SEWRPC Community Assistance Planning Report No. 316

A RESTORATION PLAN FOR THE ROOT RIVER WATERSHED

Chapter V

DEVELOPMENT OF TARGETS AND ALTERNATIVE MEASURES

INSERTS FOR MAY 1, 2013, MEETING

[Note: Page numbers for inserts refer to the 01/24/13 draft of Chapter V]

[Insert the following material on page 3 in the space reserved for Problems Related to Chlorides]

Problems Related to Chlorides
Chapter IV documents at least three problems related to concentrations of chlorides in surface waters of the Root River watershed. First, at those sampling stations for which long-term data are available, chloride concentrations increased from 1964 through 1997, but have possibly leveled off since then. The long-term increase is consistent with a trend in surface water chloride concentrations that has been observed in many waterbodies in southeastern Wisconsin. At sampling stations along the mainstem of the Root River, no increase in the mean was observed between the periods 1998-2004 and 2004-2012; however, it is uncertain whether this lack of an increase is due to a slowing or stopping of the long-term trend or to the combination of relatively small samples sizes and high variability in chloride concentrations masking an increase.[1] Second, concentrations of chloride detected at sampling stations occasionally exceed the State's chronic toxicity criterion for fish and aquatic life, and in some instances, the State's acute toxicity for fish and aquatic life. This is especially the case in upper sections of the mainstem of the Root River. Third, it appears that a reservoir of chloride may be accumulating in groundwater, at least in some locations in the watershed. This reservoir appears to be capable of affecting instream chloride concentrations, especially during low flow periods when discharge from groundwater constitutes a substantial fraction of the flow in the stream system.

The nature, extent, and severity of these problems are poorly understood because few data are available regarding instream chloride concentrations during the winter deicing season. Water quality sampling for chloride has rarely been conducted during the winter in the Root River watershed. There is little basis for estimating winter concentrations of chloride in streams of the watershed because of a paucity of winter data regarding specific

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[1]*It should be noted that tributary streams in the Root River watershed have not been sampled for chloride concentrations.*

conductance, a water quality constituent which can be used as a surrogate for chloride. The few winter samples of chloride and specific conductance that are available for streams of the watershed were largely collected during very early and very late portions of the winter season and may not be representative of instream concentrations during the middle of the winter. It is likely that they may underestimate instream concentrations during the middle of the season.

Because large amounts of chloride salts are used on streets, highways, and parking lots during the winter for snow and ice control, it is likely that instream concentrations of chloride are higher during the winter than they are during other months of the year. The results of a comparison of the few chloride data available from winter months to data from the rest of the year are consistent with this idea. Table V-0A shows comparisons of mean, median, and maximum concentrations of chlorides from winter months to those from nonwinter months at all sampling stations along the mainstem of the Root River that had at least four samples collected during the winter. At all three sampling stations the mean, median, and maximum concentrations detected during the winter were higher than those detected during the rest of the year. It should be noted that this comparison relies upon a small number of samples collected during the winter.

The results of a comparison of the specific conductance data available from winter months to data from the rest of the year suggest a more complicated situation. Table V-0B shows that the mean and median values of specific conductance detected at sampling stations along the mainstem of the Root River during the winter were higher than those detected at the same stations during the rest of the year. This is also consistent with the expectation that instream concentrations of chloride during the winter should be higher due to application of chloride salts for snow and ice control. Along some tributary streams, however, mean and median values of specific conductance detected during the winter were lower than those detected at the same stations during the rest of the year (see Table V-0B). This is not the case at all sampling stations along tributaries. It appears to be the case mostly in tributaries located in less urbanized areas with lower densities of roads.

High instream concentrations of chlorides pose a substantial threat of toxicity to freshwater aquatic organisms, such as those present in surface waters of the Root River watershed. Appendix E of this report reviews and discusses this toxicity. The chloride data available for the Root River watershed suggest that the current level of this threat is not high; however, these data are not sufficient to assess instream chloride concentrations during the time of the year when we would expect the highest instream concentrations of chloride, and the highest risk to aquatic organisms, to be present.

Data from other sites in the Southeastern Wisconsin Region might give some insight into the level of threat that chloride concentrations during the winter pose to aquatic organisms in some sections of the Root River watershed. Continuously collected data records for specific conductance are available for several sampling sites in the Menomonee River watershed. These records include collection of data during the winter deicing season. Using a regression model developed for Wisconsin streams,[2] values of specific conductance were used to estimate minimum, maximum, and mean daily chloride concentrations at monitoring stations in the Menomonee River watershed.[3] The estimated minimum, maximum, and mean daily chloride concentrations were then compared to a threshold chloride concentration associated with substantial levels of toxic effects to aquatic organisms. This

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[2]*S.R. Corsi, D.J. Graczyk, S.W. Geis, N.L. Booth, and K.D. Richards, "A Fresh Look at Road Salt: Aquatic Toxicity and Water-Quality Impacts on Local, Regional, and National Scales,"* Environmental Science & Technology, *Volume 44, 2010, pp. 7378-7382.*

[3]*SEWRPC Memorandum Report No. 204,* Development of a Framework for a Watershed-Based Municipal Stormwater Permit for the Menomonee River Watershed, *January 2013.*

threshold was identified through a review of the toxicological literature.[4] This literature review and the analyses are presented in Appendix E.

Several findings of the examination of winter values of specific conductance in the Menomonee River watershed may be relevant to the Root River watershed. First, concentrations of chloride during the winter in Honey and Underwood Creeks, as estimated from specific conductance, achieve levels that are well within the range of chloride concentrations known to produce substantial toxic effects in aquatic organisms. In both of these streams, concentrations during the winter deicing period appear to remain at levels that are associated with acute toxic effects for extended periods of time. Concentrations of chloride, as calculated from specific conductance, did not achieve these levels at stations along the Little Menomonee and Menomonee Rivers. The results suggest that chloride concentrations during the winter deicing season probably reach higher levels in smaller streams that are located in highly urbanized areas than they do in larger streams and in streams located in less urbanized areas.

The findings of the examination of specific conductance values in the Menomonee River watershed suggest that chloride concentrations in upper sections of the Root River watershed during the winter deicing season may achieve levels high enough to cause acute toxicity to aquatic organisms. As described in Chapter IV of this report, in 2000 urban land uses comprised over 60 percent of land uses in the Upper Root River-Headwaters, Upper Root River, Whitnall Park Creek, Middle Root River-Dale Creek, and East Branch Root River assessment areas (see Map IV-7 in Chapter IV). The discharge in this section of the mainstem of the Root River is comparable to discharge at the sites in Honey and Underwood Creeks where winter chloride concentrations were estimated. The mean discharge over the period of record at the USGS gage at W. Grange Avenue along the Root River is 17.1 cubic feet per second (cfs). Mean discharge at the gages along Honey and Underwood Creeks are 11.1 cfs and 15.3 cfs, respectively. While average discharge at the W. Grange Avenue gage is slightly higher than that at the gages on Honey and Underwood Creeks, average discharge at the sites on these two Menomonee River tributaries are similar to levels that are present in the Root River upstream from the W. Grange Avenue. Thus it is likely that chloride concentrations present in upper sections of the Root River during the winter deicing season get high enough to cause toxic effects and stay at those levels for extended periods during the winter deicing season.

