SECTION 9

Water Quality

Stormwater quality issues are receiving increased public and agency interest. “Non-point source” loads are naturally occurring or manmade contaminants that are dissolved or suspended by storm runoff and transported by that runoff to waterways of interest. These are distinguished from the “point source” loads, such as those that are intentionally discharged at sewage treatment plants. Strategies for control of point- and non-point sources can vary dramatically, but from a regulatory perspective, there is no difference between the types for a municipal agency like the City. For that reason, this section will describe source loads without differentiating the type.

This section discusses relevant topographical and climatic information, types of source contamination, frequently cited sources of those contaminants, observed levels of contamination, methods of removal, regulatory climate, and recommendations.

9.1 Topographical and Climate Information Relevant to Stormwater Quality

Source loading occurs throughout the Yamhill River watershed, including the part of the watershed that lies within the City. However, the area of the City’s UGB that drains to the South Yamhill River represents under 2 percent of the total 528-square-mile South Yamhill River watershed lying upstream of the City.

Most of the piped storm drainage system in the City of McMinnville discharges to Cozine Creek and other creeks that flow through the City. The well-vegetated, slow-moving creek system is believed to promote some assimilation of nutrients and other contaminants prior to discharge into the river.

A small section of the older urban area is served by combined sewers. However, even during heavy rainfall events, flow from this area of combined sewers is routed through the sewage treatment plant and treated. The City has a record of replacing these combined sewers as funds become available.

The period of concern for contaminant loading of the rivers is during the summer months of July through September. This period is important because contaminants tend to accumulate between infrequent rainfall events and are then washed into rivers with relatively low rates of flow. The low summer flow in the river limits the capacity of the river to dilute incoming contaminants. During the summer, particularly during the months of July and August, flows in the Yamhill River are at their lowest and concentration limits on phosphorus are at their most stringent because of the presence of other factors that contribute to algae bloom, namely sunlight and warm temperatures.

Since contaminant wash-off varies directly with runoff, it is necessary to consider the likelihood of a runoff event occurring during the critical summer months. Standards for the

Tualatin River have used a 0.36-inch rainfall event as the design standard for a summer storm. Rainfall is a relatively infrequent occurrence during July and August in McMinnville. The following information was derived from NRCS records for McMinnville over a 25-year period from 1963 through 1988:

- There is a 48 percent chance that there will be no measurable rain during the month of July and a 43 percent chance that there will be no measurable rain during August.
- There are only about 3.3 events per year between July 1 and August 31 when rainfall exceeds 0.10 inch.
- There is only a 28 percent chance that there will be a rainfall event during July greater than ½ inch and a 38 percent chance for August.
- The average largest 1-day rainfall during the months of July and August is only 0.30 inch and 0.28 inch, respectively.

There is no available information on runoff in McMinnville resulting from these summer storm events. However, from the above data, it is estimated that only about two rainfall events per summer (July and August) are sufficiently intense to generate runoff.

As the above information suggests, the City of McMinnville is not expected to have a major water quality problem.

9.2 Types of Contaminants

Contaminants can include the following:

- Nutrients (such as phosphorus and nitrogen)

  In excess, nutrients are a problem to streams because they act as fertilizers for any aquatic plant life. If excessive nutrients are present and other factors such as temperature and sunlight are suitable, then heavy algae blooms will result. Under normal circumstances, this photo-chemical process occurs naturally and, with tolerable nutrient loads, streams can successfully assimilate this type of contaminant.

  Nutrient contaminants can result from such sources as leaking septic or sanitary systems, domestic animal wastes, feedlots, application of fertilizers to lawns or crops, detergents (washing cars), and from decaying plant debris.

- Sediment

  Sediment is considered to be a non-point source contaminant because, in excess quantities, it can cause turbidity in streams and can deposit damaging deposits of silt on top of gravel salmonid spawning beds. It can also cause loss of flood storage volume.

  Sediment transport is the consequence of erosion. Erosion can occur at construction sites, along poorly protected banks of fast moving streams or drainage ditches, from agricultural fields, and from landscaped areas.

