravel Filter pretreatment system, located in a normal Oregon climate.
2. Non-residential facilities or facilities with non-residential components, Advantex™ or Recirculating Gravel Filter pretreatment system, located in a cold Oregon climate.

Table A-3 lists Nitrex™ tank sizing for the following configurations:

1. Single family or multiple dwellings with shower and laundry facilities, Intermittent Sand Filter pretreatment system, located in a normal Oregon climate.
2. Single family or multiple dwellings with shower and laundry facilities, Intermittent Sand Filter pretreatment, located in a cold Oregon climate.

Table A-4 lists Nitrex™ tank sizing for the following configurations:

1. Non-residential facilities or facilities with non-residential components, Intermittent Sand Filter pretreatment system, located in a normal Oregon climate.
2. Non-residential facilities or facilities with non-residential components, Intermittent Sand Filter pretreatment, located in a cold Oregon climate.

A Plan and Section views of the following four (4) basic Nitrex™ Filter System layouts are presented in Figures A1 and A2, shown in the Appendix:

1. Single Nitrex™ tank to achieve required Nitrex™ tank volume
2. Multiple Nitrex™ tanks to achieve required Nitrex™ tank volume

As the ability of the Nitrex™ Filter to perform is dependent upon the Nitrifying Pretreatment System operating properly, including complete nitrification (defined as TKN < 5 mg/l), the Certified Installer must ensure that the Nitrifying Pretreatment System was installed in accordance with Oregon DEQ regulations and manufacturer's/designer's recommendations.

1.1. Definitions

1.1.1 Nitrex™ Filter

The Nitrex™ filter consists of one or multiple denitrification filter tanks, temperature sensor(s) and transmitter(s), effluent filter basin, effluent filter and alarm and associated piping.

1.1.2 Nitrifying Pretreatment System

Only Oregon Department of Environmental Quality and LAI approved wastewater treatment systems used as Nitrex™ Filter Nitrifying Pretreatment System (e.g., intermittent sand filter, recirculating gravel filter and Orenco Advantex™) can be used. For a complete list of LAI approved nitrifying pretreatment systems visit <http://www.lombardoassociates.com>.

1.2. Nitrex™ System Supplier and Engineer is:

Lombardo Associates, Inc. (LAI)
Mr. Pio Lombardo, P.E.
49 Edge Hill Road
Newton, MA 02467
Telephone: 617-964-2924
Fax: 617-332-5477
E-Mail: Pio@LombardoAssociates.com

2. WORK PERFORMED BY CERTIFIED INSTALLER

2.1. Site Work

2.1.1 General

- a) Certified Installer shall furnish and install electric service and temporary water service as specified on the approved plans prior to startup of the Nitrex™ Filter.
- b) Certified Installer shall be responsible for filling all tanks with clean water and ensuring all tanks pass watertight tests in accordance with the State of Oregon Onsite Wastewater Treatment System Rules prior to backfilling.
- c) Permanent water service with frost-proof hydrant shall be available at the site.
- d) The area surrounding structures shall be graded to divert surface runoff away from the Nitrex™ Filter.
- e) All work on the site shall be performed in compliance with applicable erosion control requirements.
- f) The excavated area shall be protected from surface run-off.
- g) Nitrex™ tanks must be approved by LAI and approved for use in the State of Oregon.

- h) Minimum and maximum cover over Nitrex™ tanks and appurtenances are to be equivalent to requirements of tanks and appurtenances permitted in the State of Oregon.
- i) The State of Oregon Onsite Wastewater Treatment System rules shall be followed.
- j) All electrical work must conform to the requirements of the State of Oregon Department of Consumer and Business Services, Building Codes Division or municipality with jurisdiction.