Several sources and activities contribute chloride to surface waters and groundwater in the Root River watershed. While few data are available regarding the amounts of chloride these sources and activities contribute to the environment within the watershed, some inferences can be made regarding the relative contributions of these sources and activities based on what is known about natural sources, salt usage, and activities in the watershed.

Natural sources of chlorides to water resources include atmospheric deposition, weathering of bedrock and soils, geologic deposits containing halite, and volcanic activity. The contributions of chloride from atmospheric deposition are unlikely to account for the historic increases in chloride concentrations and the occasional exceedences of water quality criteria for chloride in the Root River watershed. The mean annual estimated wet deposition of chloride on the central portion of the glacial aquifer system, which includes the Root River watershed, is about 0.25 ton per square mile.[5] The estimated concentration of chloride in runoff attributable to this deposition is 0.25 to 0.50 mg/l.[6] It would be expected that weathering of bedrock and soils would remain fairly

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[4]*It should be noted that the threshold value of 1,400 mg/l is considerably higher than the State of Wisconsin's acute and chronic toxicity criteria for fish and aquatic life. This threshold was used to determine whether substantial incidences of toxic effects are likely to be occurring at the sites examined and is not intended to represent a value that would be protective of fish and aquatic life.*

[5]*John R. Mullaney, David L. Lorenz, and Alan D. Arnston,* Chloride in Groundwater and Surface Water in Areas Underlain by the Glacial Aquifer System, Northern United States, *U.S. Geological Survey Scientific Investigations Report No. 2009-5086, 2009.*

[6]Ibid.

constant over time and there are no known deposits of halite or volcanoes within or in the vicinity of the Root River watershed. Thus it is unlikely that natural sources of chloride can account for the historic increases in chloride concentrations and the occasional exceedences of water quality criteria for chloride in the Root River watershed.

Several anthropogenic uses also contribute chloride to surface water and groundwater. These uses include snow and ice control, water treatment, agricultural uses, and a variety of industrial and manufacturing uses. While few data on the amount of salt introduced by each of these uses exist for the Root River watershed, data on sales and uses of salt should give a rough estimate of what the relative contributions of chloride from these uses are likely to be. Such data are available on a national basis from mineral commodity surveys summarized by the USGS.[7] In 2012, salt for deicing consumed about 41 percent of total salt sales in the United States. Water treatment uses accounted for about 1 percent of sales and agricultural uses accounted for about 3 percent of sales. Other major uses of salt, such as chemical production, petroleum production, paper production, and textile production and dyeing either do not occur in the Root River watershed or occur at such low levels that they probably do not represent major contributors of chloride to waters in the watershed. This suggests that snow and ice control activities constitute a major source of chloride to surface water and groundwater in the Root River watershed.

The preceding discussion suggests two overall strategies for addressing the water quality problems related to concentrations of chlorides in surface waters of the Root River watershed. First, the understanding of the extent of the problems posed by chloride concentrations in surface waters of the Root River watershed and the nature of the causes of these problems is limited by substantial gaps in the data. Targets should focus on filling these gaps. Second, targets should focus on reducing contributions of chloride into surface waters and groundwater of the watershed. Since the application of chlorides for winter snow and ice control represents a major source of chlorides to waters of the watershed, a major emphasis should be placed on reducing the amount introduced into the environment through these activities while maintaining public safety.

[Insert the following material on page 7 after the first partial paragraph]

Chloride

The description of water quality problems given above concluded that two overall strategies be pursued in developing targets related to chloride: targets that focus on filling data gaps related to chlorides and targets that focus on reducing the application of chlorides in the watershed for winter snow and ice control.

The RWQMPU made recommendations whose implementation would act to reduce contributions of chlorides. These recommendations were summarized and the status of their implementation was reviewed in Chapter II of this report. The RWQMPU did not include estimates of pollutant loads of chlorides to the stream system. This was because the available water quality data and the available salt use data were inadequate for generating such loads through the calibrated water quality model. The lack of these load estimates means that in this report targets cannot be expressed quantitatively as load reductions and that the water quality conditions that would result from meeting the targets cannot be quantitatively estimated.

The following targets are established for water quality related to chloride for the Root River watershed restorations plan:

1. Fill data gaps related to chloride concentrations in surface waters or the Root River watershed. At the minimum, three areas of uncertainty need to be addressed:

[7]*Dennis S. Kostick, "Salt,"* U.S. Geological Survey, Mineral Commodity Summaries, *January 2013.*

a. Sampling should be conducted during the winter in order to characterize instream chloride concentrations during this season,

b. Sampling for chloride should be conducted at sites along tributaries and along the mainstem of the Root River in Racine County in order to characterize geographical variation in chloride concentrations in the stream system, and

c. Samples for chloride and specific conductance should be collected simultaneously in order to refine regression models that would allow the use of specific conductance as a surrogate for chloride.

2. Continue ongoing evaluations of existing county and municipal road deicing and anti-icing programs with an emphasis on achieving additional salt reductions without compromising public safety.

3. Promote evaluations of private deicing operations on commercial, industrial, institutional, and residential properties with an emphasis on achieving voluntary salt reductions without compromising public safety.

[Insert the following material on page 7 in the space reserved for Recreational Access and Use Targets]

Recreational Access and Use Targets

Description of Problems and Issues Related to Recreational Use and Access

The existing state of recreational facilities and access in the Root River watershed is described in Chapter IV of this report. That description inventories the natural resource-based recreational facilities that currently exist in the watershed. These facilities include parks and parkways, trails, and access to surface waters. An overriding consideration related to the recreational use of surface waters is whether the water is safe for human contact. Concentrations of bacteria indicative of fecal contamination, such as fecal coliform bacteria and the bacterium *Escherichia coli* (*E. coli*), are generally used to assess the suitability of waters for human contact. The description of surface water quality given in Chapter IV indicates that high concentrations of these indicator bacteria are often present in surface waters of the watershed. This indicates that these waters may not be safe for human contact because of the possible presence of waterborne disease agents. This reduces the recreational potential of the surface waters of the watershed.

Problems Related to Fecal Indicator Bacteria

Chapter IV documents at least one problem related to fecal indicator bacteria. High concentrations of bacteria indicative of fecal contamination were present in all of the streams of the watershed that were sampled for either fecal coliform bacteria or *E. coli*. At most sampling sites in the stream system, concentrations of these indicator bacteria exceeded the applicable water quality criteria a substantial portion of the time (see Table IV-17 in Chapter IV).

As explained in Chapter IV, these bacteria are not themselves pollutants of concern. Instead, they act as surrogate measures indicating the likelihood that surface waters are contaminated with fecal wastes and may contain disease-causing agents, such as pathogenic bacteria, viruses, or protozoa. These wastes can originate from several sources, including sanitary sewage, agricultural and barnyard wastes, and wastes from domestic pets and wild animals. Fecal pollution from different sources will carry different pathogens; however, fecal pollution from sanitary sewage generally constitutes a more serious public health risk because multiple human pathogens can be present in high concentrations.

