CH2M HILL
2300 NW Walnut Blvd.
Corvallis, OR
97330-3538
P.O. Box 428
Corvallis, OR
97339-0428
Tel 541.752.4271
Fax 541.752.0276

CH2MHILL

December 15, 2005

Dwight French
Oregon Water Resources Department
North Mall Office Building
725 Summer Street NE
Salem, OR 97301-1271

RE: Request for an Exception to the Willamette Basin Program Pursuant to ORS 536.295 City of Monroe Application S-86270

Dear Mr. French:

Southwood Engineering represents the City of Monroe in connection with the above referenced surface water application. CH2M HILL is a sub-consultant to Southwood Engineering.

This letter represents Monroe's request that, pursuant to ORS 536.295, the Water Resources Commission (Commission) allow the Water Resources Department (Department) to consider Monroe's surface water application S-86270 notwithstanding the Willamette Basin Program classification for the Long Tom River, a tributary of the Willamette River. The City of Monroe requests that the Commission consider this matter at its January 2006 meeting.

The City of Monroe's water supply is inadequate to meet its current and future needs. For the reasons outlined below, Monroe must turn to the natural flow of the Long Tom River as a water supply option. However, despite water being available year-round, under the Willamette Basin Program at OAR 690-502-0090(1) (b), the Long Tom River is not classified for municipal use. Unless an exception is granted by the Commission, Monroe's application S-86270 will likely be denied. For the reasons outlined below, the use proposed in Monroe's application S-86270 is necessary to ensure public health, welfare and safety and is necessary to avoid extreme hardship. We look forward to working with the Commission and Department as they consider this critical water supply option for the City of Monroe.

I. Background

A. Monroe's Current Water Supply Situation

The City of Monroe is a small community located along Highway 99W between Corvallis and Junction City in Benton County. The current population of Monroe is approximately 630. By the year 2025, it is projected that the City will grow to a population of approximately 900. The current peak day demand for water is 275 gallons per minute (gpm). The City's current supply capacity is only 113 gpm. The City's new 1 million gallon storage tank has enabled the City to provide water during peak periods. However, reliance on the entire storage capacity for daily use can dangerously deplete reserves needed for fire protection and water supply system emergencies. By 2020, it is estimated that the City's peak day demands will reach 350 gpm. Since the development of Monroe's Water System Master Plan in 1999, the City has understood it must make improvements to its water system and augment its current supply. The adopted Water System Master Plan specifically recommended the City develop a water supply of 350 gpm to meet its 20 year demand needs.

B. History of Monroe's Water Supply

From 1924 through 1998 the City relied on two springs located 3 miles southwest of town. However, this water supply was ultimately abandoned due to a number of factors including: decreased production, leaking transmission lines, and public health and source water protection concerns expressed by the Oregon Health Division. Historically, the springs provided about 20 percent of the City's summer water supply.

Between 1967 and 1986 the City's main supply was from an infiltration gallery adjacent to the Long Tom River. To address siltation and turbidity problems, in 1981 a treatment plant was constructed to filter the water being produced from the infiltration gallery. Overtime, the persistent turbidity and siltation clogged the infiltration gallery, reducing yield and ultimately resulting in the City abandoning the infiltration gallery and its water right permit for 202 gpm from the Long Tom River.

Since 1986 the City has turned to ground water as its water supply. In 1986 the City constructed Well #1 which produces approximately 100 gpm and is the City's main water supply. The water from Well #1 is high in iron and manganese and requires treatment prior to delivery. Well #2 constructed in 1998 only produces 13 gpm and has extremely poor water quality. Well # 2 is only used in peak demand situations when Well #1 is insufficient. In 2002, the City constructed an additional well (Well #3) that produces about 100 gpm. However, the water produced from Well #3 contains over 2,000 parts per million (ppm) of total dissolved solids and would require treatment by reverse osmosis prior to delivery. Based on an analysis by CH2M HILL, the capital cost for the reverse osmosis treatment would be $4,032,000 with an annual operation and maintenance cost of approximately $650,000. This cost estimate evaluation is provided in **Attachment 1**.

To date, the City has been unable to find a feasible alternative water supply that could come from the transfer of an existing ground water or surface water right.