- Bacteria

  Generally, the bacteria of concern are those, such as *E. coli*, which result from human or animal wastes. While these bacteria are not harmful for human ingestion in themselves, they are frequently indicators for other harmful bacteria and viruses as well. Fecal coliform bacteria contaminants originate as wastes from warm-blooded animals including humans and can be introduced into the watershed from leaking septic or sanitary systems, combined sewer overflows, wildlife, and from domestic animal or pet feces. Recent work by other regional agencies has indicated that a substantial fraction of bacteria, even in urban settings, may be traced, via DNA analysis, to wildlife, rather than anthropocentric sources.

- Organic Compounds and Solvents (such as benzene, oil, gasoline, and trichloroethane)

  Organic compounds can be soluble or insoluble in water and they can be lighter or heavier than water. Light floating solvents such as gasoline or oil will often be transported by surface "sheet" flow. In small quantities, these substances will be adsorbed by plants and soils along the way, will be broken down by bacteria, will evaporate, or will be carried further downstream. Large quantities, such as those that result from an actual surface spill, will often be detected. Leaking underground fuel tanks, on the other hand, can contribute to ground water contamination for years without detection. Leaking fuel will generally migrate downward until the water table is reached and then will migrate along the surface gradient of the water table.

  Heavier-than-water insolubles such as TCE will tend to migrate downward though the soil horizons rather than be transported by surface runoff. McMinnville is blessed with both fine-grained soils (which slow the migration of any plume) and with a water supply for the City which is well upstream in the watershed from industrialized areas or truck routes.

  Soluble organics, such as antifreeze (ethylene glycol), are difficult to remove and will be transported dissolved in storm runoff and stream flow. Some of these soluble organics will be broken down to simpler compounds naturally and will be assimilated by natural biological processes in the waterway.

  Activities of concern include domestic oil changing, steam cleaning, degreasing, industrial activities, underground fuel tanks, use of pesticides, and improper disposal of household cleaners, paint, etc.

- Metals (primarily lead, cadmium, copper, mercury, and zinc)

  Trace metals are a concern because of their potential toxic effect on aquatic life and their potential impact on drinking water supplies downstream. Metals in the stream sediments can enter the food chain through bottom feeding species and benthic (e.g., clams) organisms.

  Metals are often adsorbed by sediments and remain in the stream bed near their source unless the sediment itself is washed downstream by a storm event.

Significant metal contaminants can be produced by industrial processes, leaded gasoline, wearing of brake pads and tires, building materials, use of zinc or copper-based roof moss removal materials, and other similar activities.

9.3 Observed Levels of Contamination

During the preparation of the 1991 master plan, the City of McMinnville sampled water quality at four locations on April 18, 1989, during a low-flow period with no significant rainfall during the prior 2 weeks. The results have no statistical significance but are interesting in that the only causes for concern that this specific testing indicated were abnormally high fecal coliform in the North Tributary of Cozine Creek and a high level of nitrogen in the Main Branch of Cozine Creek. However, the nitrogen in Cozine Creek was highest where Cozine Creek enters the City from the agricultural areas upstream and actually lessened in concentration as Cozine Creek passed through McMinnville.

More sampling and testing over a variety of summer runoff conditions is needed before any valid conclusions can be reached about the overall stormwater quality of the City.

9.4 Methods of Removal

Different types of contamination can be reduced with varying degrees of success by using known options for removal.

9.4.1 Nutrient Removal

Nutrients, where they originate in high concentrations, such as from failed septic systems, leaking sanitary sewers, food processing facilities, feedlots, etc., can be most easily controlled at the source rather than trying to treat the diluted flow further downstream. Once they are in-stream, nutrients are most effectively removed by passage through an area where plant uptake of the nutrients is significant.

These areas can be naturally occurring or manmade grassy swales, streambeds, detention ponds, or wet ponds. In each, the objective is to maximize the amount of surface contact and contact time with the plants. Phosphorus remains with the plant growth or adsorbed by bottom sediments, and will be re-dissolved by future flows when the vegetation ultimately decays or when agitating flows occur. Phosphorus can only be permanently removed from the waterway by removal of the plant growth such as by mowing a grassy swale and then disposing of the clippings elsewhere.

