CHAPTER 9. WATER RECLAMATION

Identifying and evaluating opportunities for effluent reuse is an important part of any wastewater facilities planning effort. This chapter presents a preliminary assessment of effluent reuse opportunities that may warrant further consideration, depending on future circumstances. These opportunities were developed based on the City's reuse goals, potentially more-restrictive future effluent discharge requirements, reuse regulatory requirements, WRF effluent characteristics, and local conditions.

The reuse opportunities discussed in this chapter include land application, treatment wetlands, hyporheic discharge, and industrial reuse. These were evaluated to preliminarily define the scope and feasibility of each, including, as applicable, the development of planning level water balances, land requirement assessments, and nutrient balances.

Similarly, the potential environmental impacts of these reuse opportunities were briefly reviewed and next steps for further development and evaluation were outlined.

SHORT-TERM AND LONG-TERM REUSE GOALS

The City has developed several short-term and long-term reuse goals to address wastewater treatment needs (complementing WRF facility planning goals) and community needs. The short-term goals are to:

- Promote public acceptance of reuse through public awareness programs.
- Establish proof of community benefits of reuse through demonstration projects.
- Reduce level of treatment of some wastewater as appropriate for the type of use.

The long-term goals are to:

- Apply reuse technologies to accommodate community growth without increasing the level of WRF treatment to meet permit load limits.
- Incorporate reuse programs to reduce potable water demand so potable water is not used for irrigation, for example.
- Develop and implement reuse systems to address new total maximum daily load (TMDL) standards, such as those for temperature and iron.

TRIGGERS FOR FURTHER EVALUATION OF REUSE OPPORTUNITIES

The following circumstances are most likely to trigger additional consideration of reuse options:

- Reuse could reduce the cost of WRF upgrades by reducing the required level of effluent treatment.
- More stringent thermal load limitations are incorporated into the WRF's NPDES permit after the South Yamhill River TMDL for temperature is established.

- Iron, mercury, or other limitations are added to the WRF's permit after the South Yamhill River TMDLs for these constituents are established.

For a review and analysis of regulations pertinent to the WRF planning effort in general, refer to Chapter 5 Regulatory Requirements. This includes a review of the WRF's NPDES Permit and potential future regulatory changes. The South Yamhill River TMDL is currently under development by DEQ and due to be completed in 2010.

Treatment Requirements

For the dry weather season (May 1 through October 31), the WRF's NPDES permit includes both concentration and mass discharge limits for cBOD, TSS, ammonia, and phosphorus. These limits generally increase in a stepwise manner as river flow increases. Of specific interest are the phosphorus limits. When South Yamhill River flows are less than 100 cubic feet per second (cfs), a concentration limit (70 μg/L) applies. When river flow is between 100 and 250 cfs, a mass discharge limit of 9.6 pounds per day (lb/day) is in effect. The phosphorus limit is suspended when river flow exceed 250 cfs.

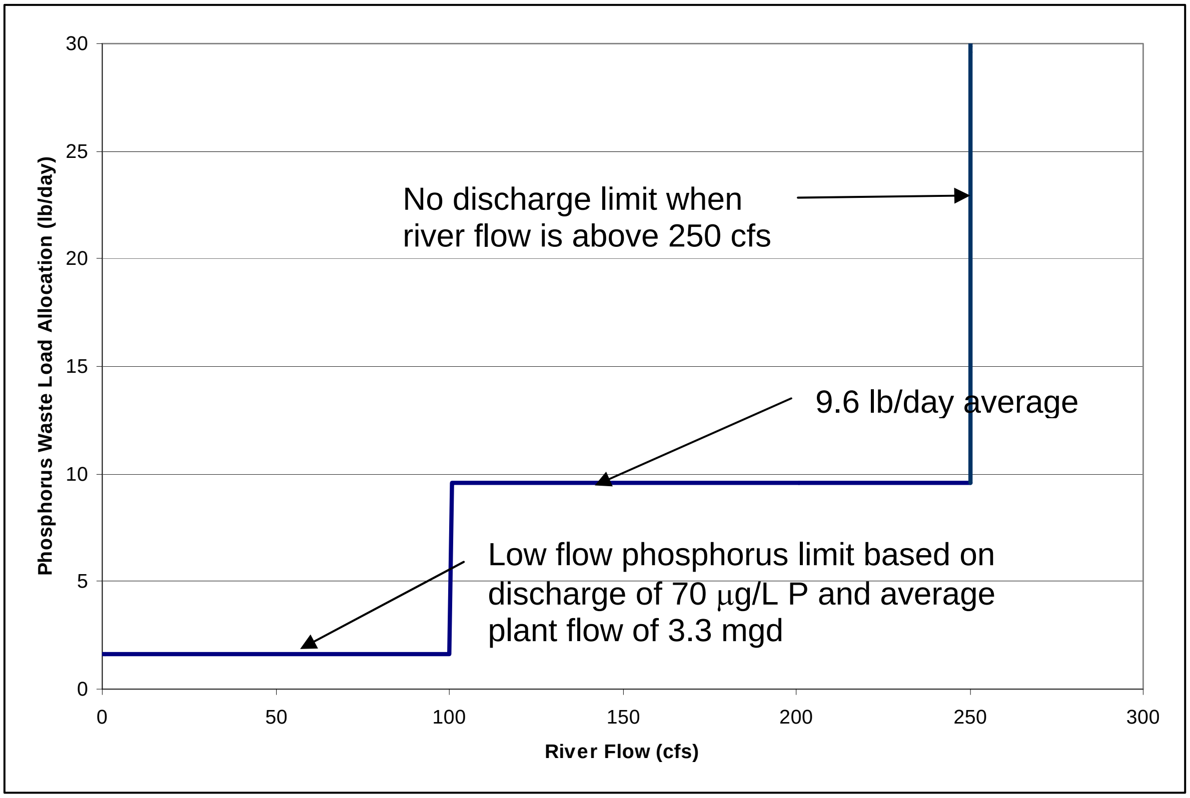
For phosphorus, the City could request to have the discharge limits set as mass limits rather than concentration to include the current total waste load at the current flow and concentration. The advantage of a mass load is that the volume of water that carries the waste load is not critical. Therefore if most of the water is reused, the waste load could be discharged in a more concentrated stream that could require less treatment. Conversely, a concentration limit requires full treatment even if only a small portion of the water is discharged. Mass loads favor reuse and concentration loads favor full discharge. However, it is important to consider the potential disadvantages of mass-only limits in the event a reuse program is not implemented. As the community grows and flows increase over time, a fixed mass limit would result in a need to continually improve effluent quality (reduce concentrations) in order to comply with the mass limit.

