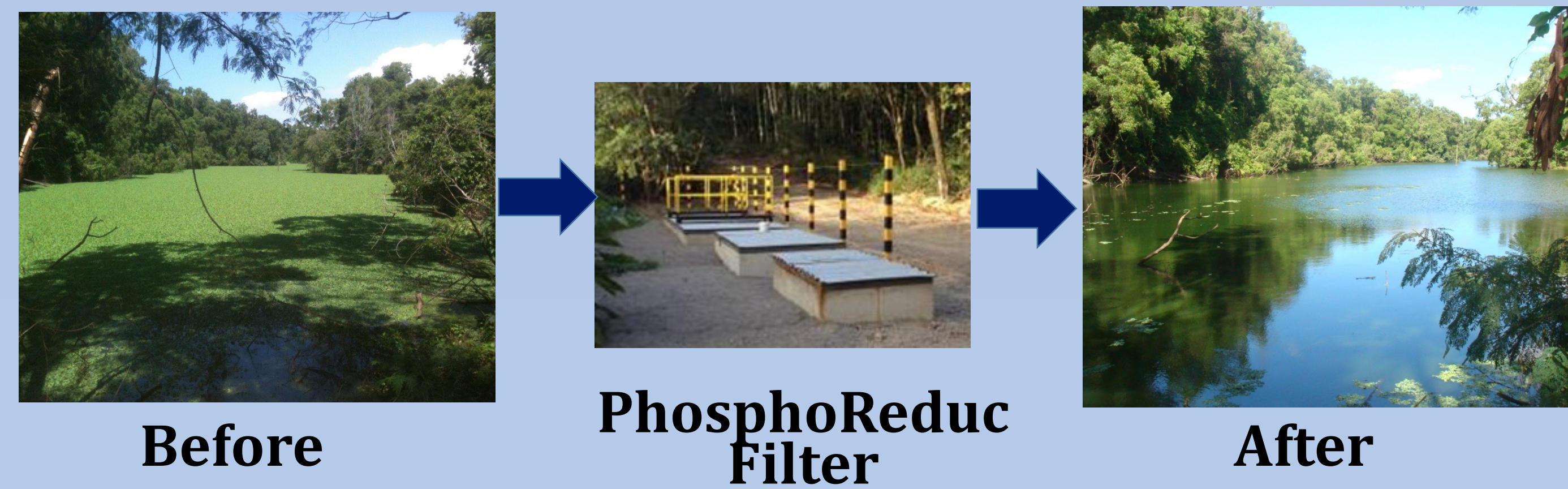
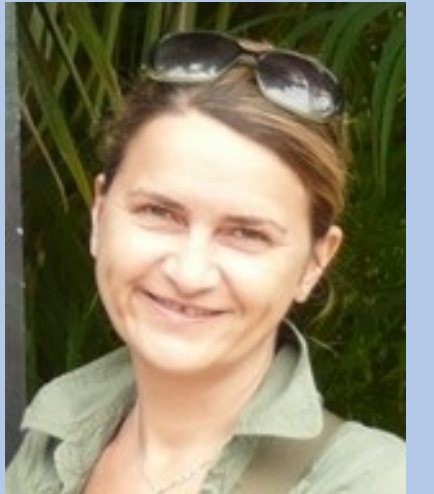


# Phosphorus harvesting, recycling and re-use via PhosphoReductechnology

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## Technology Background

PhosphoReduc harvesting and removal patented technologies, co-invented by Drizo and Picard [1] are based on 10 years of research, testing and development at the University of Vermont, USA [2-5]. They are simple, gravity fed passive filtration systems that combine readily available recyclable industrial raw materials (rich in Ca and/or Fe oxides) and cutting edge design. The media is packed in specially-designed modules to form a flexible and scalable modular composite filter. The system design allows for the highest reduction and harvesting of phosphorus while maintaining pH levels according to standards [1]; systems are simple to install and maintain, and have a long life span of 20 years. They are offered as 3 different treatment products for P removal and harvesting from:

### 1) Onsite Septic Systems (single/cluster houses);



North Carolina Ireland

### 2) Wastewater Effluents (municipal and industrial wastewater treatment utilities, highly concentrated agricultural effluents) and



ROC Taiwan Brazil

### 3) Agricultural and urban stormwater runoff.



Ohio Vermont

Implementations of PhosphoReduc products to date showed that they can reduce and harvest phosphorus and remove pathogens from sewage (> 95%), agricultural and urban point and nonpoint pollution (80 – 100%) in systems implemented in a variety of climatic regions, across 4 continents (North and South America, Asia and Europe).