9.4.2 Sediment Removal

In all cases, erosion can be reduced substantially through proper management at the source. Construction sites are often heavy contributors because land is generally left unprotected. Techniques such as straw bales, silt fences, woven matting, detention ponds, and temporary swales can be used to slow the velocity of stormwater runoff to the extent that most of the transported sediments will be deposited and will remain on the site. Another technique that can be used in addition to the above methods is to require graveled exit routes from sites to remove most of the mud from vehicle tires prior to the vehicle leaving the site.

Some sediment, such as windblown dust or car dirt, will inevitably get transported by stormwater runoff. Sumped catch basins with inverted siphons can be used with moderate success to remove coarser sediments. These same style catch basins will also tend to remove the trace metals that tend to adhere to such sediments, oils, and greases.

9.4.3 Bacteria Removal

Fecal Coliform bacteria are to be expected in all surface streams. In-stream concentrations less than 100 colonies per 100 mL are considered to be low and concentrations over 1,000 are considered high. The concern when the colonies present reach high numbers is that it is likely that other more dangerous pathogens may be present. High concentrations are not generally caused by normal surface activity in the watershed but rather by such specific contributors as failed septic systems, leaking sewer pipes, combined sewer overflows, feedlots, or by a dead animal in the stream. Recent studies have also suggested that a significant source of bacteria may be from wild animals and birds, even in urban settings. In some cases, this contributor can dwarf the impact of human development and pet activities.

If a non-natural source is suspected, the most effective solution for bacterial contamination is to pinpoint the source through selective testing in the affected watershed and to eliminate the source.

Once in the runoff stream, the same removal options as described under nutrient removal above will have some beneficial effect, but if the primary sources are removed, specific downstream treatment methods are not generally required.

9.4.4 Organic Compounds and Solvent Removal

Oils and grease on pavements can often be effectively removed by catch basins of the siphon type, if regular cleaning and maintenance practices are performed. The floating grease and oils are retained in the catch basin until cleanout. Some significant fraction of the greases and oils will also be removed by the grassy swale and detention options discussed under the nutrient removal section above.

Where oils are stored in bulk or are loaded/offloaded in quantity, the Department of Environmental Quality (DEQ) requires a Spill Prevention, Containment, and Control (SPCC) Plan. This plan requires, among other things, that a means to contain oil spills be installed at facilities that regularly handle bulk quantities of oil. Such measures, if implemented, are effective at controlling major spills at specific commercial and industrial sites.

Spill prevention plans do not prevent an individual, however, from pouring crankcase oil in a catch basin. Education and the availability of a convenient recycle or disposal alternative are the keys to minimizing this source.

Properly used, many household cleaners, herbicides, and pesticides are a great convenience and generally pose no particular threat to the environment. However, improperly used or disposed of, they can be a cause for concern. Again, the method to minimize these sources is through education about the proper use and disposal of these chemicals.

Specific industrial and commercial activities may be of concern depending on the types of chemicals that are used, stored, or manufactured on the site and also depending on how well those chemicals are prevented from being washed into the runoff stream during a rainfall event. It is possible to require the type and amounts of potentially hazardous chemicals that are used, stored, or manufactured on site to be reported to the City. The City would then be aware of the potential risk at the site and could consider measures for reducing specific risks, or specific types of risks, if appropriate.

9.4.5 Trace Metal Removal

Trace metals can be added to the runoff stream from both diffuse as well as from concentrated sources. Diffuse sources cannot be controlled at the source but significant removal value can be achieved through the use of sumped catch basins, proprietary treatment systems, and through the use of the removal alternatives discussed for nutrients above. Specific industrial sources are best controlled at the site of origin.

The following advantages and disadvantages are associated with the following types of removal methods.