C. Long Tom River - Opportunities and Impediments

Given the City's critical water supply situation and lack of feasible alternatives, the City has turned to "natural flow" from the Long Tom River, a tributary to the Willamette River.

However, despite water being available year-round, under the Willamette Basin Program the Long Tom River is not classified for municipal use. This restrictive classification, adopted by the Commission in 1992, was meant to further the Commission's policy objectives of having new appropriations on the Long Tom River rely on the release of stored water in Fern Ridge Reservoir (at the head of the Long Tom River) as compared to relying on the river's natural flow.

Ideally, the City could comply with the Commission's objectives and obtain a water right permit to use the abundant unallocated stored water from Fern Ridge Reservoir. Unfortunately, this opportunity is currently not an option for Monroe because:

(1) the water right certificate issued by the Department for Fern Ridge Reservoir does not include municipal water use; therefore, a permit to use stored water for municipal water use cannot be issued by the Department, and

(2) even if the Fern Ridge Reservoir certificate included municipal water use, the Bureau of Reclamation (BOR), which handles the stored water contracts from Fern Ridge Reservoir, would not likely issue a long-term stored water contract because of the uncertainty associated with the Endangered Species Act (ESA) consultation initiated in 1999 between BOR, Army Corp of Engineers, National Marine Fisheries Service, and the U.S. Fish and Wildlife Service to determine how operation of the Willamette Basin reservoirs impact fish species listed under the federal ESA.

On top of these issues, there is much work that needs to be done by the federal agencies and the Department to ensure the cost of stored water for municipal and industrial use is affordable. Under current federal procedures, the cost of stored water for municipal and industrial use can be up to $1700 an acre-foot. In comparison, irrigation water from the same projects can range from $9 to $12 per acre foot.

II. Exception to the Willamette Basin Program

Under ORS 536.295 the Commission may allow the Department to consider an application for a use not classified in the applicable basin program if one of the criterion under ORS 536.295(1) (a) – (g) are met and upon an evaluation of whether the use is consistent with the general policies established in the applicable basin program.

A. The Proposed Use is Necessary to Ensure Public Health, Welfare and Safety

As a municipal water provider, the City of Monroe has an obligation to provide a safe, clean, reliable and adequate water supply to its citizens. As described above, the City's water supply is not adequate to meet its current peak water use periods. Current peak day demand is 275 gpm; currently supply capacity is 113 gpm. The City's 1 million gallon storage tank (constructed in 2001) enables the City to limp through peak water use periods but falls dangerously below the storage needed in the event of a fire or an emergency interruption of the water supply. As an example of the critical nature of the City's water supply, in the summer of 2005, a temporary leak in the City's storage infrastructure resulted in the curtailment of water delivery from 10:00 pm to 5:00 am for 5 days.

The Oregon Legislature has recognized the need for adequate water supplies under ORS 536.241(1) which finds "the availability of an adequate water supply is essential to the continued health and safety of all Oregonians." The additional water supply proposed in Application S-86270 is critical for meeting Monroe's public health, welfare and safety obligations.

B. The Proposed Use is Necessary to Avoid Extreme Hardship

The term "extreme hardship" is not defined by statue or administrative rule. However, based on a number of previous Commission decisions on extreme hardship under ORS 536.295, an extreme hardship has been defined to include a situation where denial of the use and the need for the applicant to seek an alternative water supply would cause a burden that is not easily overcome. In addition, past Commission decisions on extreme hardship have recognized that the extreme hardship analysis can include the burdens on those that depend on the water as well as the burdens on the applicant. *See* for example Oregon Water Resources Department, Staff Report Agenda Item H, April 14, 2005 *Request for an Exception to the Willamette Basin Program by Springfield Utility Board Under ORS 536.295.*

In this case, the level of financial hardship that would be caused by the denial of Application S-86270 would be "extreme."

- Monroe's water supply situation is critical and must be resolved immediately.
- Monroe's immediate options are limited because Department and federal actions currently preclude the City from accessing stored water from Fern Ridge Reservoir.
- Treatment of the 100 gpm of water available from the City's Well #3 requires reverse osmosis treatment due to the high level of dissolved solids and is estimated to have a capital cost of over $4 million and an annual operations and maintenance cost of $648,000. (*See* Attachment 1)
- No existing surface water rights have been identified that are feasible (or available) to transfer to the City.
- Based on discussions with area ground water users, the purchase and transfer of a ground water right to the City (if one were available) and the associated conveyance and required treatment is estimated to carry a capital cost of approximately $3.0 million.