There are several potential sources of bacteria that may contribute to the high concentrations found in surface waters of the watershed. In urbanized areas, discharges from storm sewer outfalls may contribute bacteria to surface waters. At most locations, these discharges will contain bacteria washed off of impervious surfaces on the landscape. Sources of these bacteria include wild animals and pet waste. At some locations, these discharges may also contain bacteria originating from cross-connections between the sanitary and storm sewer systems, illicit discharges into the storm sewer system, or degrading sewer system infrastructure. Fecal material from waterfowl such as gulls and geese may also be a source of bacteria to the surface waters. Contributions from this source are likely to come from two different sets of areas: areas adjacent to waterbodies that are heavily used by these animals and impervious areas that are directly connected to surface waters through the storm sewer system. Effluent from three wastewater treatment plants that discharge treated effluent into streams of the watershed constitutes an additional source of bacteria to those streams. The limitations set in these plants' discharge permits under the Wisconsin Pollutant Discharge Elimination Program do not require disinfection of the effluent. These discharges have a strong local effect on concentrations of fecal indicator bacteria, but these effects are somewhat limited in the extent of their downstream impact. For example, the impacts from the Village of Union Grove's treatment plant are not evident beyond 1.2 miles downstream from the plant's outfall. In rural areas, malfunctioning and failing onsite sewage disposal systems may contribute fecal indicator bacteria to surface waters. Due to their age and differences in how they are regulated, onsite system developed prior to 1980 may be at particular risk for failure. Finally, animal husbandry represents a significant portion of agricultural activities in the Root River watershed. Animal wastes deposited on pastureland and cropland and in barnyards, feedlots, and manure piles can potentially contaminate water by surface runoff and infiltration into groundwater. This can pose a particular risk when animal manure is applies to the land surface during the winter, because the wastes can be subject to excessive runoff and transport, especially during the spring snowmelt period.

Two overall strategies are suggested by this definition of recreational use and access problems related to fecal indicator bacteria. First, targets should focus on locating sources that contribute sanitary wastewater to surface waters of the watershed and ending these contributions. As previously indicated, fecal pollution originating from inputs of sanitary wastewater generally constitutes a more serious public health risk because multiple human pathogens can be present in high concentrations. Second, targets should focus on locating sources that contribute fecal pollution of nonhuman origin and ending these contributions. These contributions also pose a public health risk to recreational users of surface waters in the watershed. It should be noted that U.S. Environmental Protection Agency staff have indicated that, based on the epidemiological studies they examined in developing the new recommended recreational use water quality criteria, they were unable determine that the risks to recreational users are lower from nonhuman sources of fecal indicator bacteria than from human sources of fecal indicator bacteria.[8]

Problems Related to Parks and Parkways

[This subsection will be provided for a future Advisory Group meeting.]

Issues Related to Trails

Chapter IV inventories the current state of recreational trails and bicycle routes in the Root River watershed. Currently county and municipal trail systems within the watershed include about 44 miles of off-street trails and 31 miles of on-street bicycle trails. In addition, there are several parks in the watershed that have trails within their boundaries.

The existing network of trails within the watershed can be compared to the trail network envisioned in the county park and open space plans and by other local other local efforts. Map V-Rec-A shows existing and planned recreational trails and bicycle routes in the Root River watershed. These include recommendations from the Milwaukee County and Racine County park and open space plans.[9] The Milwaukee County park and open space plan proposes adding about 16 miles of trails to the Oak Leaf Trail. One portion of this addition would run

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[8]*U.S. Environmental Protection Agency,* Recreational Water Quality Criteria, *November 26, 2012.*

[9]*SEWRPC Community Assistance Planning Report No. 132, 2nd Edition,* A Park and Open Space Plan for Milwaukee County*, in review; SEWRPC Community Assistance Planning Report No. 134, 3rd Edition,* A Park and Open Space Plan for Racine County*, February 2013.*

through the corridor along the mainstem of the Root River, from the existing Oak Leaf Trail terminus near W. Ryan Road to the existing Oak Leaf Trail near STH 38. Two other proposed additions to the Oak Leaf Trail would connect existing and proposed portions of the trail to the City of Franklin's recreational trails. About 46 miles of off-street trails and about 41 miles of on-street bicycle routes are proposed to be added to trail network within the Racine County portion of the Root River watershed (see Map V-Rec-A). The Racine County park and open space plan proposes the development of a Root River Recreational Corridor along the mainstem of the Root River. This corridor would consist of approximately 15 miles of trails and connect to the Root River Corridor in Milwaukee County on the north and the proposed Lake Michigan Corridor on the south.

Recommendations for trail development within the Root River watershed are contained in the City of Racine's park and open space plan.[10] This plan recommends that the City develop an additional mile of the Root River Pathway within Johnson Park, noting that this would complete that portion of the Root River Trail that is within the City. It also notes that the City's 2035 comprehensive plan[11] recommends the development of on-street bikeways along 27 miles of streets within the City. Much of this development would be within the Root River watershed.

The City's comprehensive plan also recommends that the City of Racine and Racine County work together to develop a water trail along the Root River. A water trail is a designated trail on a lake or stream that regularly contains sufficient water level to navigate small watercraft such as a canoe or kayak with unobstructed passageways while providing safe and convenient access points, and may contain support facilities such as parking areas, restrooms, and picnic areas. Water trails would identify parts of the Root River as a waterway that could accommodate low-impact, non-motorized watercraft. Important factors for establishing water trails include safe and convenient access to a waterway with unobstructed passageways, adequate support facilities, and safe portaging areas.

Additional pedestrian, bicycle, and trail recommendations proposed in City of Racine neighborhood plans and the Root River Revitalization Plan[12] include developing a riverwalk along the south side of the Root River from 6th Street to Main Street in the City of Racine, re-routing a portion of the Root River Pathway on Mound Avenue to an off-street location, installing bike paths and marked on-street bike routes, improving public access to the Root river through signs and marked walking paths, and improving pedestrian and bicycle access along 14th Street.

Issues Related to Surface Water Access

Chapter IV inventories the current state of public access to surface waters for boating in the Root River watershed. Several developed access sites to the Root River are available downstream from Horlick dam. These include a boat launch at Colbert Park and canoe launches at Clayton, Island, Lincoln, and 6th Street South Parks. Upstream from Horlick dam there is one developed access point, a boat launch at Horlick Park.[13] In addition, there is public boating access on two lakes of the watershed. Upper Kelly Lake currently has one public boating access site on its northeastern shore and the City of New Berlin maintains a park on its southern shore with roadside parking spaces for about five motor vehicles. There is also one carry-in access site on the eastern shore of Lower Kelly Lake.

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[10]*SEWRPC Community Assistance Planning Report No. 270, 2nd Edition,* A Park and Open Space Plan for the City of Racine: 2035, Racine County, Wisconsin, *December 2011.*

[11]*SEWRPC Community Assistance Planning Report No. 305,* A Comprehensive Plan for the City of Racine: 2035, *November, 2009.*

[12]*Root River Council, City of Racine, and River Alliance of Wisconsin,* RootWorks-Revitalizing Racine's Urban River Corridor, *July 2, 2012.*

[13]*While paddlers launch and take out canoes and kayaks at a number of parks and road crossings along the River upstream for Horlick dam, these do not constitute developed landings.*

The current number and spacing of public access sites along the Root River can be compared to the State of Wisconsin's standards for public boating access development. These standards indicate that major public canoeing/kayaking access sites with parking should be provided on major streams every 10 miles.[14] Given that all current access points are within the lower six miles of the River, the Root River may fail to conform to these standards. Developing additional carry-in boating access upstream from Horlick Park would improve the recreational opportunities available to the public in the Root River watershed.