2.1.2 Excavation and Connections to Nitrex™ System Components.

The Certified Installer shall prepare an excavation suitable for setting the custom Nitrex™ tank section(s) and tank covers. The prepared hole for all Nitrex™ structures shall consist of compacted sub-base and a minimum of 6-inch compacted crushed stone base. The 6-inch compacted crushed stone base shall be verified by the Certified Installer prior to setting tanks. Excavations shall be prepared such that the top of stone is level and at the elevation shown on the approved plans. As needed, the Certified Installer shall be responsible for installation of temporary protecting covers in the Nitrifying pretreatment and Nitrex™ system tank openings. The Certified Installer shall install permanent covers over these openings as soon as possible after tanks are permanently set. The Certified Installer shall install risers and covers to grade with watertight seal at joints. The Certified Installer shall wrap all structures in 2-inch closed-cell, water-resistant, polystyrene foundation insulation before backfilling. Manholes shall be insulated with at least 2-inch closed-cell, water-resistant, polystyrene foundation insulation. The excavation shall be backfilled with well-compacted material free of organic material.

2.2. Installation

2.2.1 Nitrex™ System Tanks and Appurtenances

The Certified Installer shall be responsible for excavation, bedding, insulation and backfilling as outlined in Paragraph 2.1.2. As elevations of the risers and covers shown on the approved plans may be approximate, due to the variable nature of the concrete seam sealant, the Certified Installer shall adjust the total height of the riser and cover to match proposed grade, if necessary.

2.2.2 Requirements for Tank Installation

The Certified Installer shall provide a staging area suitable for a crane or boom truck or other necessary vehicle, as Project and site conditions require.

2.3. Valve Vault and Appurtenances

When using multiple Nitrex™ tanks, the Certified Installer shall furnish a watertight concrete, or other suitable material, valve vault.

When using multiple Nitrex™ tanks, the Certified Installer shall furnish and install one (1) flow meter for installation in the valve vault as shown on the drawings. Flow meter shall be Badger Magnetoflow Mag Meter model Primo 3.1 or LAI approved equal.

2.4. Electrical Work

2.4.1 Power and Communications for Control Panel

The Certified Installer shall include the following functionality to the pretreatment system control panel:

- Data logging and telemetry system capable of remote downloading of data via a telephone line
- Inputs for one dry contact and 2 analog 4-20 mA inputs
- Electrical service at the Nitrex™ System control panel location.

The Nitrex™ system will send up to two temperature probes and one effluent filter alarm signals to the control/telemetry panel. The control/telemetry panel shall be capable of powering the signal loops, receiving the signals, logging the data and making it available via direct download and/or via the internet. The control/telemetry panel shall be a custom VeriComm™, TeleComm™ or LAI approved equal and may be integrated with the Nitrification Pre-treatment System Control Panel.

The Certified Installer shall be responsible for all trenching, backfilling and compaction required for electrical and signal conduits necessary to complete the connections between the Nitrex™ system instrumentation and the control/telemetry panel.

The Certified Installer shall furnish all labor materials necessary for a functioning Nitrex™ system electrical system within the limits of work shown on the approved plans. All electrical work shall be conducted in accordance with state and local electrical codes. The work consists of:

1. Connection to electric service
2. Signal wiring from all process units (i.e. temperature probe(s)/transmitter, effluent filter alarm and flow meter, if applicable) to the control panel
3. Power wiring to all instruments and alarms

All cable entries to and from electrical junction boxes shall have watertight compression seals. Power and signal lines shall be laid in separate conduits.

2.4.2 Instrumentation

The Certified Installer shall furnish all materials and labor associated with power and signal wiring at the following locations:

- **Nitrex™ Tanks** – Install one (1) temperature sensor at mid-level in the Nitrex™ Filter. Power the sensor and transmitter and transmit the analog temperature signal to the Nitrex™ System Control Panel. All junction boxes and powered connections shall be appropriate for a Class I, Division I space.
- **Panels** - Provide and install a spare duplex electrical outlet and telephone jack enclosed in a NEMA 4 enclosure within or next to the Nitrex™ System Control Panel.