- In contrast, the treatment and use of Long Tom River water, whether natural flow or stored water released from Fern Ridge reservoir, has an estimated capital cost of $1.6 million. (*See* Attachment 1) The annual operations and maintenance cost, **<u>if</u>** the City could purchase stored water from Fern Ridge Reservoir during the low-flow months of June through October (at a cost of $1700 per acre-foot) is approximately $252,500.

Given that the alternatives to the Long Tom River are two or more times more costly, denial of S-86270 would place a burden on the City of Monroe and its customers that is not easily overcome.

Finally, similar to the Springfield Utility Board hardship exception request, denial of Monroe's application would constitute an extreme hardship by resulting in an inability to provide a safe, adequate and reliable water supply to the residences and businesses that rely on the City for water. As mentioned above, Monroe's water supply is already inadequate to meet its peak water demands. Denial of Application S-86270 would result in the inability to meet growing peak water demands and could lead to water shortages and place the population of the City of Monroe at risk of not having an adequate water supply. Water shortages could also cause extreme hardship by degrading water reserves for fire protection and other emergencies, thus resulting in burdens for Monroe and its residents that are not easily overcome.

C. The Proposed Use is Not Inconsistent with the General Policies of the Willamette Basin Program

Monroe's proposed use of the Long Tom River for municipal use is not inconsistent with the general polices of the Willamette Basin Program under OAR 690-502-0020.

Monroe's proposed point of diversion is downstream of U.S. Geological Survey gage 141700 at Monroe. In the stretch of river downstream from the gage to the Willamette River, there are no instream water rights, minimum perennial streamflows or pending instream water right applications. Moreover, in this stretch of river, according to the Department's water availability database, water is available year-round for new uses and will not result in over-appropriation as defined by the Commission under OAR 690-400-010(11). In terms of the general surface water allocation policies under OAR 690-502-0020, Monroe's proposed use balances instream and out-of-stream uses, preserves opportunities for future economic development and does not result in over-appropriation. With respect to other relevant general basin program policies, Monroe's proposed use would protect adequate and safe drinking water supplies for human consumption, promote water conservation through the development of a Water Management and Conservation Plan under OAR Chapter 690, Division 86 and is consistent with state and local land use requirements.

D. Commission Objectives and Permit Conditions

The City of Monroe is aware of the Commission's policy objectives in restrictively classifying the Long Tom River to encourage the use of stored water from Fern Ridge Reservoir. However, due to circumstances beyond the control of Monroe, the City is unable to access the abundant unallocated water stored in Fern Ridge Reservoir, and lacking feasible alternatives, must seek an exception to the Commission's restrictive classification of the Long Tom River under OAR 690-502-0090(1) (b).

In discussions with Department staff regarding Monroe's exception request, staff were clear that: (1) it is the Department's long-term policy objective to connect growing communities to stored water in the Willamette Basin Projects where feasible and, (2) providing Monroe a year-round water right from the Long Tom River is not a long-term solution because at some point in the future the stored water that is currently released as public waters (and available to natural flow appropriators) might be managed differently resulting in the City's diversion from the Long Tom River under S-86270 being curtailed during the low flow months of June through October. Monroe concurs with these points and is willing to work with the Department to develop permit condition language to address them.

The City of Monroe believes that on its face its exception request meets the requirements of ORS 536.295 and should be granted. The granting of an exception by the Commission is not a public interest review of the application, but simply allows the Department to consider the application and evaluate it under the same (public interest) provisions as all other applications. Monroe does not believe it is appropriate to pre-determine public interest conditions in the context of an exception request for a pending application. However, the City would like to express to the Commission and Department its willingness to accept a condition, inserted into a proposed permit that would allow year-round use of 350 gpm from the Long Tom River, a condition along the following lines that meets the City's, Commission's and Department's objectives:

The permit holder shall seek an alternative water supply for the use authorized under this permit between June 15 and October 15 of each year.