Moreover, the results showed that there is no detrimental leachate from the spent PhosphoReduc media, and that harvested P is bio-available, and can be re-used and slow release fertilizer in forestry, horticulture, agriculture and acid mine drainage [6].



## Selected Case Studies

### Sewage and Urban Runoff Treatment, Brazil

• Combined sewage and urban runoff generated from favelas contributes to significant Phosphorus loading to Arcelor Mittal Tubarao Lagoons 2 and 3, adjacent to this area. As a result these two lagoons are completely eutrofied, preventing water use downstream.



• Two PhosphoReduc filters, designed to treat 14 m<sup>3</sup>/d each were installed in April 2013 with the aim to reduce phosphorus and suspended solids loading to two lagoons.

• Filters harvested nearly 100% of P received (the first 5 months of operation).

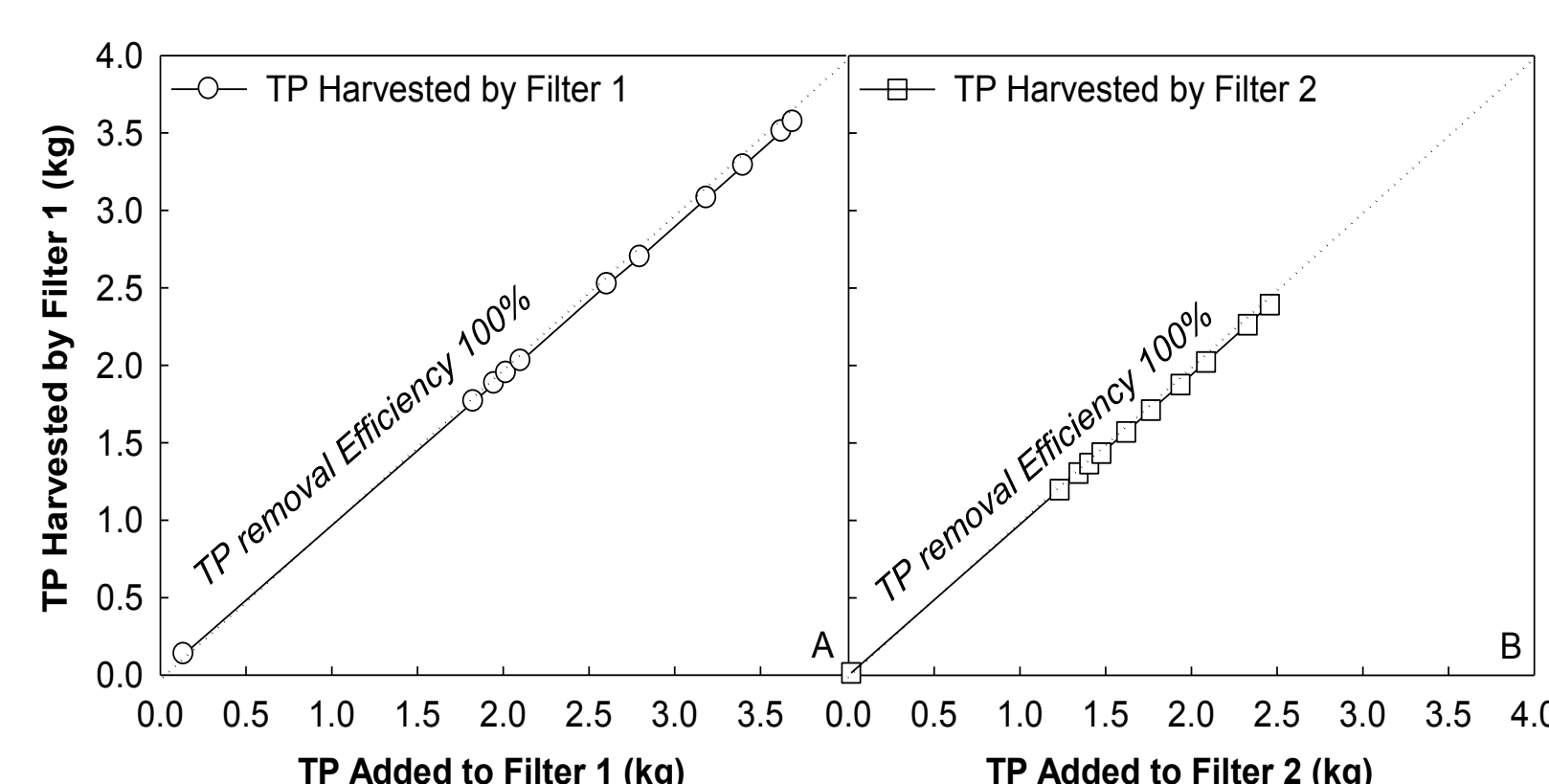


Figure 1: Total Phosphorus added and harvested (retained) by PhosphoReduc Filters 1 (A) and 2 (B) during the first 5 months of operation.

• As a result algae cover withdrew completely from Lagoon 3 for the first time (see photo on the top).