If only the low river flow (less than 100 cfs) condition is considered, it becomes apparent that continuing to use a phosphorus concentration limit in the future as flows and loads increase would make it necessary to provide high-level treatment for all of the treatment plant effluent, or provide a lower level of treatment and convey all of the effluent to a reuse system. If a mass loading limit were used, then the portion of the effluent that would cause an exceedance of the mass load limit could be diverted to reuse systems. This approach would provide permit compliance while reducing the required effluent concentration. The same water quality benefits could be achieved as mass discharges would remain unchanged. In addition, operational flexibility would be enhanced since WRF personnel would have the ability to balance treatment efficiency, discharge flow, and reuse flow to maintain permit compliance. If the low river flow phosphorus limit was changed from concentration to mass loading, a reuse program would present the City with significant permit compliance benefits. DEQ is beginning to support this change in new permits when it is requested.

Another issue that could affect the severity of future treatment requirements is whether it is more appropriate to regulate phosphorus based on the presence of ortho-phosphorus rather than total phosphorus. Total phosphorus includes the phosphorus already contained in algae and cells, which has minimal impact on aquatic plant growth compared to the soluble phosphorus fraction. Other cities and agencies, have requested to have their compliance based on instream monitoring of pH and dissolved oxygen rather than phosphorus. The intention of the TMDL standard is to protect instream pH and dissolved oxygen levels; it uses phosphorus as a controlling parameter. The river background could be 80 to 90 µg/L total phosphorus.

The discharge limit for phosphorus could be modified to be river-flow-proportional (a straight line) rather than the two-step limit that now exists. See Figure 9-1. This approach could provide additional operational flexibility with no increased environmental impact to the river—particularly in July and October when the river flow is in transition between 100 and 250 cfs. Figure 9-2 illustrates this concept.

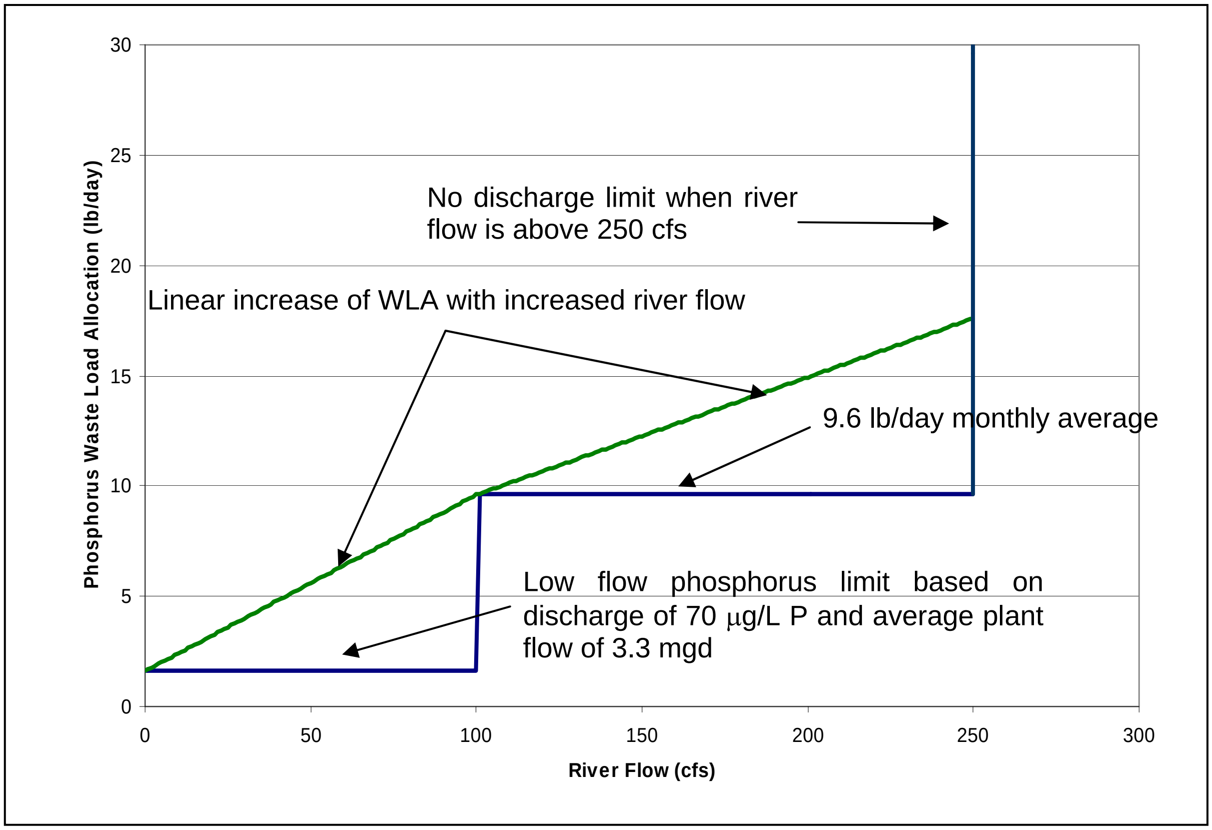
Figure 9-1. TMDL Stepped Approach to Phosphorus Waste Load Allocation



Temperature TMDL

If temperature becomes more restrictive than the current WRF permit limit, then further development and evaluation of reuse options will be advisable because mechanical refrigeration and cooling towers are expensive and complex. Land application systems can be used to consume warm water with crop uptake so the heat is not discharged to the river. In addition, wetlands can be used for partial consumption and evaporative cooling of the remaining flow that gets discharged.

Figure 9-2. Variation of Phosphorus Waste Load Allocation with South Yamhill River Flow



Future permit limits resulting from development of temperature TMDLs for the South Yamhill River may be expressed as maximum temperatures (similar to concentration limits) or as heat loads (similar to mass load limits and the current thermal limit). Maximum temperature will likely be of greatest concern in September and October when the river flows increase, the river cools, and the effluent flow has not yet cooled. More restrictive heat loads could be established such that they restrict total amount effluent that can be discharged without cooling. August, September, and October may be the most limiting, but these are good months for reuse because evapotranspiration and evaporative cooling potentials are higher than in the wet season.

Iron, Mercury, and Other Parameters

If TMDLs are developed for iron, mercury, or parameters, then the resulting permit limits may trigger further consideration of reuse opportunities. Iron could be treated with wetlands and land application.