It should be noted that recent planning efforts have proposed developing additional public access for canoes and kayaks along the Root River. The Racine County park and open space plan proposed providing an additional access site for canoes and kayaks along the River.[15] The Milwaukee County park and open space plan recommended developing canoe/carry-in boat access along the Root River on existing parkway lands.[16] The Back to the Root Plan also noted that the weir at the WDNR Root River Steelhead Facility in Lincoln Park in the City of Racine creates challenges to paddlers.[17] To assist boaters in portaging around the weir, this plan recommended modifying the existing boat launch upstream from the weir and installing an additional boat launch downstream from the weir.

A similar comparison can be made of the current public boating access to lakes in the Root River watershed to State standards for public boating access development. State standards indicate that lakes with less than 50 acres area should have one carry-in access site with parking for five vehicles. Both Lower Kelly Lake and Upper Kelly Lake meet the standards with regard to the numbers of access points; however, the Lakes have limited parking within the vicinities of the launch sites, and, hence, fail to conform to current State standards.

Recreational Use and Access Targets

Targets Related to Fecal Indicator Bacteria

The description of water quality problems given above concluded that two overall strategies should be pursued in developing targets related to bacteria indicative of fecal contamination: targets related to locating and ending contributions of sanitary wastewater to surface waters and targets related to locating sources that contribute fecal pollution of nonhuman origin and ending these contributions. Two different bacterial indicators of fecal contamination have been used and are currently in use within the Root River watershed: fecal coliform bacteria and *E. coli*. Because the State of Wisconsin's water quality criteria for fecal indicator bacteria is expressed in terms of fecal coliform bacteria and because the calibrated water quality simulation modeling conducted as part of the RWQMPU examined fecal coliform bacteria and did not examine *E. coli*, the discussion of targets related to fecal indicator bacteria will be expressed in terms of fecal coliform bacteria.[18] It should be noted that *E. coli* is a major constituent of fecal coliform bacteria.

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[14]*The applicable State standards are discussed in more detail in the subsection on targets related to surface water access below.*

[15]*SEWRPC Community Assistance Planning Report No. 134, 3rd Edition,* op. cit.

[16]*SEWRPC Community Assistance Planning Report No. 132, 2nd Edition,* op. cit.

[17]*Root River Council and River Alliance of Wisconsin,* Back to the Root: An Urban River Revitalization Plan, *July 2008.*

[18]*The use of fecal coliform bacteria for expressing watershed targets is not intended as a recommendation as to which of these indicators should be used in ongoing and future monitoring activities in the watershed or as a conclusion as to which of these indicators would be most appropriate for use in any future revisions of State of Wisconsin water quality criteria.*

The RWQMPU made recommendations whose implementation would act to reduce contributions of fecal indicator bacteria. These recommendations were summarized and the status of their implementation was reviewed in Chapter II of this report. The RWQMPU also included estimates of pollutant loads to the stream system that would occur under three sets of conditions.[19] These conditions include:

- Existing condition: Representing watershed conditions as of the year 2000;

- Revised 2020 Baseline condition: The condition projected to occur in 2020 under planned 2020 land use conditions, assuming full implementation of the urban stormwater runoff performance standards and a reasonable level of implementation of agricultural performance standards as set forth in Chapter NR 151, "Runoff Management," of the *Wisconsin Administrative Code*, but without implementation of the recommendations of the RWQMPU; and

- Recommended Plan condition: The condition projected to occur under planned 2020 land use conditions, assuming full implementation of the urban stormwater runoff performance standards and a reasonable level of implementation of agricultural performance standards as set forth in NR 151 along with implementation of the recommendations of the RWQMPU.[20]

These estimates were made using a calibrated water quality simulation model.[21] The estimated loads of fecal coliform bacteria associated with each of the three conditions are given in Appendix D of this report.

It is important to note that for fecal coliform bacteria, the portion of the pollutant loads contributed by point sources is quite low under all three conditions described above. On a whole watershed basis, point sources are estimated to have contributed less than 0.2 percent of the fecal coliform bacteria load under the Existing (2000) condition. Under the Recommended Plan (2020) condition, point sources are estimated to represent about 0.6 percent of the fecal coliform bacteria load.[22] Given that point sources are estimated to contribute these small percentages of the fecal coliform bacteria loads, the targets for this watershed restoration plan should place strong

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[19]*SEWRPC Planning Report No. 50,* op. cit.

[20]*The RWQMPU included pollutant load estimates for two additional conditions: a Revised 2020 Baseline condition with a five-year level of protection to control against sanitary sewer overflows (five-year LOP) and an Extreme Measures condition. In the Root River watershed, the estimated pollutant loads under the Revised 2020 Baseline with a five-year LOP condition were identical to the estimated pollutant loads under the Revised 2020 Baseline condition. The Extreme Measures condition examined a level of nonpoint source controls in excess of the levels envisioned under the recommend plan and envisioned the virtual elimination of phosphorus from discharges of industrial noncontact cooling water. In the Root River watershed, at most locations the degree of compliance with applicable water quality standards under the Extreme Measures condition, as estimated by the calibrated water quality simulation model, was similar to the degree of compliance under the Recommended Plan condition.*

[21]*The calibrated water quality model is described, and its results and conclusions are presented and discussed, in SEWRPC Planning Report No. 50,* op. cit.

[22]*The estimated increase in the fraction of the total phosphorus load that is contributed by point sources reflects two factors. First, anticipated urban development between 2000 and 2020 in the areas served by the Union Grove and Yorkville Sewer Utility District wastewater treatment plants can be expected to increase loads of fecal coliform discharged from these plants. Second, the RWQMPU envisions about a 40 percent decrease in the portion of the fecal coliform bacteria load that is contributed by nonpoint sources between the Existing (2000) condition and the Recommended Plan (2020) condition. Much of the increase in the percentage of the total load contributed by point sources reflects this large decrease in nonpoint source loads.*

emphasis on nonpoint sources. The reductions in nonpoint source loads between the Existing (2000) condition and the Recommended Plan (2020) condition that are envisioned in the RWQMPU define targets to be met in order to improve water quality conditions in the Root River watershed.

These targets were refined in two ways. First, the load estimates from the three conditions were used to estimate how much of the pollutant load reductions envisioned in the RWQMPU would result from implementation of the NR 151 stormwater runoff performance standards and how much would result from other elements of the recommended plan. Second, the load reductions were adjusted to account for changes in the application of NR 151 that have been made since the RWQMPU was completed.