• They also reduced *E.coli* nearly 100%

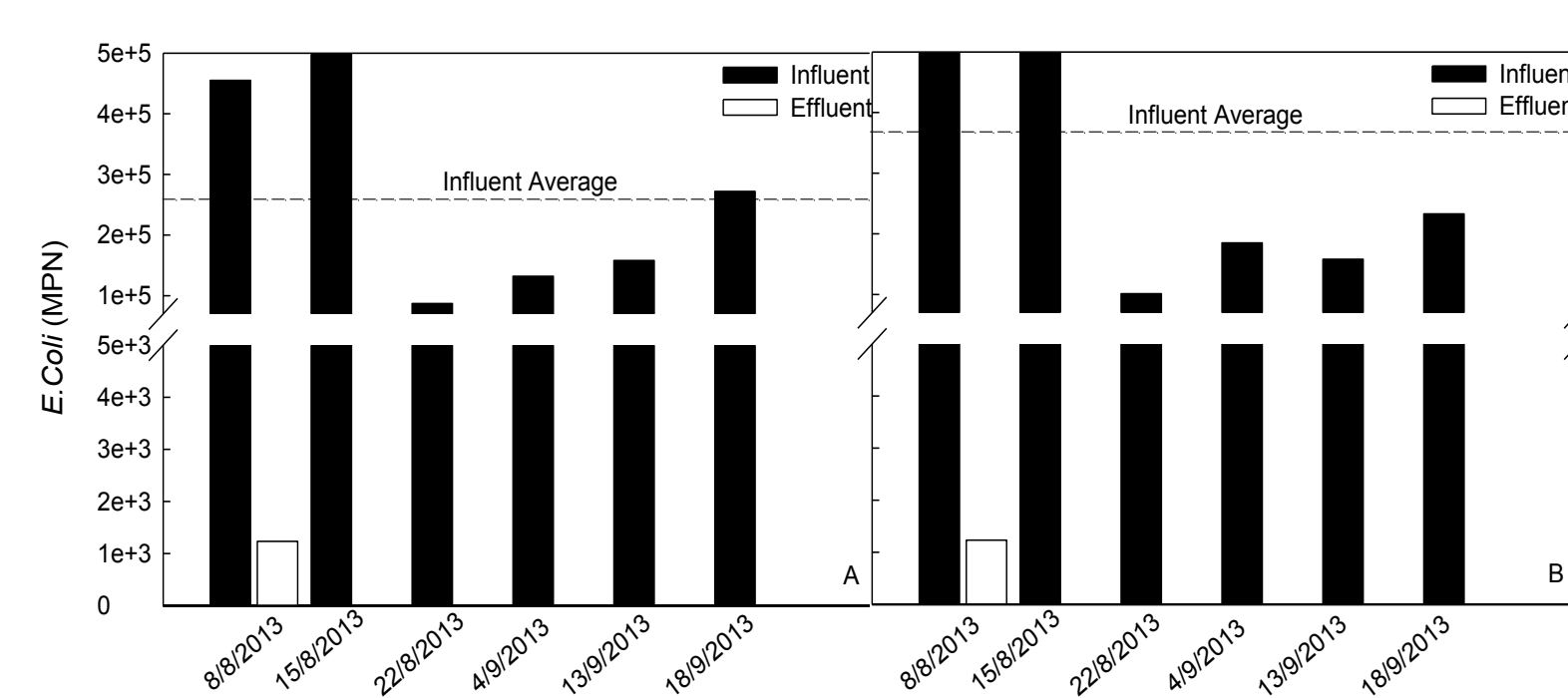
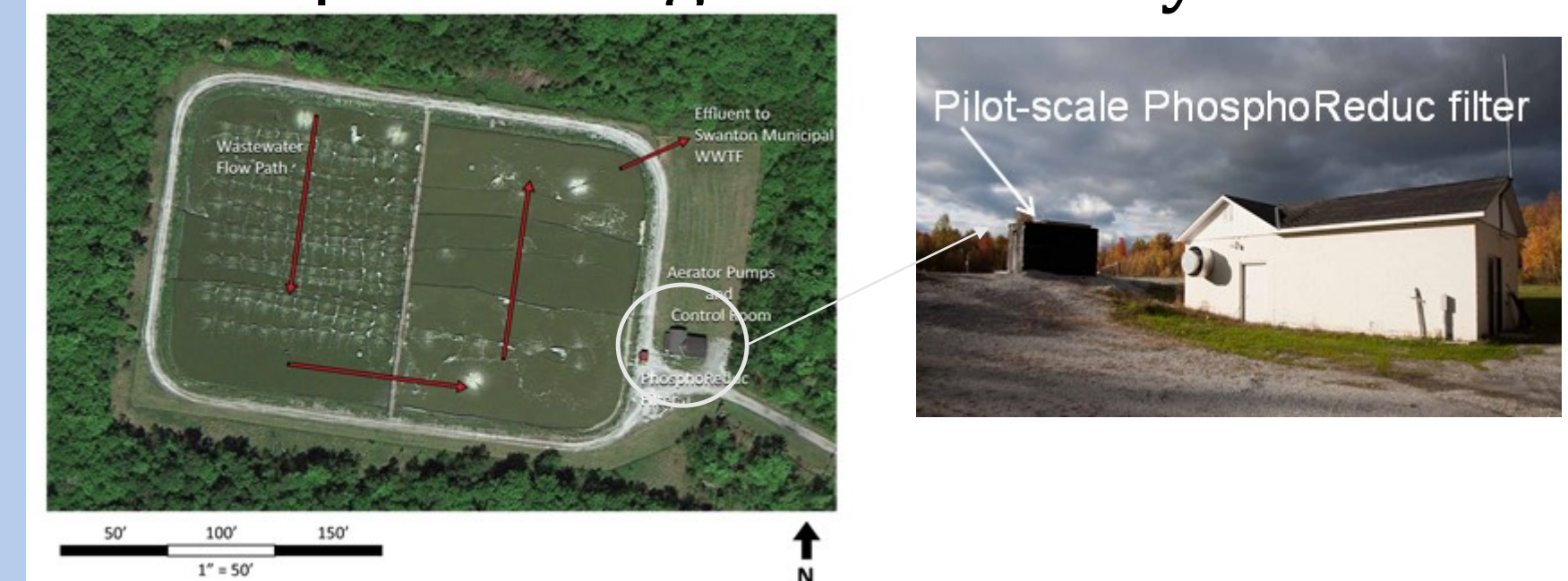


Figure 2: E.Coli influent and effluent concentrations (MPN) in Filter 1 (A) and Filter 2 (B) during the first 5 months of operation. Influent average concentrations 2.7 and 3.7 x 10<sup>5</sup> MPN in F1 and F2, Effluent concentrations less than 200 MPN in both F1 and F2.

## Cheese Processing Plant Effluent Treatment, Vermont, USA

• The system was implemented as an add-on, secondary treatment stage to existing wastewater lagoon system located in Swanton, Vermont, USA.  
• Primary stage treatment consisted of 2.5 ha wastewater lagoon, receiving 150 m<sup>3</sup> cheese processing effluent daily.