2.4.3 PVC Pipe and Valves

Except as specifically designated on the approved configurations, all piping shall meet the requirements of the Oregon Onsite Wastewater Treatment System Rules.

Valves shall be as follows:

- a. Valves shall be PVC Ball Valves or LAI approved equal.

3. MATERIALS SUPPLIED BY NITREX™ SYSTEM SUPPLIER

Table 1 shows the list of materials and the responsible parties.

Table 1: List of Materials and Responsible Parties

Nitrex™ System Equipment & Supplier				
Equipment			Responsible Party	
No.	Unit	Component	Nitrex™ System Supplier	Certified Installer
1	Nitrex™ Filters and Risers	Nitrex™ Filter, complete	x	
		Risers and Covers		x
2	Effluent Filter Vaults	Effluent Filter w/Alarm	x	
		Effluent Filter Basin	x	
3	Piping	Mechanical Piping to Nitrex™ Filter, between Nitrex System Components, and to Soil Absorption Area		x
4	Instruments	Effluent Filter Alarm	x	
		Temperature Sensor	x	
		Control Panel & Telemetry Device		x
5	Valve Vault	Flow Meter, if applicable		x
		Vault, if applicable		x

4. CERTIFICATION

Prior to substantial completion, the Certified Installer shall certify that the work has been completed by performing the following acceptance tests:

4.1. Nitrex™ Dosing Pump chamber – when pumping to Nitrex™ filter

- a. Validate pump curves.

The flow rate for the Nitrex™ feed pumps shall be validated at three pressure points along pump curve.

- b. Test Nitrex™ Dosing Pump, where used, Alarm Conditions.

The pump alarm conditions should cease when the ON float is released and the “silence” button is pressed. Alarm shall be tested for signal to Pump Control Panel. Only the audible alarm is user cancellable when alarm conditions are present.

4.2. Nitrex™ Filters

Water-tightness test shall be performed in accordance with the State of Oregon Onsite Wastewater Treatment Systems rules.

Temperature Sensors – test for signals to Nitrification System Control Panel.

4.3. Nitrex™ Effluent Filter Basin

The effluent filter basin shall be tested for water-tightness using the methods for testing tanks in the Oregon Onsite Wastewater Treatment Systems rules.

5. CONSTRUCTION SEQUENCING

The Certified Installer shall adhere to the construction sequence detailed in this section. The following table describes the construction sequence for the Nitrex™ Filter Installation.

Activity
1. Install electric service and water service, which is to be completed prior to startup of the Nitrex™ Filter.
2. Prepare excavation for Nitrex™ Tank(s).
3. Acceptance of Excavation
Installation Ready Date for Nitrex™ Filter(s) and Appurtenances
4. Equipment delivery of the Nitrex™ Filter(s) and appurtenances.
5. Install Nitrex™ tank sections and effluent filter basin.
6. Install mechanical piping and equipment
7. Complete electrical work for Nitrex™ System
8. Hydraulic testing of all mechanical piping
9. Final hydraulic test of pumps
10. Install Nitrex™ tank top(s)
11. Vacuum or Water tightness testing of Nitrex™ tank(s)
12. Install risers and covers
13. Insulation and backfilling of all process tanks
Substantial Completion Date

APPENDIX - Nitrex™ Nitrogen Filter Tank Configuration Figures and Tank Sizes

- **Figure A1: Single Nitrex™ Tank with Effluent Filter Configuration**
- **Figure A2: Multiple Nitrex™ Tanks with Effluent Filter Configuration**
- **Figure A3: Single Nitrex™ Tank without Effluent Filter Configuration**
- **Figure A4: Multiple Nitrex™ Tanks without Effluent Filter Configuration**
- **Table A-1: Single Family or Multiple Dwelling with Shower and Laundry Facilities, AX-20 or RGF Pretreatment**
- **Table A-2: Non-Residential Facility or Facility with Non-Residential Component, AX-20 or RGF Pretreatment**
- **Table A-3: Single Family or Multiple Dwelling with Shower and Laundry Facilities, ISF Pretreatment**
- **Table A-4: Non-Residential Facility or Facility with Non-Residential Component, ISF Pretreatment**