The developed urban area performance standard for municipalities set forth in Section NR 151.13 requires that municipalities with WPDES stormwater discharge permits reduce the amount of TSS in stormwater runoff from areas of existing development that was in place as of October 1, 2004, to the maximum extent practicable, by 20 percent by March 10, 2008 and by 40 percent by October 1, 2013. In addition, other sections of NR 151 require that all construction sites that have one acre or more of land disturbance must achieve an 80 percent reduction in the sediment load generated by the site. With certain limited exceptions, those sites required under NR 151 to have construction erosion control permits must also have post-development stormwater management practices to reduce the TSS load from the site by 80 percent for new development, 40 percent for redevelopment, and 40 percent for infill development occurring prior to October 1, 2012. After October 1, 2012, infill development will be required to achieve an 80 percent reduction. Recent action by the State Legislature has changed the application of these performance standards. As a result of 2011 Wisconsin Act 32 the WDNR is prohibited from enforcing the 40 percent reduction in TSS load from areas of existing development.

The impact of this is that the load reductions from urban nonpoint sources as represented under the RWQMPU need to be adjusted to account for the change in application of the developed urban area performance standard. The need to adjust the load reductions applied to the load reductions for fecal coliform bacteria, as well as TSS and total phosphorus, because many of the stormwater management practices that would have been installed to achieve a 40 percent reduction in TSS loads would also act to reduce fecal coliform bacterial loads.

The adjustment in load reductions was done on a subwatershed basis using the existing 2000 land use (see Table IV-3 in Chapter IV) and the planned 2035 land use (see Table IV-5 in Chapter IV) to estimate the portions of urban lands within each subwatershed under the Recommended Plan (2020) condition that represent:

- Existing development that would have been subject to the 40 percent TSS reduction requirement, and
- New development that is subject to the 80 percent TSS reduction requirement, redevelopment that is subject to the 40 percent TSS reduction requirement, and infill development, which is subject to a 40 percent TSS reduction requirement prior to October 1, 2012 and an 80 percent TSS reduction requirement after October 1, 2012.

To adjust the urban nonpoint source load reductions for the changes in the application of NR 151, the portion of the NR 151-related load reductions that are attributable to existing development was estimated for each subwatershed. This portion of the pollutant load was reduced by half.[23] In order to maintain the recommended levels of water quality improvement envisioned under the RWQMPU, the amount of this reduction was added to the "other reductions" categories for urban nonpoint sources in Table V-Fec-A.

Table V-Fec-A shows the adjusted nonpoint source load reductions for fecal coliform bacteria for the Root River watershed. On a watershed basis, this sets a target of reducing nonpoint source loads of fecal coliform bacteria to

[23]*This reflects a change from controlling 40 percent of TSS as expected under planned conditions prior to promulgation of 2011 Wisconsin Act 32, to controlling 20 percent of TSS.*

the stream system by 4,725.42 trillion cells between 2000 and 2020. Of this reduction, 3,982.57 trillion cells would come from urban nonpoint sources, with 963.29 trillion cells of this reduction being attributable to implementation of NR 151 and 3,019.28 trillion cells of this reduction being attributable to implementation of other measures. The remaining 828.98 trillion cells would come from rural nonpoint sources, with 204.67 trillion cells of this reduction being attributable to implementation of NR 151 and 624.31 trillion cells of this reduction being attributable to implementation of other measures.

Table V-Fec-A also shows adjusted nonpoint source load reductions for fecal coliform bacteria for individual subwatersheds. The reduction targets range from a reduction of 54.30 trillion cells in the Root River Canal subwatershed to a reduction of 1,327.66 trillion cells in the Lower Root River subwatershed.

In addition to presenting estimates of pollutant loads, the RWQMPU provided estimates of water quality conditions under the Existing (2000) and Recommended Plan (2020) conditions.[24] These estimates were calculated using the calibrated water quality model. Comparison of the modeled water quality conditions under the Recommended Plan (2020) condition to those under the Existing (2000) condition provides an estimate of the degree of improvement in water quality conditions in the Root River watershed that would be achieved by meeting the load reduction targets given in Table V-Fec-A. For fecal coliform bacteria, these estimates of water quality conditions were made over both the whole year and over the 153-day swimming season from May 1 through September 30. Because the heaviest use recreational use of surface waters occurs during this period and full-body contact uses are most likely to occur during this period, it would be reasonable to conclude that if the bacteria criteria were met during the swimming season, the stream or stream reach stream in question would meet the water use objective for recreational use. Estimates of water quality conditions under Existing (2000) and Recommended Plan (2020) conditions made over the whole year and over the swimming season are given in Tables V-Fec-B and V-Fec-C, respectively.

Table V-Fec-B shows a comparison of modeled fecal coliform bacteria summary statistics under the Existing (2000) and Recommended Plan (2020) conditions calculated over the entire year. These summary statistics are estimated for 15 assessment points located at or near the downstream ends of the 15 assessment areas. The locations of these assessment points are shown on Map IV-1 in Chapter IV. Estimated mean concentrations of fecal coliform bacteria at these assessment points under the Existing (2000) condition ranged between 2,401 cells per 100 ml and 8,198 cells per 100 ml, with an average value of 5,009 cells per 100 ml. Under the Recommended Plan (2020) condition, estimated mean concentrations of fecal coliform bacteria ranged between 2,105 cells per 100 ml and 4,213 cells per 100 ml, with an average value of 2,978 cells per 100 ml. Estimated geometric mean concentrations of fecal coliform bacteria at these assessment points under the Existing (2000) condition ranged between 262 cells per 100 ml and 1,262 cells per 100 ml. Under the Recommended Plan (2020) condition, estimated geometric mean concentrations of fecal coliform bacteria ranged between 121cells per 100 ml and 714 cells per 100 ml. The highest estimated mean concentrations under both conditions were present in upper portions of the watershed, including the Upper Root River-Headwaters, Upper Root River, Whitnall Park Creek, Middle Root River-Dale Creek, East Branch Root River, and Middle Root River-Legend Creek assessment areas. The highest estimated geometric mean concentrations under both conditions were present in central portions of the watershed, including the Middle Root River-Dale Creek, Middle Root River-Legend Creek, Middle Root River-Ryan Creek, and Lower Root River-Caledonia assessment areas.

Table V-Fec-B also shows estimates of the degree of compliance with the State's water quality criteria for fecal coliform bacteria at each assessment point under both conditions. Two estimates are given: the percent of time that concentrations of fecal coliform bacteria would be at or below the single-sample criterion of 400 cells per 100 ml and the number of days per year that the geometric mean of fecal coliform bacteria concentrations would be at or below the geometric mean criterion of 200 cells per 100 ml. The estimated level of compliance with the single-

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[24]*The RWQMPU also provided estimates of water quality conditions under the Revised 2020 Baseline, the Revised 2020 Baseline with a five-year LOP, and Extreme Measures conditions.*

sample criterion under the Existing (2000) condition ranged between 43 percent and 72 percent, with an average level of compliance of 57 percent. The estimated level of compliance with the single-sample criterion under the Recommended Plan (2020) condition ranged between 51 percent and 72 percent, with an average level of compliance of 61 percent. The estimated level of compliance with the geometric mean criterion under the Existing (2000) condition ranged between 6 days per year and 148 days per year, with an average level of compliance of 46 days per year. The estimated level of compliance with the geometric mean criterion under the Recommended Plan (2020) condition ranged between 18 days per year and 248 days per year, with an average level of compliance of 94 days per year.