9.4.5.1 Grassy Swales, Wet Ponds, and Detention Ponds

Advantages:

- Can often be integrated into landscaped or greenway areas
- Can often be planned to serve multiple drainage purposes such as detention and stormwater conveyance, in addition to water quality enhancement
- Can serve to create opportunities for wildlife habitat enhancement within an urban setting

Disadvantages:

- Are more difficult and time consuming than piped systems to maintain
- Consume more dedicated surface area than piped systems (which can be aligned in roads)

9.4.5.2 Sumped and Siphoned Catch Basins

Advantages:

- Are effective in removal of metals that tend to adhere oils and greases
- Do not consume land area sediments, trace to those sediments

Disadvantages:

- Are more time consuming to clean than self-cleaning catch basins
- Access for maintenance of catch basin un-sumped leads more difficult
- Must be cleaned frequently to be of any value, since turbulence from flow through the catch basin will tend to re-entrain the oil and suspend the sediments

9.5 Regulatory Climate

DEQ administers the National Pollutant Discharge Elimination System (NPDES) for Oregon on behalf of the U.S. Environmental Protection Agency (EPA). In general terms, this means the agency regulates the terms and conditions of permits that allow discharge of pollutants into regulated receiving waters.

In 1990, rules were adopted for permitting of municipal separate storm sewer systems (MS4s). This approach treats the City's system as a single pollutant source, instead of permitting each individual storm sewer outfall. At this time, the program does not include end-of-pipe monitoring, but focuses instead on program-level performance and in-stream monitoring of the receiving waters. Phase I MS4 regulations were applied to communities with populations greater than 100,000. Initially, Phase II regulations were applied to cities of greater than 50,000, but they are in the process of being expanded to reach smaller communities in Oregon. At this time, McMinnville is not classified as a Phase II community.

In addition, DEQ is currently revising the Yamhill Sub-Basin Total Maximum Daily Load (TMDL). The Yamhill Sub-Basin was included in the 2006 Willamette Basin TMDL for mercury. The Yamhill TMDL is expected to include temperature and nutrients. The Willamette mercury TMDL does not contain waste load allocations (WLA), but instead requires development of a mercury reduction plan by the City. At the next revision of the Willamette TMDL, it is possible that WLAs will be developed for mercury, most likely as a sector allocation (for example, for municipal wastewater treatment plants or municipal stormwater discharges). When the Yamhill TMDL is issued, the City will be required to develop an implementation plan that identifies specific steps and benchmarks to indicate, over a number years, that activities are being implemented to improve water quality in the Yamhill River. Implementation of TMDL requirements also must be incorporated into MS4 documents as required to create an integrated stormwater management strategy.

Mercury is naturally occurring within the Willamette watershed, but within the City the primary expected source is from wastewater discharge. The small portion of the City that is served by a combined sewer may also contribute to receiving water levels. It is currently unclear how significant the programmatic stormwater management elements may be to ensure compliance. Enhanced erosion control standards may be the most relevant stormwater best management practice (BMP).

Also of agency concern is the concentration of phosphorus present in the Yamhill River during the summer months. DEQ has determined that if total phosphorus concentrations in the river can be sufficiently reduced (to below 70 micrograms per liter), then algae growth and pH can be maintained within acceptable limits.

Data collected by DEQ for the South Fork of the Yamhill River indicate that the concentration of phosphorus remains relatively constant and within an acceptable range in the river upstream of McMinnville. Because of the relatively rural characteristics of the watershed upstream from McMinnville, this balance between phosphorus loading and assimilation is not expected to change significantly in the coming years. As with mercury, within the City of McMinnville, the point source sewage treatment plant discharge is of primary concern. The increase in phosphorus load as measured in the change of in-stream concentrations from upstream to downstream of the City is significant. Also of potential concern, though to a lesser degree, is the possibility of future non-point source increases within the City.

The current position of DEQ relative to source contamination from the City of McMinnville is that the current level of loading is acceptable and that an allocatable reserve loading is being held for possible future allocation by DEQ to the City and other watershed non-point source contributors, if needed. It is not expected, nor is there available technical data to suggest, that major structural improvements will be needed within the City of McMinnville to reduce the non-point source impacts to acceptable levels. This is not to say that such requirements could not be imposed by reviewing agencies, that further testing may not warrant such facilities, or that future expansion of the City may not create the need for such water quality facilities. Rather, there does not appear to be a specific current need. However, the regulatory trend is clearly toward more stringent water quality requirements.

