MSA
Murray, Smith & Associates, Inc.
Engineers/Planners

121 S.W. Salmon, Suite 900 ■ Portland, Oregon 97204-2919 ■ PHONE 503.225.9010 ■ FAX 503.225.9022

08-0957.402
July 1, 2009

Mr. Brian Issa
Community Development Director
City of Veneta
88184 East Eighth Street
P.O. Box 458
Veneta, OR 97487

Re: Report on Study of Water Treatment Plant Filter Backwash Water Treatment and Recycling

Dear Brian:

The following is our report documenting our analysis of and conclusions regarding the potential for treating and recycling filter backwash water at your two groundwater treatment plants.

Introduction and Purpose

The City of Veneta owns and operates two groundwater treatment plants to supply its water system. The plants remove iron from the groundwater. The purpose of this study was to review alternatives for the treatment and recycling of filter backwash water and to develop recommendations and cost estimates for a system at each plant to treat and recycle the backwash water. Until recently, filter backwash water was disposed of on site at both plants. Presently, all filter backwash water is discharged to the City's sanitary sewer system for treatment and disposal.

The ability to treat and recycle the filter backwash water would be a significant water conservation measure for the City. Groundwater resources are limited and costly to develop in the Veneta area and there is potentially significant economic value to recycling of filter backwash water.

Existing Facilities

The City's main water treatment plant is located at the main reservoir site and public works facility at the east end of East Broadway Avenue. The plant has three pressure filters. The peak raw water flow is about 550 gpm with the raw water iron content being about 3.2 to 3.7 mg/l. The total backwash volume per backwash cycle is about 30,000 gallons. The runtime between backwash cycles is about 45 hours.

The filter backwash is discharged to a ground-level backwash tank with about 30,000 gallons of capacity. The tank has a floating decant system. The intent of the system was to decant the filter backwash water and recycle the decanted water to the head end of the treatment process. The operators report that the system was not able to decrease the iron content of the backwash waste sufficiently to allow for recycling. The remaining high iron content in the decanted backwash water "spiked" the influent iron concentration, thereby spiking the iron in the filtered effluent to unacceptable levels. The operators modified the operation of the backwash treatment system. They continued to discharge filter backwash to the tank and then drained the tank at a constant rate to the ground nearby, the rate being sufficient to empty the tank before the next backwash cycle. It is understood that most of the flow infiltrated to the ground with some amount of flow finding its way to a nearby storm drain system and eventually to an open drainageway. The City recently modified this arrangement by installing a temporary gravity connection to divert the backwash flow to the City's sanitary sewer system for treatment and disposal.

The Jeans Road treatment plant is located on Jeans Road east of Hope Lane. The plant has two pressure filters. The peak raw water flow is approximately 300 gpm with the raw water iron content being about 1.2 mg/l. The total backwash volume per backwash cycle is about 22,000 gallons. The runtime between backwash cycles is about 38 hours.

The filter backwash is discharged to two settling basins with a sand bed and underdrain system. The underdrain discharges to a large diameter infiltration pipe located on the plant site. The system does not operate as intended. According to the operators, the sand beds blind and the City is not able to devote the labor necessary to remove the material ("schmutzdecke") from the sand bed. In addition, the infiltration pipe system is unable to dispose of the volume of backwash water. Until recently, the backwash water overflowed the infiltration pipe and flowed overland and off of the City's plant site onto adjacent private properties. The City recently installed a temporary gravity connection to divert the backwash flow to the City's sanitary sewer system for treatment and disposal.

Potential Treatment and Recycling Alternatives

Potential treatment and recycling alternatives that could be applied to the project were identified. Identified alternatives include the following:

- Dissolved air flotation
- Membrane filtration
- Microfiltration
- Filtration (several options)
- Enhanced settling

A preliminary analysis and review was conducted of all of these alternatives. The first three alternatives require a substantial investment in equipment and are relatively complex with respect to operation and maintenance. These were eliminated from further consideration as not being appropriate or economical for the low water volumes to be treated and recycled.