Figure A1: Single Nitrex™ Tank Configuration with Effluent Filter

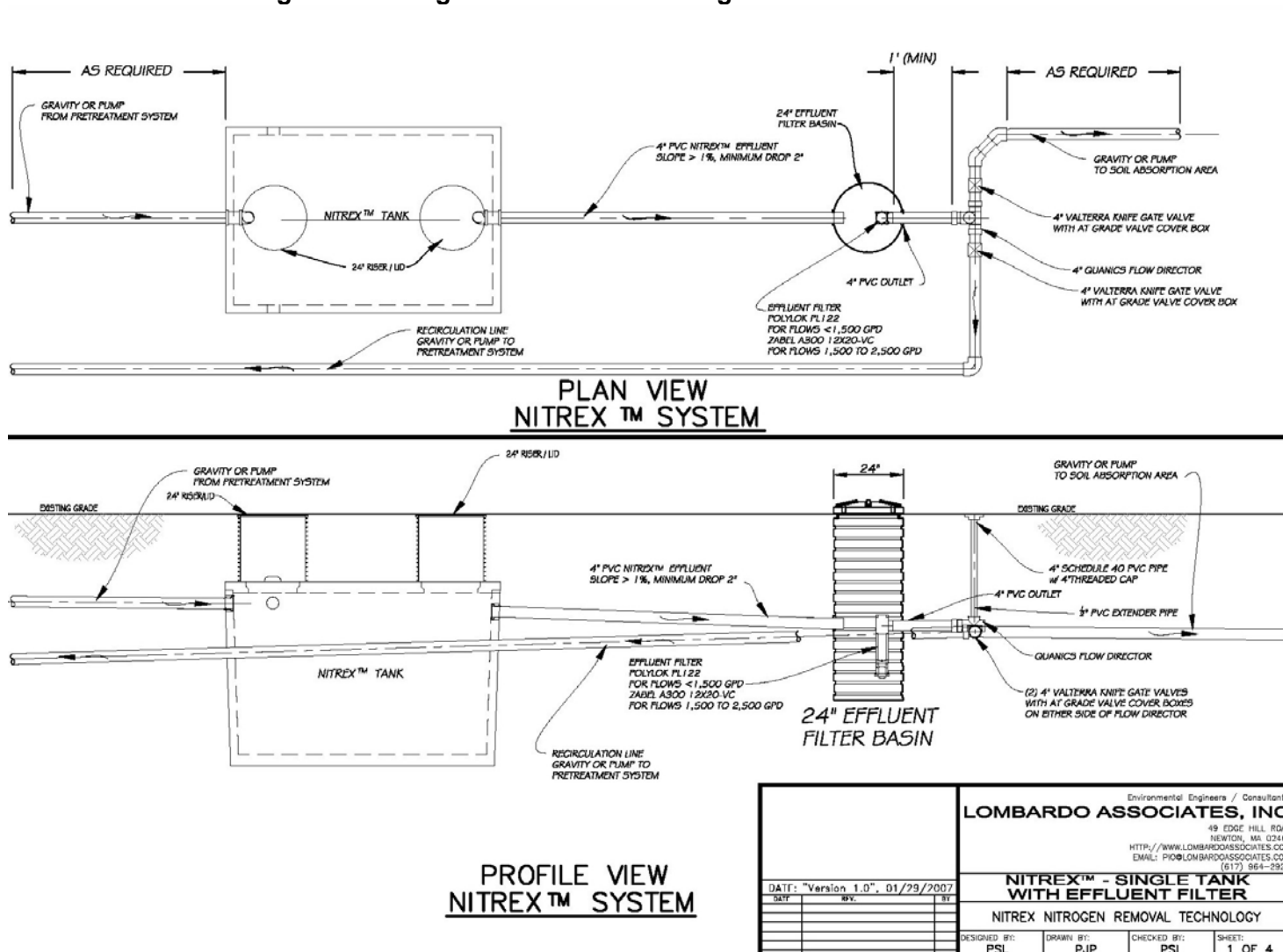