9.6 Recommendations

Although future stormwater quality regulations cannot always be accurately predicted, the direction is apparent and several steps may be prudent to take in anticipation of the actual rule promulgation. The following actions are recommended with respect to stormwater quality.

9.6.1 Water Quality Testing

Water quality sampling may be required to comply with a DEQ-approved TMDL Implementation Plan.

9.6.2 Catch Basin Types

It is recommended that the City consider adoption of the sumped and siphoned style of catch basins for both public and private facilities within the City and that this style be used as new catch basins are built or as old catch basins are replaced within the normal schedule of maintenance and improvements.

9.6.3 Preservation of Open Channel Waterways

It is recommended that the City do the following:

- Retain natural existing open channel waterways as such to the extent possible, rather than allow their replacement with piped systems. Exceptions to this policy should include situations where the waterway cannot be maintained sufficiently free from encroaching vegetation or human activities to prevent flooding of adjacent lands due to such encroachment.
- Consider increased detention requirements to manage potential sediment loss and instability impacts (e.g., channel down-cutting) or if significant growth is expected in a specific stream basin.

Although limitations exist on development in FEMA-designated floodplain areas, these restrictions apply to only a portion of the City's waterways. Some communities have adopted buffer requirements as part of development code to ensure that stream corridors are not impacted by development on private property. The benefit of stream buffers on water quality in receiving waters for temperature and other pollutants is well documented. EPA has recently published a report titled *Riparian Buffer Width, Vegetative Cover, and Nitrogen Removal Effectiveness: A Review of Current Science and Regulations* (2005), as one example of recent work in this area.

9.6.4 Passive Water Quality Treatment Facilities

It is recommended that the City consider broadening the reach of developments requiring treatment to include those above a much lower threshold of increased impervious area (5,000 to 10,000 square feet is common). This would be a major change for development within the City. Types of allowable treatment facilities have expanded greatly in recent years, with refined design criteria and presumptive treatment efficiencies. More discussion of these, and the interaction with water quantity management techniques, would be appropriate additions to design standards.

In addition, it is recommended that the City evaluate desired outcomes for the water quality treatment criteria and establish an effective approach to developing design flows consistent with expected permit language and effectiveness requirements.

9.6.5 Best Management Practices

Although the exact details of a required stormwater management plan or TMDL implementation plan may not currently be known, many common elements will likely be required. In some cases, it is advantageous to begin developing or enhancing these program elements before being directed to do so by regulators. The BMPs described below are suggested to give a sampling of the kinds of expected program activities. Much of this discussion is taken from published EPA and DEQ guidance. More investigation will be warranted to determine the best fit for McMinnville’s needs.

9.6.5.1 Public Education

Because stormwater runoff is generated from dispersed land surfaces—pavements, yards, driveways, and roofs—efforts to control stormwater pollution must consider individual, household, and public behaviors and activities that can generate pollution from these surfaces. These common individual behaviors have the potential to generate stormwater pollution:

- Disposing of pet-waste
- Applying lawn-chemicals
- Washing cars,
- Changing motor-oil on impervious driveways
- Household behaviors like disposing leftover paint and household chemicals

It takes individual behavior change and proper practices to control such pollution. Therefore, it is important to make the public sufficiently aware and concerned about the significance of their behavior for stormwater pollution, through information and education, to promote beneficial changes in behavior.

It may be valuable to educate the community about the pollution potential of common activities, and increase awareness of the direct links between land activities, rainfall-runoff, storm drains, and their local water resources. Most important is to give the public clear guidance on steps and specific actions that they can take to reduce their stormwater pollution-potential.

9.6.5.2 Public Involvement

A single regulatory agency or municipal office working alone cannot be as effective in reducing stormwater pollution as when it has the participation, partnership, and combined efforts of other groups in the community all working towards the same goal. The point of public involvement is to build on community capital—the wealth of interested citizens and groups—to help spread the message about preventing stormwater pollution, to undertake group activities that highlight storm drain pollution, and contribute volunteer community actions to restore and protect local water resources.