The filtration option was eliminated from further consideration. The City has such a facility at the Jeans Road facility and it is not operating satisfactorily. The enhanced settling option was determined to be the most appropriate for this application and it is likely the lowest cost alternative. It is the type of system in place at the City's main treatment plant and is used at other iron removal water treatment plants in the U.S. An example is the city of Minneapolis, Kansas.

Concept Development of Enhanced Settling Alternative

The following is a discussion of the enhanced settling alternative as it would apply to the City's water treatment plants. Iron floc, which is created ahead of the treatment plant filters by an oxidation process with the addition of chlorine, is relatively small and light. In the backwash process, the floc is broken up and essentially becomes a colloid, which won't settle easily on its own. In order to promote settlement of the iron, it is necessary to add a coagulant chemical to aggregate the colloid particles so that they will settle; thus, the reference to enhanced settling.

Preliminarily, a long-chained coagulant polymer would be considered as appropriate for this application. The polymer would be added to the filter backwash waste flow. A chemical storage and metering system would be required along with a backwash waste flow meter and chemical feed control system. An in-line static mixer would mix the polymer with the waste flow. The backwash waste would then flow to a settling tank. The tank would be filled and allowed to settle for about 2-3 hours. At that time, a decant system in the tank would be activated. Iron will tend to revert back to solution if left too long in the tank so it is important to decant the tank and recycle the flow back to the filters within a relatively short period of time, perhaps not exceeding 12 hours or so.

The settled decant from settling process would be recycled to the head of the plant. An underflow system from the settling tank would be needed to remove and dispose of the iron sludge. There are numerous sludge disposal alternatives which could include discharge to sanitary sewer system and lagoon storage for drying and ultimately landfill disposal.

Implementation of Recommended Alternative

In order to implement the recommended alternative, enhanced settling, several work elements need to be accomplished. These are described as follows:

Bench Scale Studies: It is essential that a bench scale study be performed in order to: a) characterize the filter backwash water, b) determine the optimum chemicals and dosages to improve the settling characteristics of the backwash water, and c) provide critical design parameters and guidelines for the treatment system.

Preliminary Design Report: Prepare a preliminary design report including the recommendations of the bench scale study. Develop the design to approximately the 30 percent level incorporating existing facilities where feasible. Prepare preliminary cost estimates.

Final Design, Bidding and Award and Construction: Upon approval by the City, proceed with final design and final cost estimates, bidding and award, and construction and system startup.

The ability to incorporate the existing backwash tank at the main treatment plant site is not known at this time. The bottom of the tank is not presently conducive to removal of solids as it doesn't appear to have a sloping bottom. A conical bottom will need to be installed in the tank. A flushing system would need to be installed to provide for removal of the iron sludge. Installation of a conical bottom may reduce the tank volume to below that required for the process. The existing backwash waste treatment facilities at the Jeans Road facility would have no apparent value in an enhanced treatment system. Space at the site has been provided for a backwash tank installation.

Conceptual Level Cost Estimates

Conceptual level cost estimates were made for each plant for the enhanced settling alternative. These costs include construction costs, bench scale testing, engineering and administration costs, and contingencies. The conceptual level project cost estimate for the main treatment plant, assuming the existing backwash tank can be utilized and modified, is in the range of $110,000 to $135,000. For the Jeans Road plant, the conceptual level project cost estimate is in the range of $155,000 to $170,000. For both plants, it is assumed that the iron sludge from the settling process would be discharged to the City's sanitary sewer system for treatment and disposal.

Summary

An analysis of alternatives for treating and recycling of backwash water was performed. The enhanced settling alternative is the recommended alternative at both of the City's water treatment plant. Filter backwash waste can potentially be treated and recycled if bench testing studies demonstrate that a suitable treatment chemical is available to enhance settlement of the iron.

If you have any questions or need any further information, please don't hesitate to contact us.

Sincerely,

MURRAY, SMITH & ASSOCIATES, INC.

Philip H. Smith, P.E.
Founding Principal

PHS:kjc