Pharmaceuticals are an example of a parameter that is not expected to be included in the next TMDL, but could be regulated in the future. A numeric limit for mercury was not included in the 2006 TMDL. However, the City is required to develop a Mercury Reduction Plan and perform additional sampling to comply with enforcement of the 2006 TMDL. Wetlands have been known to reduce mercury by 17 percent (Kadlec and Knight, 1996).

BASIS OF PLANNING

Wastewater Flows and Loads

The wastewater flows and loads used in the identification and preliminary assessment of conceptual reuse opportunities were presented in Chapter 4. The reuse opportunities were developed for current and buildout conditions. For planning purposes, the average dry weather flows (ADWFs) were used to estimate the size requirements of the facilities. These correspond to the average of daily flows over the 6-month dry weather season, from May 1 through October 31. For current conditions, ADWF = 3.3 mgd; for buildout, ADWF = 6.1 mgd. If the City moves forward with a detailed assessment of reuse, a month-by-month analysis of dry season flows should be prepared to provide a more accurate assessment of land requirements. Storage requirements may be based on higher flows such as maximum month dry weather flow.

Current and buildout effluent loads were estimated using the 2006 dry weather concentrations shown in Table 9-1. To provide buildout load estimates, it was assumed that future effluent concentrations would be the same as they were in 2006.

Table 9-1. McMinnville WRF Effluent Loads During 2006 Dry Weather Season

	Average Daily Flow (mgd)	CBOD (mg/L)	TSS (mg/L)	Average Total P (mg/L)	Average Total P (lb/day)	Maximum Day Total P (mg/L)	Ammonia (mg/L)	TKN (mg/L)	Nitrate & Nitrite Available Data (mg/L)
May	3.99	2	4.9	0.12	4.09	0.24	0.16	1.28	7.392
June	3.41	2	1.81	0.07	2.12	0.11	0.23	0.79	10.75
July	3.07	2	1.02	0.05	1.35	0.13	0.12	0.91	11.68
August	2.81	2	1.32	0.06	1.46	0.11	0.06	0.86	12.36
September	2.8	2	1.25	0.07	1.71	0.14	0.47	0.95	14.925
October	2.67	2	0.88	0.05	1.22	0.13	0.04	0.62	13
Average	3.13	2.00	1.86	0.07	1.99	0.14	0.18	0.90	11.68

CBOD = carbonaceous biochemical oxygen demand
TSS = total suspended solids
Total P = total phosphorus
TKN = total Kjeldahl nitrogen

Reuse Regulatory Requirements

Wastewater effluent reuse practices are specified under Oregon Administrative Rules (OAR) 340-55, which establish DEQ rules and regulations for treatment and monitoring of recycled water. The previous rules had been in place for over 15 years. New rules were recently adopted which are comparable to the existing rules except that they include provisions intended to encourage more reuse.

Currently, levels of recycled water are defined according to the level of treatment required for reuse in specific applications. In general, lower quality water can be used for applications with little to no risk of human exposure to reuse water, such as agricultural irrigation of fodder, fiber, and seed crops not for human ingestion. Higher quality water is required for applications with a higher chance of human exposure to reuse water, including irrigation of parks, playgrounds, and schoolyards or irrigation of food crops. The newly adopted treatment and monitoring requirements for use of recycled water, as published by DEQ (OAR 340-055-005 to 340-055-030) is provided in Appendix C. Tables 9-2 through 9-4 briefly compare the previous to the newly adopted reuse regulations.

Table 9-2. Previous Recycled Water Regulation

Level	Treatment	Uses
1	Biological	Timber
2	Biological, disinfection	Non food crops
3	Biological, disinfection	Non food crops
4	Biological, disinfection, clarification, coagulation, filtration	Public Spaces, Food crops

Table 9-3. Newly Adopted Recycled Water Regulations

Class	Treatment	Uses
A	Biological, filtration, disinfection	Public Spaces, Food crops
B	Biological, disinfection	Irrigation, Commercial Construction
C	Biological, disinfection	
D	Biological, disinfection	Timber, pasture
Non Disinfected	Biological	Timber, pasture

The four potential water reuse opportunities for McMinnville (in order of least to most stringent treatment requirements) are industrial reuse (although user can impose more stringent requirements), wetlands irrigation, agricultural irrigation, and groundwater recharge. To use recycled water for industrial reuse or wetland irrigation, Level II treatment requirements must be met. For agricultural irrigation, Level II (for everything except food crops) requirements must be met. For food crops, Level IV requirements must be met to protect human health. Orchards and vineyards are an exception; they require Level II treatment.

Table 9-4. Major Differences Between Previous and Newly Adopted Regulations

Current	Proposed
No Groundwater recharge	Allows ground water recharge
Irrigation Only	Grey water/car washes/fountains
ODHS Approval of All Uses	ODHS Classes ≤C
No Human Contact	Contact Allowed (Class A)
Arbitrary Requirements	Site Specific Requirements
WWTP/User Agreement	No Agreement

Currently, the WRF discharge meets Level II requirements. Improved disinfection would be necessary for the WRF to meet Level IV treatment requirements.

Indirect Discharge to Surface Water

In response to a growing interest in the use of indirect discharge, DEQ developed the *Disposal of Municipal Wastewater Treatment Plant Effluent by Indirect Discharge to Surface Water via Groundwater or Hyporheic Water* Internal Management Directive to provide DEQ staff with guidelines for permitting such systems (Oregon Department of Environmental Quality, 2007). As stated in the internal management directive, an indirect discharge system should have the following characteristics:

- Designed to route wastewater through shallow unsaturated soils and/or groundwater for additional polishing and diffusion before it discharges to surface water. This includes situations where wastewater is discharged to hyporheic water.
- Site conditions (geology or hydrogeology) and system design are such that (effectively) all the wastewater and affected groundwater will discharge to surface water after leaving the waste management area.
- As required by the Groundwater Quality Protection rules in OAR 340-040, groundwater outside the waste management area will not be adversely affected by the system.
- Conditions in the waste management area and the quality of discharge are such that long-term contamination would be unlikely following termination of the discharge.
- A local government or special district owns or otherwise controls the property containing the waste management area.
- Water supply wells do not exist and cannot be placed within the waste management area.