On a schedule determined by the Department, the permit holder shall provide a written report to the Department describing the permittee's progress in obtaining an alternative water supply for the use authorized under this permit between June 15 and October 15 of each year. The report shall specifically describe the permittee's progress in securing a

long-term contract and associated water right permit for the use of stored water from Fern Ridge Reservoir.

Use of water under this permit shall not be allowed between June 15 and October 15 of each year beginning two years from the date a long-term contract and water right permit are available to the permittee that allows the use of stored water from Fern Ridge Reservoir for municipal use between June 15 and October 15 of each year.

III. Conclusion

In conclusion, the City of Monroe requests that, pursuant to ORS 536.295, the Commission allow the Department to consider the City's Application S-86270 notwithstanding the classification of the Long Tom River under OAR 690-502-0090 (1) (b) which does not allow municipal use.

Please feel free to contact me at (541) 768-3212 if you have any questions or need additional information.

Sincerely,

Adam Sussman
Senior Water Resources Consultant
CH2M HILL/CVO

Attachment 1 – Monroe, Oregon Water Treatment Cost Estimates

Attachment 1

TECHNICAL MEMORANDUM **CH2MHILL**

Monroe, Oregon Water Treatment Cost Estimates

PREPARED FOR: Southwood Engineering

PREPARED BY: Paul Mueller/CVO

DATE: September 12, 2005

Southwood Engineering requested an estimate of capital and operating costs for treatment of alternate water supplies at Monroe, Oregon. A design capacity of 350 gallons per minute (gpm) will be used for generating capital costs. An annual average flow rate of half the design flow will be used for assessing operating costs.

Two alternative treatment schemes will be considered:

- Treatment of groundwater from a combination of existing wells, per the schematic shown in Figure 1.
- Treatment of surface water from the Long Tom River, per the schematic shown in Figure 2.