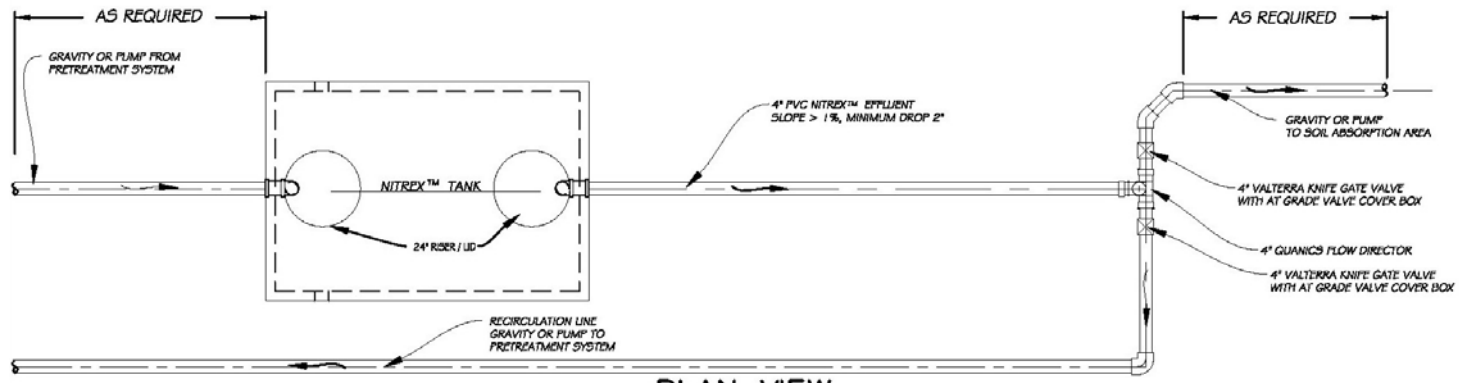
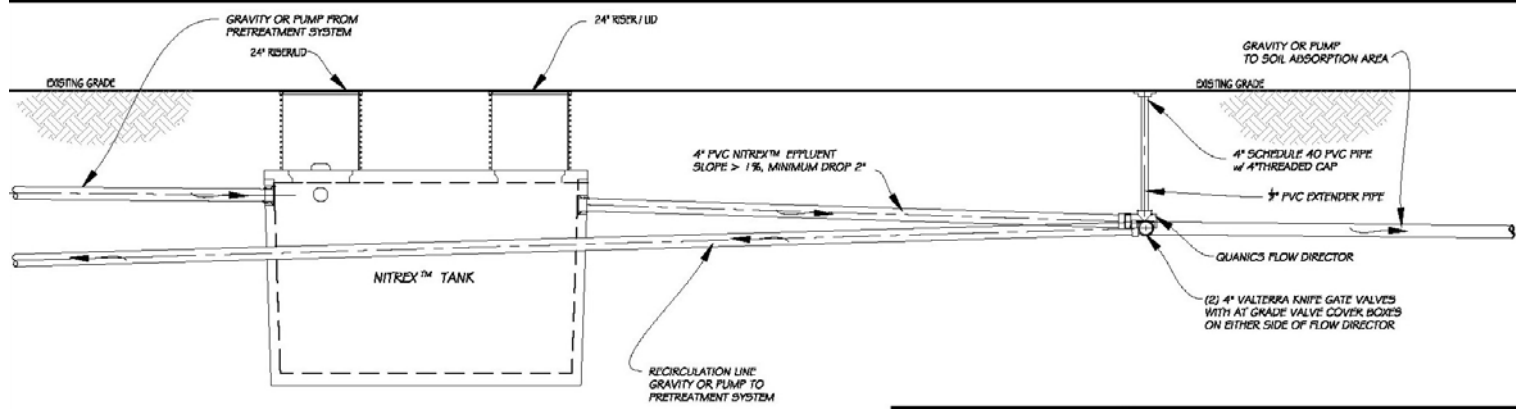