The rules that govern these types of systems include:

- Groundwater Quality Protection (OAR 340-040)

- Water Quality Standards: Beneficial Uses, Policies, and Criteria For Oregon (OAR 340-041)
- Construction and Use of Waste Disposal Wells or Other Underground Injection Activities (Underground Injection Control) (OAR 340-044)
- Regulations Pertaining to NPDES and Water Pollution Control Facilities (WPCF) Permits (OAR 340-045)

PRELIMINARY ASSESSMENT OF POTENTIAL REUSE OPPORTUNITIES

Each of the potential reuse opportunities will require construction of a pump station and pipeline. Pumping costs are expected to be relatively low because the local topography is relatively flat. Pipeline costs will depend primarily on length required to convey to the reuse site.

Land Application

Land application is a potentially viable reuse option for the WRF because many acres of agricultural land are available in the vicinity. As shown in Figure 9-3, there is a significant amount of green space and agricultural land in the area. Also, the prevalent soil types are productive for irrigated agriculture. Many nearby water rights holders remove river water for irrigation which could be replaced with recycled water, providing the double benefit of preserving river flow and reusing effluent.

The net irrigation rates for typical crops in the Tualatin Valley (which includes the Yamhill basin) are summarized in Table 9-5 General examples include vineyards, grain, and corn, which consume 10–12 inches/acre during the growing season; alfalfa, grass seed, pasture, and turf grass, which consume 16–18 inches/acre; and orchards or poplar trees, which consume 22 inches/acre. Nearby in the Willamette Valley, the City of Woodburn Wastewater Treatment Plant's 80-acre poplar tree plantation reuses 1 mgd during 2 months of the year.

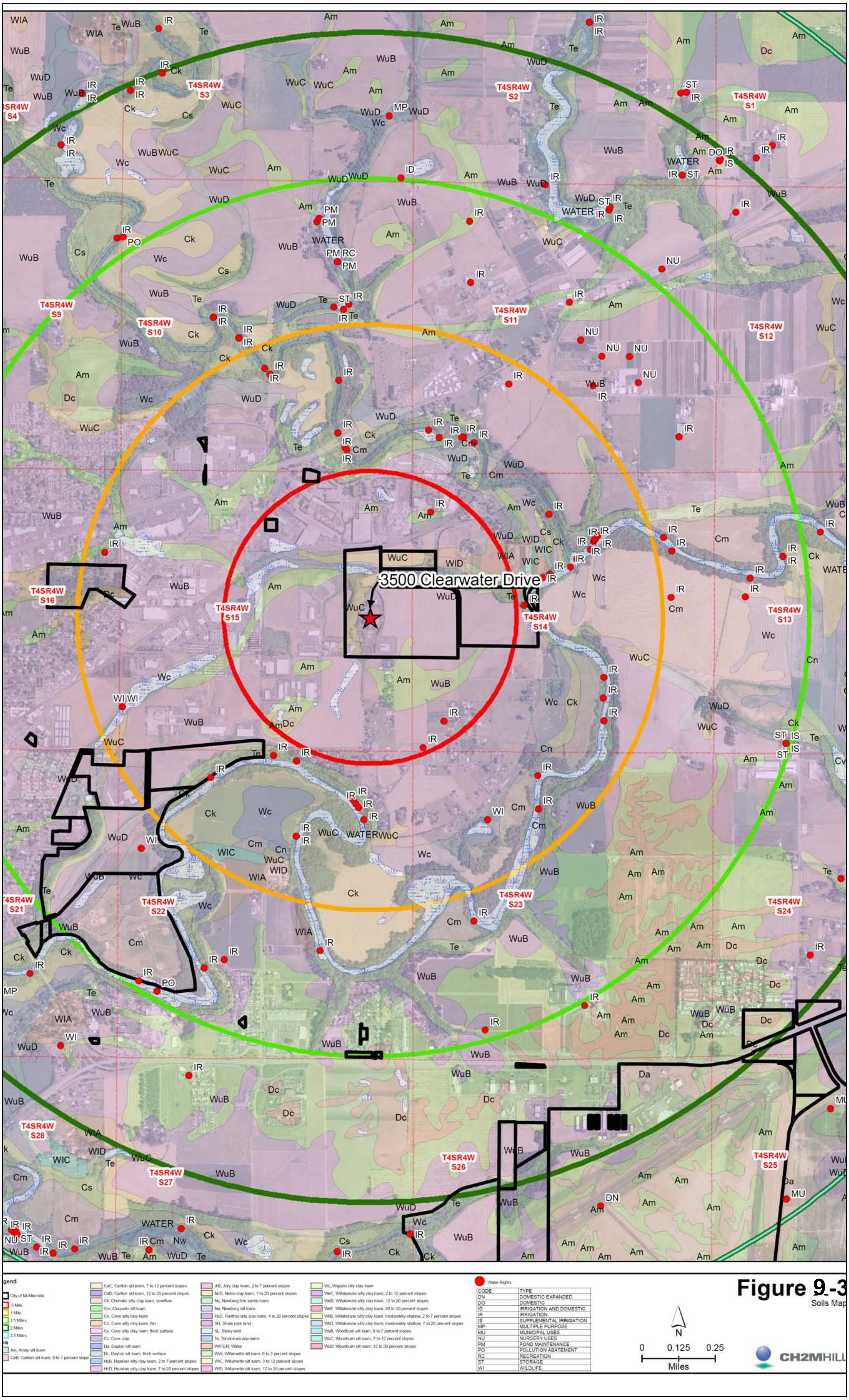
Table 9-5. Typical Tualatin Valley Crop Net Irrigation Rates (inches)

	Alfalfa Hay	Apples, Cherries, Filberts	Beans	Berries	Corn (field)	Grain (spring)	Grain (winter)	Grapes	Grass Seed (fall)	Pasture
Season Total	16.3	21.97	8.07	10.62	12.44	12.13	11.66	10.15	18.59	18.44

Data obtained from Oregon Crop Water Use and Irrigation Requirements; June 1992 for Tualatin Valley 5 out of 10 years

Root zone water balances were developed to identify the estimated number of acres needed to land apply existing and future ADWFs. For purposes of illustration, it was assumed that the WRF effluent would be land applied to grass seed. With further development of the option, a combination of crops could be used, depending on land availability, local circumstances, and site characteristics. Detailed root zone water balance results are provided in Appendix D.

Figure 9-3. Site Map



Without storage, approximately 1,000 acres of grass land would be needed to accommodate the current dry season flow of 3.3 mgd. By comparison, the buildout ADWF of 6.1 mgd would require approximately 1,900 acres of grass land without storage. Again assuming that the City elects to request, and is successful in obtaining, mass-discharge-only limits for effluent phosphorus, it could potentially be necessary to reuse only a portion of the WRF's effluent. For example, about one tenth of the current dry season (May through October) flow could be consumed on about 100 acres of land. The most critical months of June to August could have no discharge at the current flows if 644 acres of grass were irrigated. The analysis assumes that all effluent is discharged during the less sensitive wet weather season.