FIGURE 1
Groundwater Treatment

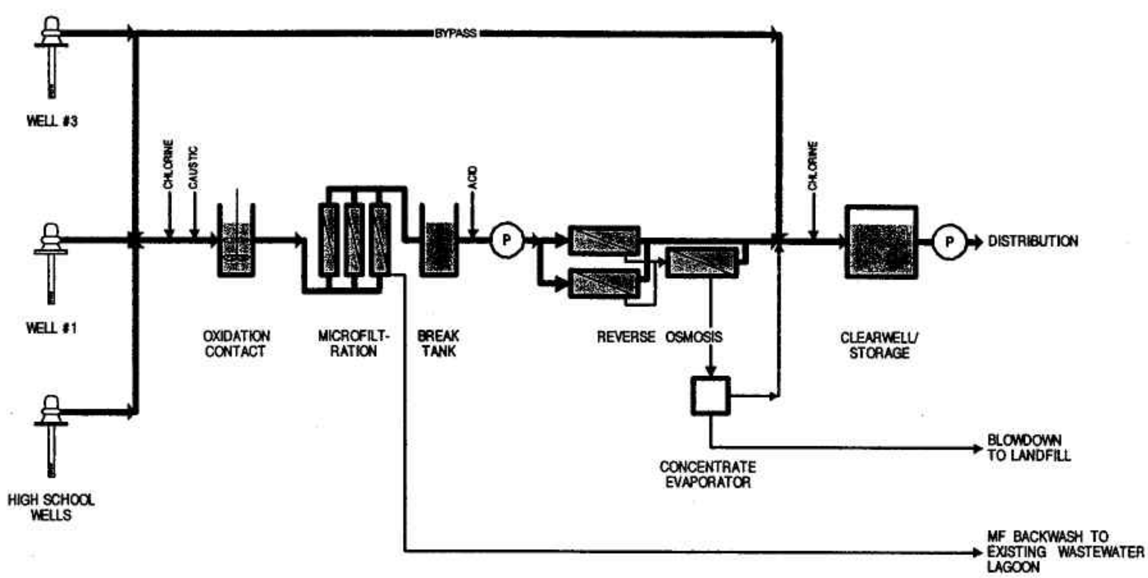
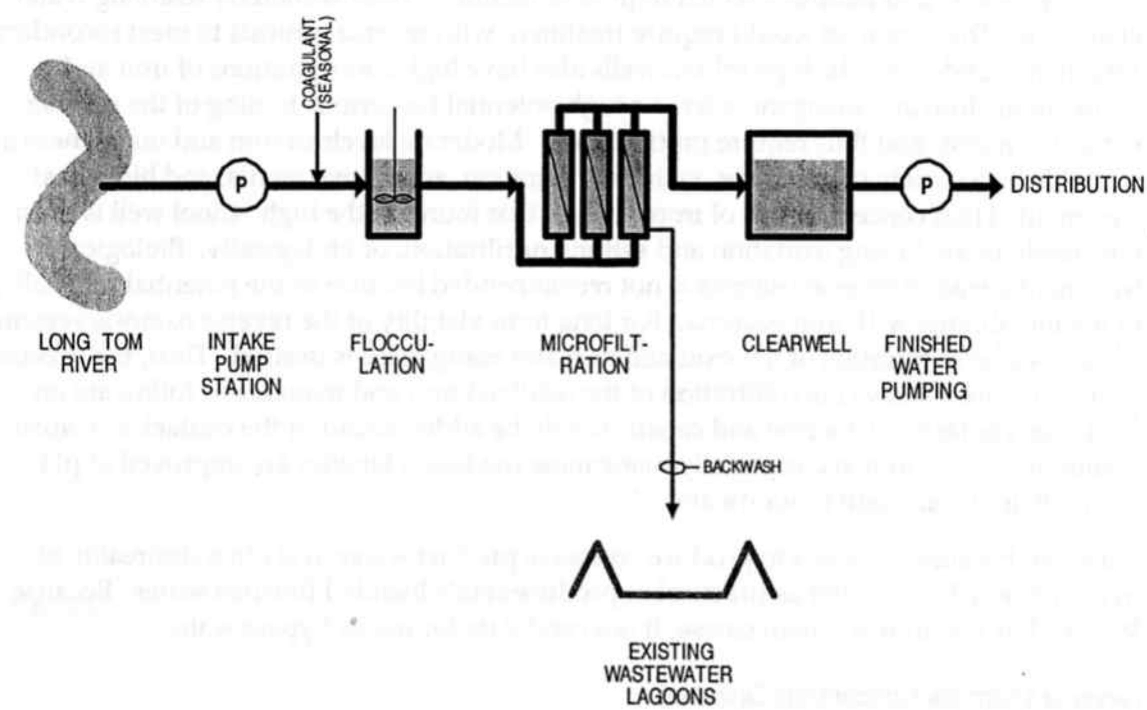


FIGURE 2
Surface Water Treatment



Groundwater Treatment

Three groundwater sources are available:

- Well #1, which has a capacityof 100 gpm and is currently in service.
- Well #3, which has a capcity of 100 gpm and has been tested but is not on line
- Wells at the high school which were used as part of a heating/cooling system at the school

Treatment Issues

Key water quality associated with the main treatment issues for the three wells is presented in Table 1.

TABLE 1
Groundwater Quality

Parameter		Well 1	Well 3	High School
Hardness	mg/L as $CaCO_3$	206	847	650
Total Dissolved Solids	mg/L	294	2,010	1,160
Iron	mg/L	3.92	0.09	21.9
Manganese	mg/L	0.74	0.12	0.27

Well 1 requires treatment for iron and manganese removal, but is low in total dissolved solids and moderately high in hardness. The other two sources have elevated toatal dissolved solids and hardness which require reduction to meet secondary drinking water standards. These sources would require treatment with reverse osmosis to meet secondary treatment standards. The high school wells also have high concentrations of iron and manganese. Iron and manganese have a high potential for serious fouling of the reverse osmosis process, and thus require pretreatment. Moderate levels of iron and manganese are treatable by a variety of processes, including filtration, adsorptive media, and biological treatment. High concentrations of iron, such as that found in the high school well is most effectively treated using oxidation and settling or filtration, or biologically. Biological treatment ahead of reverse osmosis is not recommended because of the potential for fouling of the membranes with iron bacteria. For long term viability of the reverse osmosis system, a high degree of filtration of the oxidized iron and manganese is desired. Thus, the process train in Figure 1 shows microfiltration of the oxidized iron and manganese following an oxidation contactor. Chlorine and caustic would be added ahead of the contactor. Caustic is shown because iron and especially manganese oxidation kinetics are improved at pH higher than the ambient groundwater.