Figure A3: Single Nitrex™ Tank Configuration without Effluent Filter



PLAN VIEW
NITREX™ SYSTEM



PROFILE VIEW
NITREX™ SYSTEM

Environmental Engineers / Consultants LOMBARDO ASSOCIATES, INC. 49 EDGE HILL ROAD NEWTON, MA 02457 HTTP://WWW.LOMBARDOASSOCIATES.COM EMAIL: P10@LOMBARDOASSOCIATES.COM (617) 554-2924	
NITREX™ - SINGLE TANK WITHOUT EFFLUENT FILTER	
NITREX NITROGEN REMOVAL TECHNOLOGY	
DATE: "Vd" 1.0", 01/29/2007 DATE: BY: BY:	DESIGNED BY: PSL DRAWN BY: PJP CHECKED BY: PSL SHEET: 3 OF 4

Figure A4: Multiple Nitrex™ Tanks Configuration without Effluent Filter

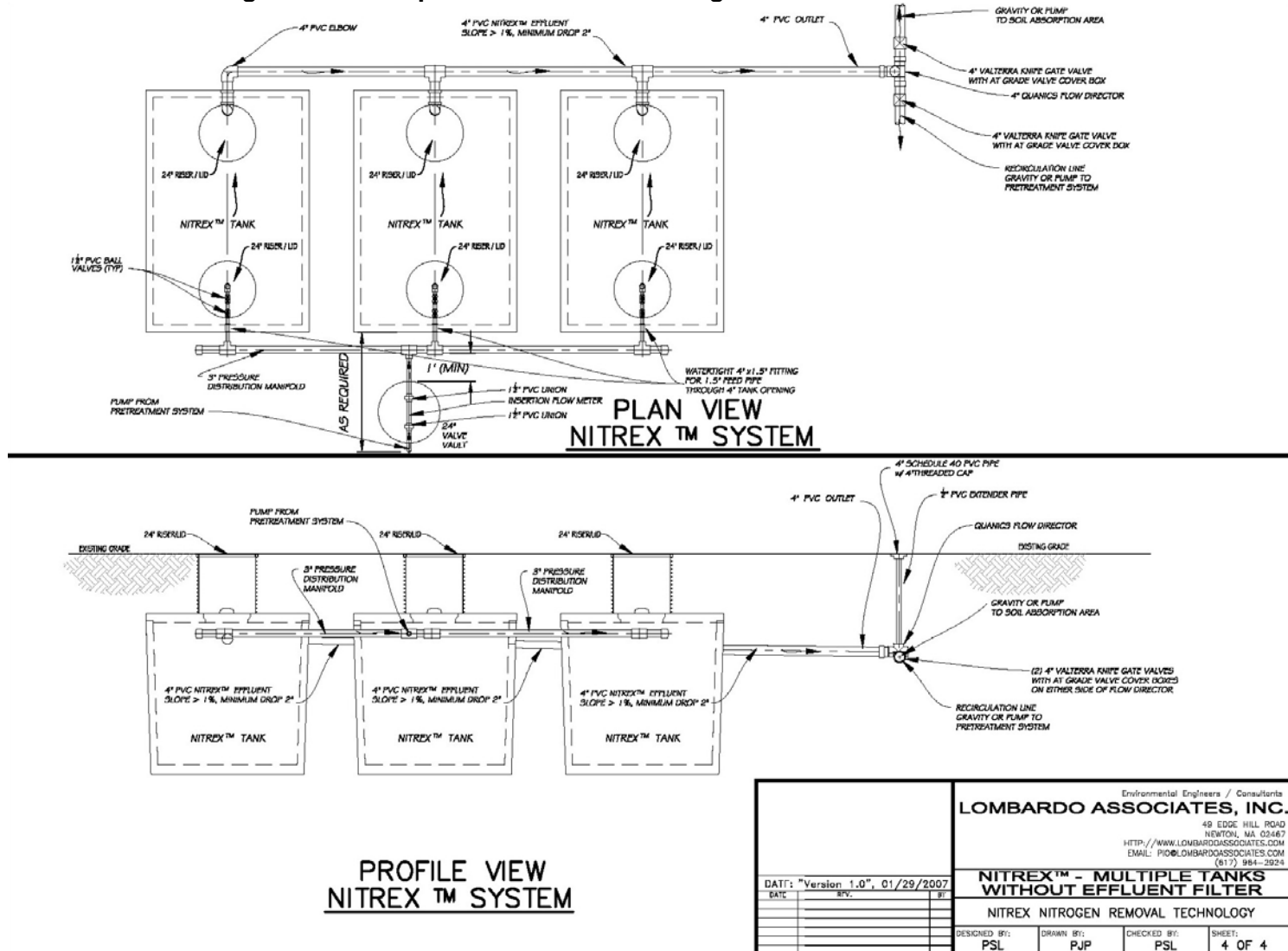


Table A-1: Single Family or Multiple Dwelling with Shower and Laundry Facilities, AX-20 or RGF Pretreatment

Design Flow (gpd)	Model Number	Nitrex™ Tank Size (gal.)	Model Number	Nitrex™ Tank Size (gal.)
	Normal Oregon Climate		Cold Oregon Climate	
300	300-SFD-RMF-R	1,000	300-SFD-RMF-C	1,200
450	450-SFD-RMF-R	1,500	450-SFD-RMF-C	1,800
600	600-SFD-RMF-R	2,000	600-SFD-RMF-C	2,400
750	750-SFD-RMF-R	2,500	750-SFD-RMF-C	3,000
900	900-SFD-RMF-R	3,000	900-SFD-RMF-C	3,600
1,050	1050-SFD-RMF-R	3,500	1050-SFD-RMF-C	4,200
1,200	1200-SFD-RMF-R	4,000	1200-SFD-RMF-C	4,800
1,350	1350-SFD-RMF-R	4,500	1350-SFD-RMF-C	5,400
1,500	1500-SFD-RMF-R	5,000	1500-SFD-RMF-C	6,000