Table V-Fec-C shows a comparison of modeled fecal coliform bacteria summary statistics under the Existing (2000) and Recommended Plan (2020) conditions calculated over the 153-day May through September swimming season These summary statistics are estimated for 15 assessment points located at or near the downstream ends of the 15 assessment areas. The locations of these assessment points are shown on Map IV-1 in Chapter IV. Estimated mean concentrations of fecal coliform bacteria at these assessment points under the Existing (2000) condition ranged between 1,995 cells per 100 ml and 5,142 cells per 100 ml, with an average value of 3,241cells per 100 ml. Under the Recommended Plan (2020) condition, estimated mean concentrations of fecal coliform bacteria ranged between 1,393 cells per 100 ml and 2,141 cells per 100 ml, with an average value of 1,708 cells per 100 ml. Estimated geometric mean concentrations of fecal coliform bacteria at these assessment points under the Existing (2000) condition ranged between 158 cells per 100 ml and 770 cells per 100 ml. Under the Recommended Plan (2020) condition, estimated geometric mean concentrations of fecal coliform bacteria ranged between 55cells per 100 ml and 394 cells per 100 ml. The highest estimated mean concentrations under the Existing (2000) condition were present in upper portions of the watershed, including the Upper Root River-Headwaters, Upper Root River, Whitnall Park Creek, and Middle Root River-Dale Creek, assessment areas. Under the Recommended Plan (2020) condition, estimated mean concentrations in these assessment areas were similar to those in the assessment areas that make up the Root River Canal and its East and West Branches. The highest estimated geometric mean concentrations under both conditions were present in central portions of the watershed, including the Middle Root River-Dale Creek, Middle Root River-Legend Creek, and Middle Root River-Ryan Creek assessment areas.

Table V-Fec-C also shows estimates of the degree of compliance with the State's water quality criteria for fecal coliform bacteria during the swimming season at each assessment point under both conditions. Two estimates are given: the percent of time that concentrations of fecal coliform bacteria would be at or below the single-sample criterion of 400 cells per 100 ml and the number of days out of 153 that the geometric mean of fecal coliform bacteria concentrations would be at or below the geometric mean criterion of 200 cells per 100 ml. The estimated level of compliance with the single-sample criterion during the swimming season under the Existing (2000) condition ranged between 55 percent and 81 percent, with an average level of compliance of 69 percent. The estimated level of compliance with the single-sample criterion during the swimming season under the Recommended Plan (2020) condition ranged between 63 percent and 80 percent, with an average level of compliance of 72 percent. The estimated level of compliance with the geometric mean criterion during the swimming season under the Existing (2000) condition ranged between three out of 153 days and 84 out of 153 days, with an average level of compliance of 27 out of 153 days. The estimated level of compliance with the geometric mean criterion during the swimming season under the Recommended Plan (2020) condition ranged between 12 out of 153 days and 138 out of 153 days, with an average level of compliance of 54 out of 153 days.

Targets Related to Parks and Parkways

[This subsection will be provided for a future Advisory Group meeting.]

Targets Related to Trails

[This subsection will be provided for a future Advisory Group meeting.]

Targets Related to Surface Water Access

The WDNR has developed standards for public boating access to waterbodies in the State. These standards are set forth in Sections NR 1.90 through NR 1.93 of the *Wisconsin Administrative Code*. A major means of implementation of these standards is through eligibility of waterbodies for natural resource enhancement services. Natural resource enhancement services consist of funding or activities that increase the recreational or environmental values of a waterway. They include, but are not limited to, fish stocking, fish population management, habitat development, financial assistance for aquatic plant harvesting, and lake restoration grants. Under the provisions of Section NR 1.91(4)(a), the Department may only provide natural resource enhancement services for a body of water when it determines that the general public has been provided with reasonable boating access. Reasonable access is defined as the waterbodies meeting minimum public boating access development standards (see below). Section NR 1.91(4) grants the Department the discretion to continue to provide natural resource enhancement to waterbodies that do not meet the minimum public boating access development standards in cases where the Department determines that the existing access facilities are sufficient to meet existing public demand for access. In addition, Section NR 1.91(4) grants the Department the discretion to provide natural resource protection services for pollution abatement or prevention, natural resource protection, public safety, or boating access if public boating access is not available on a waterway.[25]

Table V-Rec-A summarizes the State of Wisconsin's public boating access development standards for lakes. These standards specify that launch facilities and minimum numbers of parking spaces, including automobile parking spaces and car-trailer spaces, that should be present based upon the size of the lake. Under these standards, parking is to be contiguous with the launch site unless the Department determines that resource protection, spatial restrictions, or other factors require a greater distance. One additional parking space, in addition to the minimum specified in the table, must be provided for use by disabled persons. The standards also specify a maximum number of parking spaces to be provided. This also varies according to the size of the lake, in recognition that too many boats on a lake may threaten both the safety of lake users and the environmental quality of the lake.

Table V-Rec-B summarizes the State of Wisconsin's public boating access development standards for rivers and the Great Lakes. These standards specify that launch facilities and parking along rivers be available based upon proximity to incorporated communities and distance along streams. Under these standards, parking is to be contiguous with the launch site unless the Department determines that resource protection, spatial restrictions, or other factors require a greater distance. One additional parking space, in addition to the minimum specified in the table, must be provided for use by disabled persons. The standards also specify a maximum number of access sites to be provided. For the Root River, these standards indicate that carry-in access points with parking should be provided every 10 miles.

It should be noted that natural resource enhancement services may be provided for waters that have less public boating access than specified in the standards given in Tables V-Rec-A and V-Rec-B and that public boating access may be developed that exceeds the levels given in the standards only if local governments or the WDNR have an alternative public boating access and waterway protection plan. Plans written by local government require written approval by the WDNR prior to adoption. The factors to be considered in the development of such a plan are given in Section NR 1.91(6) of the *Wisconsin Administrative Code*.

Application of the public boating access development standards given in Tables V-Rec-A and V-Rec-B give the following targets for additional public boating access in the Root River watershed:

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[25]*Resource protection services include but are not limited to nonpoint pollution control grants, loans for municipal sewage treatment facilities, acquisition grants under the urban green space program, lake planning grants, lake protection grants, and funding for municipal boating safety patrols and aids to navigation.*

- There should be one carry-in access site per 10 miles of stream along the mainstem of the Root River. This indicates that one to two access sites should be created upstream from Horlick dam, and

- There should be one carry-in access site with parking for five vehicles on each of the Kelly Lakes. This indicates that additional parking may need to be developed at the existing access sites on these lakes.

Habitat Targets

[This subsection will be provided for a future Advisory Group meeting.]

Flooding Targets

[This subsection will be provided for a future Advisory Group meeting.]