To evaluate nutrient loading, both current and buildout flows were evaluated using current dry season water quality data. The average total nitrogen content during the dry season is 12.6 mg/L. Nitrogen is the key nutrient that drives loading calculations, as phosphorus and potassium are comparatively low in the wastewater. Many different crops are grown in Yamhill County, with a wide range in nitrogen requirements, as shown in Table 9-6. Management considerations such as the preceding crop and yield goals also affect appropriate nitrogen loading. An "average" crop, requiring 120 lb/ac/year of supplemental applied nitrogen was assumed. Nitrogen demand varies during the growing season, and the specific pattern varies by crop. Peak demands were projected for late spring to early summer growth.

Table 9-6. Crop Uptake Data (lb/acre)

Nutrient	Alfalfa Hay	Apples	Corn (field)	Filberts (almonds)	Grain (spring)	Grain (winter)	Grapes	Grass Seed (fall)	Pasture
N	480	120	240	200	115	175	125	300	150
P_2O_5	95	55	100	75	40	70	45	100	55
K_2O	480	215	240	250	145	200	195	375	250

Data obtained from Western Fertilizer Handbook, 7th edition, 1985

The results of this analysis show that the acreage requirement based on nitrogen loading would range from 416 to 716 acres under current dry season flows, and would be 768 to 1,324 acres for buildout flows. The nutrient balance is presented in Table 9-7 for the current ADWF of 3.3 mgd and buildout ADWF of 6.1 mgd.

The wastewater nutrient characteristics do not appear likely to be a limiting factor in the development of land application sites. The sites are more likely to be hydraulically limited. Also, the nutrient levels are low enough that recycled water could potentially be land applied in combination with biosolids at the same sites.

If the discharge to the South Yamhill River were limited to only a portion of the summer, soil moisture storage could be used to reduce the total site area by allowing the soil to dry out before irrigation begins. Excess water could be used to refill the root zone. High rate irrigation in combination with hyporheic discharge could also reduce the site size required.

This is discussed below under the Hyporheic Discharge with High-Rate-Irrigation Land Application or Permeable Wetlands.

Table 9-7. Nutrient Balance Summary

	May	June	July	August	September	October	Total
Existing ADWF Scenario							
mgd	3.3	3.3	3.3	3.3	3.3	3.3	—
Million Gallons	102.3	99	102.3	102.3	99	102.3	607.2
lb N/month*	10,740	10,394	10,740	10,740	10,394	10,740	—
Projected Crop Utilization (lb/ac)	25	25	20	15	15	20	120
Acreage Required	430	416	537	716	693	537	—
Buildout ADWF Scenario							
mgd	6.1	6.1	6.1	6.1	6.1	6.1	—
Million Gallons	189.1	183	189.1	189.1	183	189.1	1,122.4
lb N/mo*	19,853	19,212	19,853	19,853	19,212	19,853	
Projected Crop Utilization (lb/ac)	25	25	20	15	15	20	120
Acreage Required	794	768	993	1,324	1,281	993	—

* Assumes 12.58 mg/L TN.

Treatment Wetlands

Wetlands provide a combination of reuse and treatment. They naturally affect many aspects of water quality. They consume water, grow plants, and would require a water right if supplied with river water. Because they are treatment processes, they are regulated. The permit for a wetland should be developed so that the compliance point is at the WRF, except for temperature and any other specific parameters that the WRF cannot meet. These would be monitored at the outlet of the wetland. Wetlands for treatment can have public access.

During the dry season, wetlands can consume as much as 36 inches/acre of effluent, more than double that of conventional crops, while the remaining flows would be discharged. Wetlands can cool effluent, and remove some metals and ammonia.

Based on wetlands temperature modeling done for treatment wetlands in the Willamette Valley, it is estimated that a detention time of 2 to 3 days is required to achieve optimal cooling. Beyond this, little additional cooling is achieved. Wetlands designed for effluent cooling would have a footprint of about 18 acres for 3.3 mgd.

The Salem effluent treatment wetland is an example of a cooling wetland in the same climatic region as McMinnville that achieves about a 5 to 10˚F temperature reduction all summer and meets a 68˚F discharge standard. The levels of wetland temperature reductions shown in Figure 9-4 could also be expected in McMinnville. Depending on several other factors, the wetlands may need to be lined.

Although wetlands can be effective in reduction of phosphorus from 5 mg/L to 1 mg/L, McMinnville's phosphorus limit of 0.07 mg/L is very low. Nutrient removal happens through a series of processes within the wetlands. These processes include volatilization, sedimentation, precipitation, nitrification/denitrification, and adsorption. It is estimated that nearly 2,000 acres of wetlands would be needed to treat 3.3 mgd with a concentration of 5 mg/L phosphorus to the 0.07 mg/L limit. Therefore, it clearly makes more sense to remove phosphorus at the WRF, and use treatment wetlands for temperature reduction, if needed.

In the permit for this scenario, phosphorus would be monitored upstream of the wetland and temperature would be monitored downstream of the wetland. The wetlands treatment calculations are provided in Appendix D.