1,650	1650-SFD-RMF-R	5,500	1650-SFD-RMF-C	6,600
1,800	1800-SFD-RMF-R	6,000	1800-SFD-RMF-C	7,200
1,950	1950-SFD-RMF-R	6,500	1950-SFD-RMF-C	7,800
2,100	2100-SFD-RMF-R	7,000	2100-SFD-RMF-C	8,400
2,250	2250-SFD-RMF-R	7,500	2250-SFD-RMF-C	9,000
2,500	2500-SFD-RMF-R	8,500	2500-SFD-RMF-C	10,000

Table A-2: Non-Residential Facility or Facility with Non-Residential Component, AX-20 or RGF Pretreatment

Design Flow (gpd)	Model Number	Nitrex™ Tank Size (gal.)	Model Number	Nitrex™ Tank Size (gal.)
	Normal Oregon Climate		Cold Oregon Climate	
300	300-COM-RMF-R	3,000	300-COM-RMF-C	4,000
450	450-COM-RMF-R	4,500	450-COM-RMF-C	6,000
600	600-COM-RMF-R	6,000	600-COM-RMF-C	8,000
750	750-COM-RMF-R	7,500	750-COM-RMF-C	10,000
900	900-COM-RMF-R	9,000	900-COM-RMF-C	12,000
1,050	1050-COM-RMF-R	10,500	1050-COM-RMF-C	14,000
1,200	1200-COM-RMF-R	12,000	1200-COM-RMF-C	16,000
1,350	1350-COM-RMF-R	13,500	1350-COM-RMF-C	18,000
1,500	1500-COM-RMF-R	15,000	1500-COM-RMF-C	20,000
1,650	1650-COM-RMF-R	16,500	1650-COM-RMF-C	22,000
1,800	1800-COM-RMF-R	18,000	1800-COM-RMF-C	24,000
1,950	1950-COM-RMF-R	19,500	1950-COM-RMF-C	26,000
2,100	2100-COM-RMF-R	21,000	2100-COM-RMF-C	28,000
2,250	2250-COM-RMF-R	22,500	2250-COM-RMF-C	30,000
2,500	2500-COM-RMF-R	25,000	2500-COM-RMF-C	32,000