Note that because RO tends to produce corrosive product water, it is often desireable to bypass as much raw water as practical to produce stable blended finished water. Because Well #3 has low iron and manganese, it is a candidate for use as bypass water.

Reverse Osmosis Concentrate Disposal

Disposal of concentrate from reverse osmosis treatment, which contains elevated concentrations of TDS, Hardness, and other contaminants rejected from the source water, can be a major cost component of an overall treatment facility. Options for disposal of reverse osmosis concentrate include:

- Solar Evaporation Ponds
- Mechanically Assisted Evaporation Ponds
- Mechanical Evaporation
- Natural treatment Systems
- Deep-well injection
- Wastewater effluent mixing
- Irrigation
- Rapid Infiltration

Evaporation ponds are not viable in the climate of western Oregon, as the annual net evaporation rate is low. Because of ultimate discharge to surface water, wastewater effluent mixing, irrigation, natural treatment, and rapid infiltration are not considered viable at Monroe either. Deep well injection has significant permitting and project implementation risks, and is not a recommended alternative for this facility. The only viable disposal option at Monroe is mechanical evaporation.

Mechanical evaporation can treat membrane concentrate by converting the water component to steam, leaving behind a wet salt to be landfilled. Many different options for mechanical evaporation equipment exist, such as:

- Single-effect evaporator

- Multiple-effect evaporator
- Vapor compression evaporator
- Vertical tube falling film brine concentrator
- Horizontal tube spray film brine concentrator
- Forced-circulation crystallizer

The most common combination of equipment to accomplish full evaporation of membrane reject streams is a vertical tube falling film brine concentrator followed by a forced-circulation crystallizer. Since this arrangement of evaporation equipment is typically the most economical, it will be the focus of further discussion for mechanical evaporation of membrane concentrate.

1. Membrane reject is pumped through a heat exchanger that raises its temperature to the boiling point.

2. Hot feed combines with the brine slurry in the sump. The brine slurry is constantly circulated from the sump to a floodbox at the top of a bundle of heat transfer tubes. Calcium sulfate crystals are seeded into the brine slurry to act as precipitation nuclei for scalants that would otherwise scale the heat transfer surfaces. Membrane concentrate saturated with calcium sulfate may avoid adding additional calcium sulfate crystals.

3. Some of the brine evaporates as it flows in a falling film down through the tubes and back into the sump.

4. The vapor passes through mist eliminators and enters the vapor compressor, which heats it slightly. Compressed vapor flows to the outside of the heat transfer tubes. Mechanical compressors are used in most applications. The mechanical vapor compressor is responsible for about 80 percent of the 70- to 90-kilowatt-hours (kWh) power usage per 1,000 gallons of brine concentrator feed. A thermal (or steam-driven vapor compressor) can be economical if waste steam is available. However, mechanical vapor compressors cannot be retrofitted to steam driven, and vice versa.

5. Heat from the compressed vapor is transferred to the cooler brine falling inside the tubes, causing some of the brine to evaporate. As the compressed vapor releases heat, it condenses as product water. This condensate is highly pure with a TDS content from 5 to 10 mg/L, making it an excellent water source for boiler makeup, cooling makeup, and process use. There may be potential to negotiate the sale of this low-TDS product to private facilities at a premium over typical water rates. The sale of the distillate may be more economical than blending with plant effluent to reduce TDS.

6. This high-purity distillate is pumped back through the heat exchanger, where it gives up heat to the incoming membrane reject. Total product water recovery across the brine concentrator is between 95 and 99 percent. The distillate can be delivered as drinking water or sold separately for cooling tower use as discussed above.

7. From 1 to 5 percent of the brine slurry is blown down from the sump to control the brine density to between 20 and 30 percent (200,000 to 300,000 mg/L). Blowdown may be sent to a crystallizer feed tank and then on to a forced-circulation crystallizer

for ultimate conversion to a nearly dry salt product; however, the cost of a crystallizer is extremely expensive. For the purposes of this evaluation, disposal of the blowdown as a liquid waste requiring landfill is assumed.