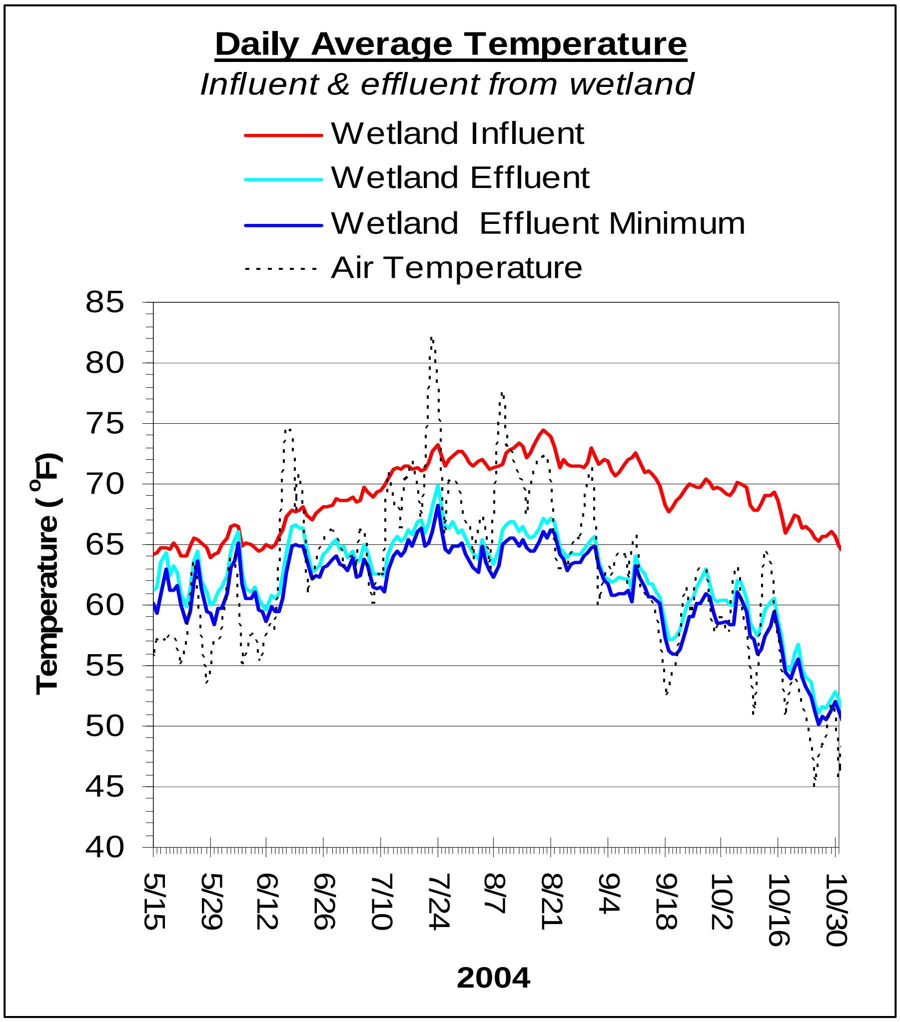
There is a relatively large amount of green space and agricultural land in the vicinity of the WRF that could be converted to treatment wetlands. In addition, area soils are well suited for wetlands as determined by detailed soils analyses on the same soil types at Woodburn as part of their design work for constructing unlined effluent treatment wetlands.

Hyporheic Discharge with High-Rate-Irrigation Land Application or Permeable Wetlands

Another reuse opportunity to consider is the use of hyporheic discharge or groundwater discharge (indirect discharge to surface water) in combination with high-rate-irrigation land application or permeable wetlands as the mechanism to introduce the water to the hyporheic zone and to provide additional treatment. This approach can significantly reduce the number of acres needed for the reuse site. Hyporheic discharge could also be done alone, but it would lack the additional treatment provided by reuse. For example, hyporheic discharge through discharge of effluent directly into drain tiles removes no heat and removes fewer nutrients than discharge through a cropped field or wetland.

Hyporheic systems are excellent diffusers with flow discharged in springs and seeps in the river bottom over a large section of the river. They also help to restore riparian hydrology for plants and wildlife. Evaporation from the surface where the water is applied, such as a permeable wetland or a high-rate irrigation system, can also provide cooling. The water does not cool once it is in the ground but rather is diluted with cold groundwater. In addition, the temperature is greatly buffered by soil heat transfer. Cooling requires that the heat is removed from the system (such as into the atmosphere) whereas heat transfer into another component of the system such as soil merely stores the heat for discharge at some other time. Temperature monitoring could be performed at the surface and in the top of the groundwater mound under the site.

Figure 9-4. Wetland Temperature Reduction



The City of McMinnville appears to be in a good position to implement this approach because: (1) it owns nearby property that could be used for this purpose (local government ownership is required by DEQ), and (2) the property does not contain drinking water wells that could be potentially impacted by hyporheic discharge (also required by DEQ). Hyporheic discharge is very soil specific, but the local soils appear to be well suited for hyporheic discharge.

With hyporheic discharge, the following rates are believed to be possible based on data collected at comparable sites in the Willamette Valley:

- Poplar tree high-rate irrigation 100 inches/acre
- Wetlands without surface discharge 200 inches/acre
- Non cropped infiltration basins plowed monthly 300 inches/acre

With hyporheic discharge, a treatment wetland can be sized for temperature attenuation because some phosphorus could be removed, depending on clay content, as it passes through the soil for discharge. The maximum rate of discharge is very dependant upon system design, management, and soil and groundwater conditions.

Industrial Reuse

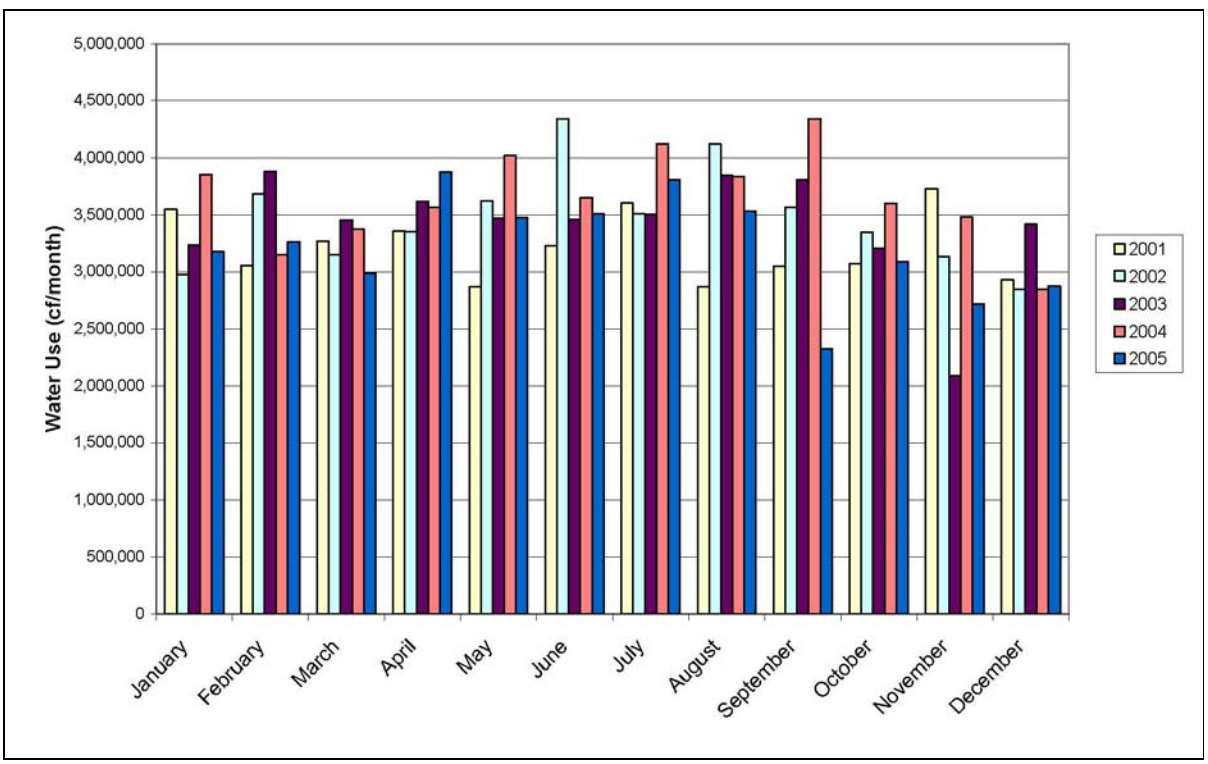
Based on information from the McMinnville Water & Light Reuse Evaluation, the cost of drinking water is relatively low and does not provide a large incentive for conservation. Reuse has recently been investigated, and the targeted large customers were Cascade Steel and Joe Dancer Park irrigation. Figure 9-5 indicates that the water use at Cascade Steel is high year-round and peaks in the summer when reuse would benefit the WRF the most.