Horlick Dam Alternatives

Introduction
Issues of Concern
    Water Quantity
    Water Quality
    Natural Resources
    Social
    Cost
Baseline Condition
Conceptual Alternatives
    Modify Dam to Enhance Spillway Capacity
        Utilize Current Fishway Area
    Modify Dam to Enable Fish Passage
        Modify Current Fishway
    Modify Dam to Enhance Spillway Capacity and Fish Passage
        Partial Notch of Current Dam Spillway
    Remove Dam
        Complete Notch of Current Dam Spillway
        Full Removal

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SEWRPC Community Assistance Planning Report No. 316

A WATERSHED RESTORATION PLAN FOR THE ROOT RIVER WATERSHED

Chapter V

DEVELOPMENT OF TARGETS AND ALTERNATIVE MEASURES

TABLES FOR MAY 1, 2013, MEETING

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Table V-0A

AVERAGE AND MAXIMUM CHLORIDE CONCENTRATIONS IN THE ROOT RIVER AT SAMPLE SITES WITH AT LEAST FOUR SAMPLES COLLECTED DURING THE WINTER: 1998-2012

River Mile	Mean Chloride Concentration (mg/l)		Median Chloride Concentration (mg/l)		Maximum Chloride Concentration (mg/l)		Samples	
	Winter	Nonwinter	Winter	Nonwinter	Winter	Nonwinter	Winter	Nonwinter
36.7	587	255	266	260	1,610[a]	590[b]	6	136
28.0	277	156	155	150	670[b]	410[b]	4	130
11.5	193	123	196	123	402[b]	227	17	31

[a] *This maximum concentration exceeds both the acute toxicity criteria of 757 mg/l and the chronic toxicity criteria of 395 mg/l.*

[b] *These maximum concentrations exceed the chronic toxicity criteria of 395 mg/l.*

Source: SEWRPC.

Table V-0B

AVERAGE SPECIFIC CONDUCTANCE IN STREAMS OF THE ROOT RIVER WATERSHED AT SAMPLE SITES WITH AT LEAST FOUR SAMPLES COLLECTED DURING THE WINTER: 1998-2012

Stream	River Mile	Mean Specific Conductance (μS/cm)		Median Specific Conductance (μS/cm)		Samples	
		Winter	Nonwinter	Winter	Nonwinter	Winter	Nonwinter
Root River	38.6	4,707	1,440	3,700	1,380	13	26
	36.7	4,293	1,438	3,655	1,510	29	165
	28.7	2,280	1,162	1,970	1,160	11	13
	28.0	2,115	1,055	2,430	1,090	9	142
	18.6	1,128	994	1,178	1,017	5	61
	13.6	1,117	962	1,153	999	5	61
	11.5	1,272	961	1,155	952	41	142
	9.4	1,103	979	1,130	998	5	61
	5.9	1,028	838	1,079	838	6	208
	3.9	1,013	945	990	863	6	60
	3.1	996	942	984	966	6	60
	1.8	1,421	895	1,642	865	4	9
	1.5	994	927	992	950	6	60
	0.0	880	666	888	654	6	181
Hoods Creek	0.5	1,066	1,137	1,080	1,135	6	68
Husher Creek	1.0	1,182	964	1,161	893	5	61
East Branch Root River Canal	8.1	899	1,084	900	1,089	5	61
	0.5	1,038	898	1,056	883	5	61
Legend Creek	0.5	1,114	1,049	1,108	1,080	5	61
Raymond Creek	0.8	932	1,087	910	928	5	61
Root River Canal	3.7	1,083	1,103	1,063	1,084	6	157
West Branch Root River Canal	9.3	1,389	1,880	1,350	2,020	5	61
	0.3	1,099	1,323	1,096	1,315	5	62

Source: SEWRPC.

Table V-Fec-A

ANNUAL REDUCTIONS IN NONPOINT SOURCE LOADS OF FECAL COLIFORM BACTERIA REQUIRED BY THE RWQMPU ADJUSTED FOR CHANGES IN NR 151

		Annual Reduction in Loads of Fecal Coliform Bacteria (trillion cells)						
		Urban Sources			Rural			
Subwatershed	Assessment Areas	NR 151 Related	Other Reductions	Subtotal	NR 151 Related	Other Reductions	Subtotal	Total
Upper Root River	Upper Root River, Upper Root River Headwaters	288.92	881.95	1,170.87	0.47	0.00	0.47	1,171.34
Whitnall Park Creek	Whitnall Park Creek	160.70	495.76	656.46	7.36	34.28	41.64	698.10
Middle Root River	Middle Root River-Dale Creek, Middle Root River-Legend Creek, Middle Root River-Ryan Creek	69.40	404.50	473.90	0.00	60.84	60.84	534.74
East Branch Root River	East Branch Root River	47.98	211.89	259.87	2.16	0.00	2.16	262.03
West Branch Root River Canal	Upper West Branch Root River Canal, Lower West Branch Root River Canal	28.60	38.37	67.33	31.67	158.44	190.11	257.44
East Branch Root River Canal	East Branch Root River Canal	0.00	11.80	11.80	14.20	70.91	85.11	96.91
Root River Canal	Root River Canal	2.84	4.77	7.61	0.00	46.69	46.69	54.30
Lower Root River	Lower Root River-Caledonia, Lower Root River Johnson Park, Lower Root River-Racine	320.68	740.18	1,060.86	115.48	151.32	266.80	1,327.66
Hoods Creek	Hoods Creek	44.19	143.55	187.74	33.33	101.83	135.16	322.90
	Total	963.29	3,019.28	3,982.57	204.67	624.31	828.98	4,725.42

Source: SEWRPC.

Table V-Fec-B

MODELED FECAL COLIFORM BACTERIA ANNUAL SUMMARY STATISTICS FROM THE RWQMPU FOR THE ROOT RIVER WATERSHED[a]

Assessment Point	Assessment Area	Mean Concentration (cells per 100 ml)		Percent Compliance with Single Sample Standard (<400 cells per 100 ml)		Geometric Mean Concentration (cells per 100 ml)		Days of Compliance with Geometric Mean Standard (<200 cells per 100 ml)[b]	
		Existing (2000)	Recommended Plan (2020)	Existing (2000)	Recommended Plan (2020)	Existing (2000)	Recommended Plan (2020)	Existing (2000)	Recommended Plan (2020)
RT-2: Root River	Upper Root River-Headwaters	7,040	3,765	66	69	630	333	27	98
RT-4: Root River	Upper Root River	7,101	3,707	56	61	865	450	19	64
RT-5: Whitnall Park Creek	Whitnall Park Creek	8,198	4,213	55	59	896	461	18	66
RT-8: Middle Root River	Middle Root River-Dale Creek	6,584	3,674	46	52	1,262	714	6	27
RT-9: East Branch Root River	East Branch Root River	6,332	3,443	65	67	594	349	35	104
RT-10: Root River Upstream of Ryan Creek	Middle Root River-Legend Creek	6,995	3,770	48	55	1,189	628	9	39
RT-11: West Branch Root River Canal	Upper West Branch Root River Canal	2,428	2,152	72	71	262	209	129	172
RT-13: West Branch Root River Canal	Lower West Branch Root River Canal	2,372	2,105	64	68	412	313	59	101
RT-15: East Branch Root River Canal	East Branch Root River Canal	3,272	2,698	71	72	288	189	121	209
RT-16: Root River Canal	Root River Canal	2,401	2,161	62	65	423	332	62	95
RT-17: Root River at Upstream Crossing of Milwaukee-Racine County Line	Middle Root River-Ryan Creek	4,656	2,909	43	51	1,123	713	7	18
RT-18: Root River Upstream of Hoods Creek	Lower Root River-Caledonia	4,253	2,801	46	51	983	629	11	37
RT-20: Hoods Creek	Hoods Creek	4,039	1,975	69	71	286	121	148	248
RT-21: Root River at City of Racine	Lower Root River-Johnson Park	4,547	2,672	48	53	853	522	17	57
RT-22: Mouth of Root River at Lake Michigan	Lower Root River-Racine	4,924	2,765	47	51	869	516	28	68

[a]Within the water quality models for the recommended plan condition, the detection and elimination of illicit discharges to storm sewer systems and control of urban source pathogens, including those in stormwater runoff, are represented using stormwater disinfection units. Such units were initially considered as a recommended approach to treatment of runoff, but were eliminated from further consideration based on comments from the RWQMPU Technical Advisory Committee. However, the use of such units is considered to be appropriate as a surrogate representation of the varied and as yet undetermined means that would be applied to detect and eliminate illicit discharges and to control pathogens in urban stormwater runoff. Those units explicitly address the control of bacteria in stormwater runoff, and, based on the way that bacteria loads are represented in the calibrated model, they also implicitly provide some control of bacteria that may reach streams through illicit connections that contribute to baseflow.