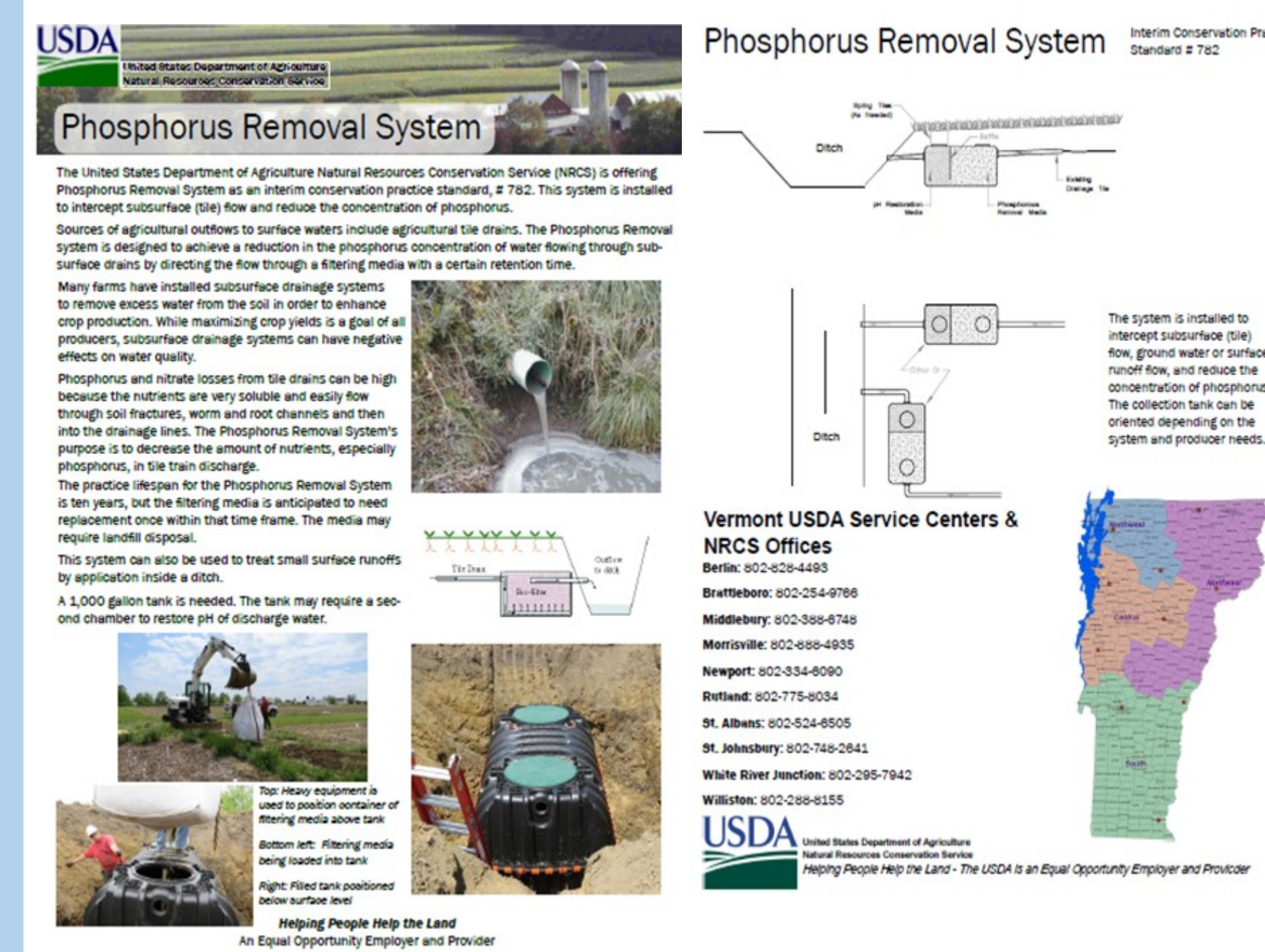
• Influent Average Inflow : TP ~ 25 mg/L, DP ~ 20 mg/L and TSS ~ 120 mg/L.

• According to the agreement with the client, 3 different modes of operation were tested during 280 days of monitoring period.

• The average treatment efficiency was 80% (TSS), 91% (TP) and 96% (PO<sub>4</sub>-P). Total Phosphorus discharge concentration averaged 1 mg/L while dissolved Phosphorus was 0.23 mg/L.

## Agricultural Runoff Treatment

Following 3 years of pilot and demonstration testing in VT, PA and OH, PhosphoReduc system has been adopted by the VT USDA NRCS as the first best management practice for P removal from agricultural lands (e.g. Phosphorus Removal System 782)[7].



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