The viability of industrial reuse depends on the specific characteristics of potential industrial users. Cascade Steel could potentially use 0.85 mgd average, or 10,000 acre-inches/year. While Cascade Steel has a high demand for water, its water quality requirements are relatively high, which could trigger the need for additional treatment. Past discussions with the Cascade Steel process department indicate the following key concerns about water quality:

- Water with high levels of total dissolved solids, organics, total suspended solids, or hardness could cause mineral deposits in the ½-inch copper tubing used in cooling processes.
- Excess ammonia in the reuse water could corrode copper tubing.
- Bacterial growth in the cooling system could lead to release of airborne bacteria from the cooling towers and possibly cause infection of workers.

Although treatment modifications at the WRF could potentially address all of the above concerns, further discussions with Cascade Steel representatives would be needed to determine whether this approach would be acceptable.

Figure 9-5. Cascade Steel Water Use History



As shown in Table 9-8, the water use at Cascade Steel is largely for cooling, The cooling system's ½ inch diameter copper tubes could potentially become scaled, or grow slime, or corrode the copper if the water quality is not adequate. The quality of water required could be discussed with Cascade Steel to determine their specific needs or if they could provide any additional treatment if that is needed. Cascade Steel undoubtedly has a large annual water bill and could potentially benefit from reuse water.

Table 9-8. Cascade Steel Water Use by Process

Process	Water Use (gallons per hour)
Blast Furnace Cooling	14,000
LRF Furnace Cooling	1,000
Transformer Cooling	400
Tank 1 System	7,000
Tank 2 System	2,500
Rolling Mills	4,000
Reheating System	4,500
Total Use	33,400

As shown in Figure 9-6, the water use at Joe Dancer Park is much lower and has the typical bell shaped curve of water demand for turf grass with low demand in spring and fall. However, the July, August, and September demands are critical since that is when the river flow is lowest and discharge may become most restrictive.

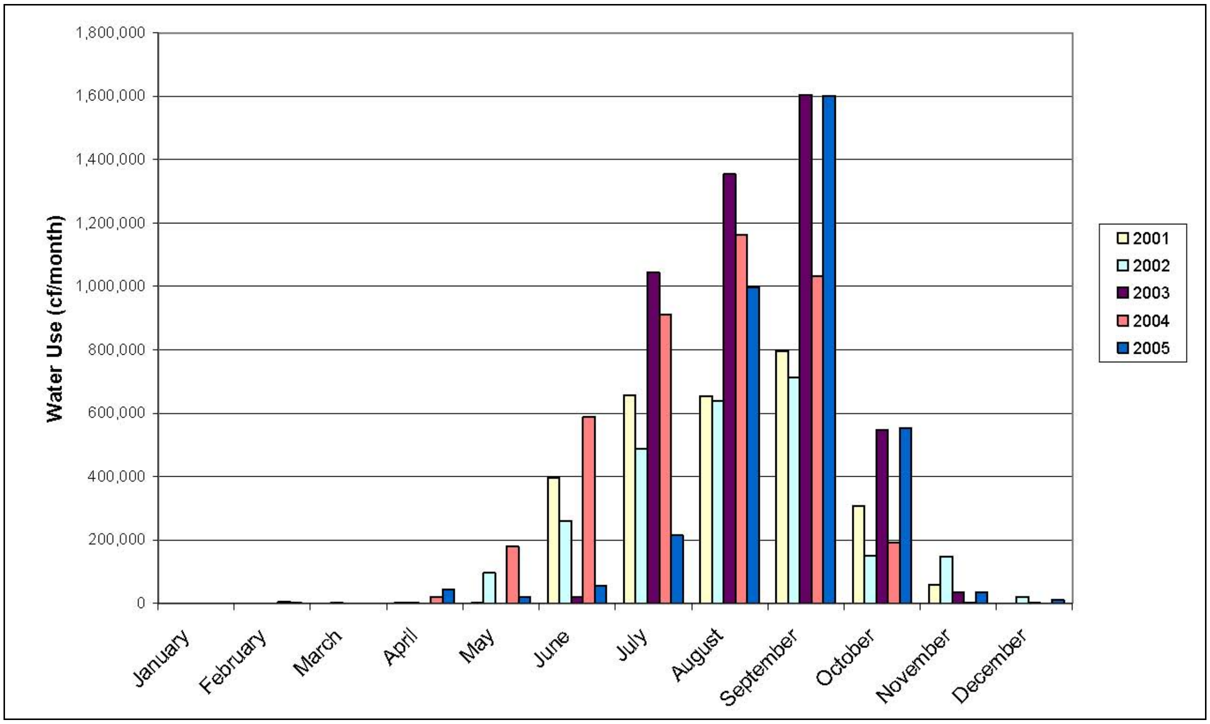
The total combined water demand of Cascade Steel and Joe Dancer Park shown in Figure 9-7 is significant. It may be possible to reopen the discussion of reuse as a cost effective drinking water conservation measure if the cost of the conveyance and reuse conversion facilities are split with the customer, McMinnville Water & Light, and the McMinnville WRF.

Spartec Plastic Manufacturing is another nearby potential industrial reuse customer. Western Oregon Waste Green Waste Composting could also be a very good nearby reuse pilot since they could use any quality of recycled water and only need water in summer.