To be effective, opportunities for public involvement should be built into the fundamental process of community stormwater management. For example, a community can offer opportunities to the public to participate in stormwater program development and implementation through positions on a local stormwater management panel.

Public involvement also includes facilitating opportunities for direct action, educational, and volunteer programs such as riparian planting days, volunteer monitoring programs, storm drain marking, or stream-clean up programs. Groups such as watershed groups and conservation corps teams who want to participate in promoting environmental causes should be encouraged and offered opportunities to participate in the stormwater management program.

9.6.5.3 Illicit Discharge Detection and Elimination

Illicit discharges are generally any discharge into a storm drain system this is not composed entirely of stormwater. The exceptions include water from fire fighting activities, discharges from facilities already under an NPDES permit, and other discharges of un-polluted water (such as foundation drains). Illicit discharges are a problem because unlike wastewater, which flows to a wastewater treatment plant, stormwater generally flows to waterways without any additional treatment. Illicit discharges often include pathogens, nutrients, surfactants, and various toxic pollutants.

It may be appropriate to develop a program to detect and eliminate these illicit discharges. This primarily includes developing the following:

- Storm sewer system map
- Ordinance prohibiting illicit discharges
- Plan to detect and address these illicit discharges
- Education program on the hazards associated with illicit discharges

An effective illicit discharge program needs to be both reactive and proactive. The program must be reactive in addressing spills and other illicit discharges to the storm drain system as they are discovered. The program must also be proactive in preventing and eliminating illicit discharges through education, training, and enforcement.

9.6.5.4 Construction

Uncontrolled stormwater runoff from construction sites can significantly affect rivers, lakes, and estuaries. Sediment in water bodies from construction sites can reduce the amount of sunlight reaching aquatic plants, clog fish gills, smother aquatic habitat and spawning areas, and impede navigation.

It may be appropriate to develop a program to reduce pollutants in stormwater runoff to the MS4 for construction sites disturbing one or more acres. This primarily includes developing:

- An ordinance
- Requirements to implement erosion and sediment control BMPs
- Requirements to control other waste at the construction site
- Procedures for reviewing construction site plans
- Procedures to receive and consider information submitted by the public
- Procedures for inspections and enforcement of stormwater requirements at construction sites
- Removal of sediment control measures following construction.

9.6.5.5 Post-Construction

The best way to mitigate stormwater impacts from new developments is to use practices to treat, store, and infiltrate runoff onsite before it can affect water bodies downstream. Innovative site designs that reduce imperviousness and smaller-scale low impact development practices dispersed throughout a site are excellent ways to achieve the goals of reducing flows and improving water quality.

It may be appropriate to address post-construction stormwater runoff from new development and redevelopments that disturb one or more acres. This primarily includes developing:

- Strategies to implement a combination of structural and non-structural BMPs
- An ordinance to address post-construction runoff
- A program to ensure adequate long-term operation and maintenance of BMPs

9.6.5.6 Good Housekeeping

Municipalities conduct numerous activities that can pose a threat to water quality if practices and procedures are not in place to prevent pollutants from entering the MS4. These activities include winter road maintenance, minor road repairs and other infrastructure work, automobile fleet maintenance, landscaping and park maintenance, and building maintenance. Municipalities also conduct activities that remove pollutants from the MS4 when performed properly, such as parking lot and street sweeping and storm drain system cleaning. Finally, municipal facilities can be sources of stormwater pollutants if BMPs are not in place to contain spills, manage trash, and handle non-stormwater discharges.

Because of the benefits to water quality achieved by best maintenance practices, it may be valuable to ensure staff have adequate training about ways to protect stormwater, particularly when maintaining MS4 infrastructure and performing daily municipal activities, such as park and open space maintenance, fleet and building maintenance, new construction and land disturbances, and stormwater system maintenance. This primarily includes:

- Developing inspection and maintenance procedures and schedules for stormwater BMPs
- Implementing BMPs to treat pollutants from transportation infrastructure, maintenance areas, storage yards, sand and salt storage areas, and waste transfer stations
- Establishing procedures for properly disposing of pollutants removed from the MS4
- Identifying ways to incorporate water quality controls into new and existing flood management projects