[b]Out of 365 days.

Source: Tetra Tech, Inc., and SEWRPC.

Table V-Fec-C

MODELED FECAL COLIFORM BACTERIA SWIMMING SEASON SUMMARY STATISTICS FROM THE RWQMPU FOR THE ROOT RIVER WATERSHED[a,b]

Assessment Point	Assessment Area	Mean Concentration (cells per 100 ml)		Percent Compliance with Single Sample Standard (<400 cells per 100 ml)		Geometric Mean Concentration (cells per 100 ml)		Days of Compliance with Geometric Mean Standard (<200 cells per 100 ml)[c]	
		Existing (2000)	Recommended Plan (2020)	Existing (2000)	Recommended Plan (2020)	Existing (2000)	Recommended Plan (2020)	Existing (2000)	Recommended Plan (2020)
RT-2: Root River	Upper Root River-Headwaters	3,968	1,927	77	79	464	240	10	46
RT-4: Root River	Upper Root River	4,018	1,681	66	71	603	297	7	33
RT-5: Whitnall Park Creek	Whitnall Park Creek	5,142	2,141	66	70	628	301	7	34
RT-8: Middle Root River	Middle Root River-Dale Creek	3,951	1,788	58	65	770	394	3	18
RT-9: East Branch Root River	East Branch Root River	3,348	1,590	79	79	365	213	21	59
RT-10: Root River Upstream of Ryan Creek	Middle Root River-Legend Creek	3,768	1,655	59	68	717	353	4	26
RT-11: West Branch Root River Canal	Upper West Branch Root River Canal	1,995	1,579	81	80	164	137	67	85
RT-13: West Branch Root River Canal	Lower West Branch Root River Canal	2,099	1,801	74	77	256	198	41	62
RT-15: East Branch Root River Canal	East Branch Root River Canal	2,853	2,109	80	80	213	142	64	109
RT-16: Root River Canal	Root River Canal	2,066	1,772	72	75	255	202	47	66
RT-17: Root River at Upstream Crossing of Milwaukee-Racine County Line	Middle Root River-Ryan Creek	2,994	1,594	55	63	720	422	4	12
RT-18: Root River Upstream of Hoods Creek	Lower Root River-Caledonia	2,687	1,589	60	65	556	330	9	29
RT-20: Hoods Creek	Hoods Creek	3,354	1,393	81	80	158	55	84	138
RT-21: Root River at City of Racine	Lower Root River-Johnson Park	3,041	1,489	62	67	479	268	13	43
RT-22: Mouth of Root River at Lake Michigan	Lower Root River-Racine	3,327	1,508	62	67	440	240	22	54

[a]*Within the water quality models for the recommended plan condition, the detection and elimination of illicit discharges to storm sewer systems and control of urban source pathogens, including those in stormwater runoff, are represented using stormwater disinfection units. Such units were initially considered as a recommended approach to treatment of runoff, but were eliminated from further consideration based on comments from the RWQMPU Technical Advisory Committee. However, the use of such units is considered to be appropriate as a surrogate representation of the varied and as yet undetermined means that would be applied to detect and eliminate illicit discharges and to control pathogens in urban stormwater runoff. Those units explicitly address the control of bacteria in stormwater runoff, and, based on the way that bacteria loads are represented in the calibrated model, they also implicitly provide some control of bacteria that may reach streams through illicit connections that contribute to baseflow.*

[b]*The swimming season is taken as May through September.*

[c]*Out of 153 days total.*

Source: Tetra Tech, Inc., and SEWRPC.

Table V-Rec-A

STATE OF WISCONSIN PUBLIC BOATING ACCESS STANDARDS FOR INLAND LAKES

Size (acres)	Minimum Public Boating Access Development	Maximum Public Boating Access Development
<50	One carry-in access site for five vehicles	One carry-in access site for five vehicles
50-99	One or more access sites which in total provide a combination of five vehicle and car-trailer units	One or more access sites which in total provide five car-trailer units
100-499	One or more access sites which in total provide one car-trailer unit per 30 open water acres, but no less than five units for lakes of 50 to 150 open water acres	One or more access sites which in total provide one car-trailer unit per 15 open water acres
500-999	One or more access sites which in total provide one car-trailer unit per 35 open water acres, but no less than 17 units for lakes of 500 to 595 open water acres	One or more access sites which in total provide one car-trailer unit per 25 open water acres, but no less than 33 units for lakes of 500 to 825 open water acres
1,000-4,999	One or more access sites which in total provide one car-trailer unit per 50 open water acres, but no less than 29 units for lakes of 1,000 to 1,450 open water acres	One or more access sites which in total provide one car-trailer unit per 30 open water acres, but no less than 40 units for lakes of 1,000 to 1,200 open water acres
5,000 or More	One or more access sites which in total provide one car-trailer unit per 70 open water acres, but no less than 100 units for lakes of 5,000 to 7,000 open water acres	One or more access sites which in total provide one car-trailer unit per 50 open water acres, but no less than 167 units for lakes of 5,000 to 8,350 open water acres

Source: Section NR 1.91 of the Wisconsin Administrative Code*.*

Table V-Rec-B

STATE OF WISCONSIN PUBLIC BOATING ACCESS STANDARDS FOR RIVERS AND THE GREAT LAKES

Class	Minimum Public Boating Access Development	Maximum Public Boating Access Development
Rivers and Lakes Michigan and Superior and Their Bays	One access site within five miles of each incorporated community bordering the shore	One access site per five miles of flowing water or where the Department determines additional facilities would exceed the resource capacity of the waterbody
Rivers and Streams Accessed Primarily by Carry-In	One access site per 10 miles of stream thread	One carry-in site per 10 miles of flowing water
Exceptions	Determined case-by-case based on a plan	Determined by a plan

Source: Section NR 1.91 of the Wisconsin Administrative Code*.*

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SEWRPC Community Assistance Planning Report No. 316

A WATERSHED RESTORATION PLAN FOR THE ROOT RIVER WATERSHED

Chapter V

DEVELOPMENT OF TARGETS AND ALTERNATIVE MEASURES

MAPS FOR MAY 1, 2013, MEETING

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Map V-Rec-A

EXISTING AND PLANNED RECREATIONAL TRAILS AND BIKE ROUTES WITHIN THE ROOT RIVER WATERSHED: 2013