ENVIRONMENTAL IMPACTS OF REUSE ALTERNATIVES

Water reuse applications in this area will provide benefits to the surrounding community as well as the environment. Water quality can be improved through all discussed water reuse alternatives. Land application and industrial reuse reduce the total volume of water and mass load discharged. Wetlands and hyporheic discharge polish the water to allow most of it to be discharged with reduced mass load and concentration. Deep potable groundwater is not adversely affected as shallow groundwater is perched and discharges to surface water and is not used for drinking.

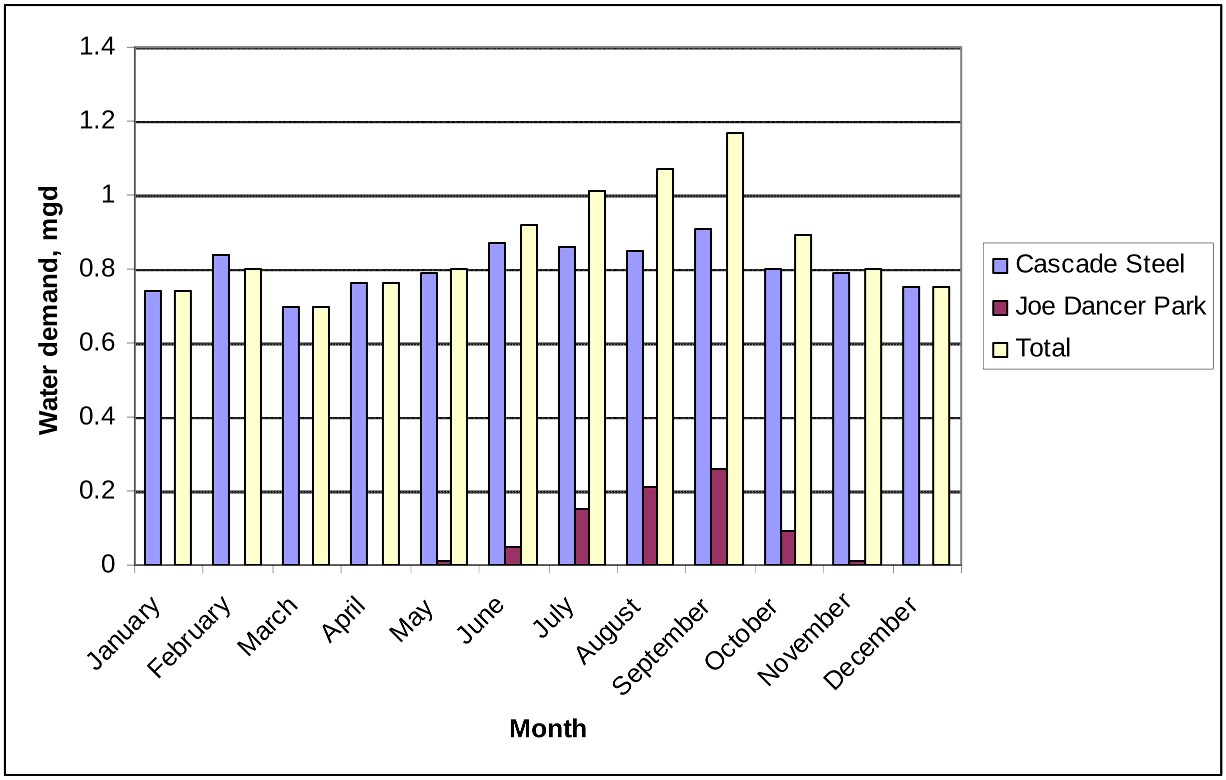
Figure 9-6. Joe Dancer Park Water Use History



Wetlands cool and remove nutrients from water contained in the designated area. Cooling is done through densely vegetated wetlands losing the heat that the surrounding open water gains.

Because the South Yamhill River is part of the rearing and migration route for salmon and trout, and also holds migrational corridors for salmon and steelhead, the goal of returning the water quality to its historical level is important. Without regulated temperature, plentiful dissolved oxygen, and consistent flows, the aquatic life will continue to be stressed. By implementing innovative reuse options, such as wetlands and irrigation, the recycled water can be used to benefit the river's ecology.

Figure 9-7. Combined Industrial Water Demand



NEXT STEPS

The following actions should be considered to take advantage of potential reuse opportunities:

- Increase City of McMinnville involvement in Yamhill Subbasin TMDL development. Offer to provide review and input. Items to track:
  - Status of temperature modeling.
  - Status of natural system potential analysis. Is monitoring being performed? Are the models being calibrated to provide an accurate representation of natural system potential?
  - Status of potential future TMDLs for new constituents: iron manganese, bacteria, pesticides, and pharmaceuticals.
- Pursue negotiations with DEQ regarding permit limits based on mass loads to establish standards that have the flexibility to take advantage of reuse opportunities, which can reduce costs of expansion and provide water quality benefits. Specifically, address inconsistency of using concentrations for phosphorus at low river flows and mass loads for higher river flows.
- Pursue negotiations with DEQ regarding the use of phosphorus limits as a controlling parameter to protect instream pH and dissolved oxygen levels. Seek the use of ortho-phosphorus since it is more appropriate and does not include the phosphorus already in algae and cells, or, better yet, the use of instream monitoring of pH and dissolved oxygen.

- Reopen discussions with Cascade Steel about potential recycled water reuse opportunities. Would Cascade Steel be interested in using a portion of WRF effluent for some of its processes? Involve McMinnville Water & Light in the discussions. Could the costs be split three ways?
- Assuming Cascade Steel will also need to address more stringent NPDES permit limits in the future, investigate the possibility of developing a natural treatment system in partnership with Cascade Steel. Could a demonstration system be installed at the steel mill or could Cascade Steel wastewater be conveyed to McMinnville WRF reuse sites? Are there efficiencies that might be realized by combining this with conveyance of WRF effluent to Cascade Steel for selected reuse?
- Develop a pilot reuse project to demonstrate benefits and foster public acceptance. Using existing city land install several different natural treatment systems: land application, treatment wetlands, high-rate-irrigation land application with hyporheic discharge, and permeable wetlands with hyporheic discharge. The data collected from these pilot systems can be used in permit negotiations and to develop full-scale system designs tailored to the specific project characteristics.

REFERENCES

Kadlec, Robert H., and Robert L. Knight. 1996. Treatment Wetlands. CRC Lewis Publishers, Boca Raton, New York.