Executive Summary

Company Background

Founded in 1978, the Minnesota Rural Water Association (MRWA) is a non-profit organization that provides technical assistance to and trains personnel at small municipal and non-municipal systems, rural water districts, and wastewater districts with populations less than 10,000. They offer professional services in several areas, including state and federal regulations, fiscal management, system operation and maintenance, source water protections, and more. The Minnesota Pollution Control Agency (MPCA) is the leading organization that monitors environmental quality and enforces environment regulations in the state of Minnesota. Both MRWA and MPCA are partnered with MnTAP to identify nutrient removal solutions for wastewater ponds across Minnesota.

Breckenridge and Karlstad are small towns in northern Minnesota. Their wastewater ponds serve to break down wastes and remove nutrients from the municipal wastewater. They discharge into the Red River which runs north through the Minnesota-North Dakota border and into Canada where it ends in Lake Winnipeg in Manitoba, Canada. Ponds require less energy and cost less to build and operate than treatment plants and are a good option in areas with low population density.

Project Background

Funded through a grant by the Legislative Citizen Commission on Minnesota Resources (LCCMR), the goal of the partnership of MnTAP, MRWA, and MPCA is to work with cities in optimizing the removal of nitrogen and phosphorus from their wastewater. Doing so involves analyzing current operations of their wastewater pond systems, researching best practices, calculating potential improvements, suggesting operational changes, and promoting the implementation of these low-cost solutions. The scope of this project encompasses the wastewater treatment ponds in the cities of Breckenridge and Karlstad. The goal for this project is to improve phosphorus removal so that it will meet MPCA permit limits and improve environmental protection

Incentives to Change

This project focuses on researching and implementing wastewater pond treatment strategies to improve nitrogen and phosphorus removal before it is discharged into receiving waters. Nitrogen and phosphorus are naturally occurring elements essential to life, but in excessive quantities they cause eutrophication in receiving water bodies which results in the death of aquatic life. These pond systems are trying to meet their permit nutrient concentration limits, and are interest in opportunities for improvement.

Solutions
Flow Pattern.

Altering the way water flows through a wastewater pond can help immensely in increasing the hydraulic retention time (HRT) and maximizing the depth of water. As the amount of time water stays in the pond system increases, the treatment time increases, leading to better nutrient removal and cleaner discharge water. The overall goal is to keep the wastewater ponds as full as possible over the course of

the year, ensuring that as much of the total pond volume as possible is actually being used for treatment time.

Inflow and Infiltration.

Inflow and infiltration (I&I) refers to the unintentional flow of storm water into the sanitary sewer system. It leads to ineffective use of the available volume in a pond, since storm water does not need to be treated but still takes up space, and reduces overall treatment time. Reducing inflow and infiltration by performing dye tests, resealing manhole covers, and inspecting private properties would serve to improve system hydraulic retention time.

Waterfowl Prevention.

Waterfowl, such as geese, contribute heavily to nutrient levels in these ponds in the form of fecal loading. Because waterfowl migration periods tend to align with wastewater pond discharge windows, and waterfowl like to use secondary, polishing ponds, slug loads of nutrients from waterfowl may have adverse impacts on effluent nutrient concentrations. Deterring geese from landing on the ponds during migration periods and deterring nesting at the ponds can lead to a direct decrease in nutrient levels. The use of mylar flags and coyote cutouts are suggested as options worth testing to reduce direct waterfowl nutrient loading into the ponds.

Chemical Phosphorus Removal.

Chemical addition is a common method of addressing phosphorus and is recommended only if lower effluent levels cannot be achieved using the other solutions provided in this report. A cost analysis for four chemicals, ferric chloride, aluminum sulfate, Phoslock, and RE300, was compiled. From this, ferric chloride, with a cost of $21 per lb of phosphorus removed, was recommended. In order to reduce costs associated with the use of a boat or mixer to add chemicals, gravitational addition of ferric chloride solution to the transfer structures between the primary and secondary ponds as water is being transferred was identified as an option worth trialing.

Recommendation	Waste reduced (per year)	Cost savings (per year)	Status
Increase Hydraulic Retention Time (Karlstad)	100 lb P	$0	Recommended
Use Mylar Flags, Coyote Decoys, or Similar to Reduce Waterfowl Loading (Karlstad)	100 lb P 350 lb N	$550	Recommended
Add Aluminum Sulfate as Chemical Phosphorus Treatment (Karlstad)	70 lb P	$0	Recommended

Increase Hydraulic Retention Time by Reducing Inflow and Infiltration (Karlstad)	75 lb P	$0	Recommended

Recommendation	Waste reduced (per year)	Cost savings (per year)	Status
Increase Hydraulic Retention Time (Breckenridge)	560 lb P	$0	Recommended
Use Mylar Flags, Coyote Decoys, or Similar to Reduce Waterfowl Loading (Breckenridge)	250 lb P 940 lb N	$0	Recommended
Add Aluminum Sulfate as Chemical Phosphorus Treatment (Breckenridge)	270 lb P	$0	Recommended
Increase Hydraulic Retention Time by Reducing Inflow and Infiltration (Breckenridge)	1900 lb P	$0	Recommended