Table A-3: Single Family or Multiple Dwelling with Shower and Laundry Facilities, ISF Pretreatment

Design Flow (gpd)	Model Number	Nitrex™ Tank Size (gal.)	Model Number	Nitrex™ Tank Size (gal.)
	Normal Oregon Climate		Cold Oregon Climate	
300	300-SFD-ISF-R	2,500	300-SFD-ISF-C	3,000
450	450-SFD-ISF-R	3,500	450-SFD-ISF-C	4,500
600	600-SFD-ISF-R	5,000	600-SFD-ISF-C	6,000
750	750-SFD-ISF-R	6,000	750-SFD-ISF-C	7,500
900	900-SFD-ISF-R	7,000	900-SFD-ISF-C	9,000
1,050	1050-SFD-ISF-R	8,000	1050-SFD-ISF-C	10,500
1,200	1200-SFD-ISF-R	10,000	1200-SFD-ISF-C	12,000
1,350	1350-SFD-ISF-R	11,000	1350-SFD-ISF-C	13,500
1,500	1500-SFD-ISF-R	12,000	1500-SFD-ISF-C	15,000
1,650	1650-SFD-ISF-R	13,000	1650-SFD-ISF-C	16,500
1,800	1800-SFD-ISF-R	14,000	1800-SFD-ISF-C	18,000
1,950	1950-SFD-ISF-R	16,000	1950-SFD-ISF-C	19,500
2,100	2100-SFD-ISF-R	17,000	2100-SFD-ISF-C	21,000
2,250	2250-SFD-ISF-R	18,000	2250-SFD-ISF-C	22,500
2,500	2500-SFD-ISF-R	20,000	2500-SFD-ISF-C	25,000

Table A-4: Non-Residential Facility or Facility with Non-Residential Component, ISF Pretreatment

Design Flow (gpd)	Model Number	Nitrex™ Tank Size (gal.)	Model Number	Nitrex™ Tank Size (gal.)
	Normal Oregon Climate		Cold Oregon Climate	
300	300-COM-ISF-R	7,000	300-COM-ISF-C	9,000
450	450-COM-ISF-R	10,000	450-COM-ISF-C	14,000
600	600-COM-ISF-R	14,000	600-COM-ISF-C	18,000
750	750-COM-ISF-R	18,000	750-COM-ISF-C	22,000
900	900-COM-ISF-R	22,000	900-COM-ISF-C	27,000
1,050	1050-COM-ISF-R	25,000	1050-COM-ISF-C	32,000
1,200	1200-COM-ISF-R	28,000	1200-COM-ISF-C	36,000
1,350	1350-COM-ISF-R	32,000	1350-COM-ISF-C	40,000
1,500	1500-COM-ISF-R	36,000	1500-COM-ISF-C	45,000
1,650	1650-COM-ISF-R	40,000	1650-COM-ISF-C	50,000
1,800	1800-COM-ISF-R	43,000	1800-COM-ISF-C	55,000
1,950	1950-COM-ISF-R	46,000	1950-COM-ISF-C	60,000
2,100	2100-COM-ISF-R	50,000	2100-COM-ISF-C	65,000
2,250	2250-COM-ISF-R	54,000	2250-COM-ISF-C	70,000
2,500	2500-COM-ISF-R	60,000	2500-COM-ISF-C	80,000