Besides cost, the primary obstacle in implementing mechanical evaporation for the disposal of membrane concentrate is the size and complexity of the equipment. For example, a falling film brine concentrator for a 1.3-million-gallon-per-day (mgd) concentrate stream is approximately 100 feet in height. In addition to the large size of mechanical evaporation equipment, evaporators and crystallizers are relatively complex to operate compared to other methods of membrane concentrate disposal. Reliance on mechanical compressors results in lower reliability than other methods of concentrate disposal that are less mechanically intensive.

Regulatory Issues

Permit requirements are minimal for operation of mechanical evaporation equipment for membrane concentrate disposal. Depending on the zoning regulations and height of the falling film brine concentrator, a variance to allow a structure in excess of the regulated maximum height may be required. State and local agencies should be contacted for other regulations that may apply.

Cost Considerations

The primary drawback for implementing mechanical evaporation for membrane concentrate disposal is the relative high expense. Mechanical evaporation equipment is both capital and operational cost-intensive.

Operational cost of the mechanical evaporation equipment is almost completely associated with power usage of the large vapor compressors used in the process. As mentioned previously, the brine concentrator requires 70 to 90 kWh of power per 1,000 gallons of brine concentrator feed. Therefore, mechanical evaporation is extremely sensitive to power costs at a given location. A small increase in power costs can dramatically increase the cost to treat a specified volume of membrane concentrate.

Landfill costs are also incurred for ultimate salt disposal. Salt sludge must be disposed of in either a municipal landfill or an RCRA-approved landfill depending on the makeup of the salt sludge. Disposal of salt sludge in an RCRA-approved landfill will increase costs due to the liner and leak detection system requirements.

Surface Water Treatment

Treatment of the Long Tom River would require filtration with appropriate pretreatment. For the purposes of this evaluation, the use of microfiltration is assumed. For small systems, microfiltration pacakage systems are cost effective to conventional treatment (coagulation, sedimentation and media filtration) packagae systems, and provide state of the art filtration. Coagulation is not required to achieve the desired filtration efficiency for microfiltration; however, because micofilters are not effective at removing dissolved material such as natural organic matter or color that may be present in the source water, coagulant addition (at least seasonally) is often provided as a means of removing such cantaminants.

As opposed to reverse osmosis, the reject from the microfiltration process contains only solids that were present in the source water or were induced through coagulant addition.

There is no elevation of total disoolved solids through the process. Therefore, the wastewater from the process can be disposed of in a manner similar to other surface water filtration plant residuals. At Monroe, proximity of the likely plant location to the existing wastewater lagoons should allow diposal of process waste without additional processing. This approach has been assumed in the cost estimates below.

Cost Opinions

Capital and operating cost opinions for the two approaches described above is presented in Table 1. The cost of the groundwater treatment is substantially higher than for the surface water treatment, due primarily to the cost of reverse osmosis concentrate treatment and disposal.

TABLE 1

Comparative Cost Estimates

Groundwater Option

Capital

Oxidation System		$160,000
Microfiltration		$470,000
Reverse Osmosis		$280,000
Concentrate Evaporator		$830,000
Building		$200,000
Electrical		$155,000
I&C		$210,000
Direct Cost Total	=	$2,305,000
Contractor Indirect Cos	+	$472,000
Construction Contract	=	$2,777,000
Engineering	+	$583,000
Project Subtotal	=	$3,360,000
Project Contingency	+	$672,000
Total Project Cost	=	$4,032,000
Annualized Capital Cost		$271,000

perations

Power	$76,500
Chemicals	$20,700
Labor	$125,000
Membrane Replacement	$53,000
Concentrate Disposal	$102,000
Total	$377,200

tal Annual Cost $648,200

Cost per 1,000 gallons

Pretreatment		$160,000
Microfiltration		$480,000
Building		$150,000
Electrical		$63,000
I&C		$85,000
Direct Cost Total	=	$938,000
Contractor Indirect Cos	+	$192,000
Construction Contract	=	$1,130,000
Engineering	+	$238,000
Project Subtotal	=	$1,368,000
Project Contingency	+	$273,600
Total Project Cost	=	$1,641,600
Annualized Capital Cost		$110,000

Operations

Power	$2,400
Chemicals	$7,600
Labor	$100,000
Membrane Replacement	$22,600
Total	$132,600