3. PROPOSED MANAGEMENT PROGRAM

The 1993 Stormwater Management Plan was based on the concept of regional detention facilities serving large watersheds likely to be developed. The detention facilities were intended to provide peak flow reduction as well as pollutant removal. The design criteria for water quantity management consisted of reducing the 100-year post-development discharge rates to two-year pre-development levels. The water quality management criteria required wet detention ponds be constructed to achieve a prescribed pollutant reduction goal at each wetland or water body.

The most innovative concept of the 1993 Plan was that it is to be implemented mainly by the City of Franklin - not individual site developers. It should be noted that the 1993 Plan presented a comprehensive set of recommended facilities that TOGETHER would achieve the runoff control and pollution removal goals. This meant that its recommendations and design criteria did not necessarily include the evaluation and assessment of site-specific implementation of stormwater management practices. Therefore, the Plan did not contain guidance and recommendations for site-specific implementation of stormwater management.

Soon after the City's adoption of the Plan, it became evident that the concept of regional stormwater management, even within a single municipality, was not a practical idea. Because of this, Franklin chose to pursue a site-specific application of the stormwater management criteria presented in the Plan. The City also required all new development after 1993 comply with runoff control and pollution reduction goals originally established in the Comprehensive Plan.

With the Stormwater Management Plan Update, we are proposing a management program that requires individual developers comply with water quantity and quality management on a site-specific basis. This approach aligns the current stormwater management practice in Franklin with the adopted Stormwater Management Plan and related ordinances.

Another important difference between the 1993 Plan and the current Update is that we no longer recommend the use of natural depressions and wetlands as stormwater management practices. In the 1993 Plan, existing wetlands were assigned peak runoff reduction and some flood control functions; meaning, that the number of engineered regional ponds was minimized. The present update removes all stormwater management functions from natural wetlands and requires all (or most) runoff be routed through constructed stormwater detention facilities. In other words, the updated Management Program seeks to PROTECT wetlands from both runoff increase and Nonpoint source pollution due to development.

3.1. Management Program Update

The proposed Stormwater Management Program has two distinct but related components: (1) stormwater quantity management and (2), nonpoint source pollution control. While the Proposed Plan maintains the requirement that the 100-year post-development discharge rates be reduced to two-year pre-development levels, the MMSD Chapter 13 rules introduce two additional runoff control criteria that must be enforced. The Proposed Plan includes these new requirements.
In addition, the Proposed Plan introduces specific water quality management requirements are based on the latest design guidance published by the WDNR. Facilities are designed and constructed in accordance with these WDNR guidelines have been shown to provide an 80-percent reduction of total suspended solids in pond outflows.

The management practices proposed and recommended herein are intended to:

- Mitigate runoff discharge rate increases, due to new development, to prevent downstream drainage capacity problems,
- Mitigate runoff discharge rate and volume increases, due to new development activity, to prevent flooding along waterways and rivers,
- Bring the City of Franklin into compliance with Milwaukee Metropolitan Sewerage District Chapter 13 Surface Water and Stormwater regulations,
- Mitigate nonpoint source pollution increases, due to new development, to protect wetlands and waterways,
- Bring the City of Franklin into compliance with Wisconsin Administrative Code Chapter NR 216 regulations.
- Provide a clear and concise "Management Guidance" targeted at the development community.

In addition to engineering design recommendations to protect water quality, we are cognizant of the need to preserve and enhance the whole of the natural environment in Franklin. Though the development of natural resource management guidance is outside the scope of this document, we can nevertheless identify general concepts that, in our opinion, would benefit the quality of life and the environment in the City.

3.2. Stormwater Quantity Management

The stormwater quantity management practices recommended herein apply to development or redevelopment projects that will result in an increase of runoff discharge due to the construction of impervious surfaces. In addition, the present recommendations follow the requirements of MMSD Chapter 13 rules by introducing additional flood control and protection in waterways and rivers in Franklin. See Appendix C for the MMSD Chapter 13 regulations.

Land development activity that involves an increase of one-half acre (21,780 square feet), or more of impervious surface but less than 1.5 acres (65,340 square feet), will only be subject to water quantity management requirements. In general, this will mean that such developments will be required to meet runoff discharge reduction goals through the use of dry detention facilities.

For phased developments, the cumulative effect of all phases should be considered. This means that water quantity management will be required when the cumulative amount of new impervious surface is 0.5 acres (21,780 square feet) or more, even if the individual components of a development each create less than 0.5 acre of impervious surface.

The stormwater quantity management rules will reduce post development peak runoff discharge rates in order to maintain or improve the safe handling capacity of downstream drainage systems. The reduction in peak discharges will also maintain the existing 100-year flood elevations in Franklin's rivers and waterways.

Most communities in the Milwaukee metropolitan area have adopted stormwater management standards similar to the proposed rules for Franklin. As a reference, we have complied the following summary of management practices in the area:

Community	Stormwater Quantity Criteria
City of Franklin (current rules)	Reduce 100-yr. post-development discharge to 2-yr. pre-development discharge.
City of Mequon	Maintain the 100, 10, 2-yr. post-development discharge at 100, 10, 2-yr. pre-settlement levels.
City of Brookfield	Maintain the 100, 10, 2-yr. post-development discharge at 100, 10, 2-yr. pre-development levels.
City of New Berlin	Reduce 100-yr. post-development discharge to 10-yr. pre-settlement discharge.
City of Oak Creek	Reduce 100-yr. post-development discharge to 10-yr. pre-development discharge.
City of Muskego	Reduce 100-yr. post-development discharge to 2-yr. pre-development discharge.
Waukesha County	Maintain the 100, 10, 2-yr. post-development discharge at 100, 10, 2-yr. pre-development levels.
Village of Germantown	Reduce 100-yr. post-development discharge to 2-yr. pre-development discharge. Bulletin 71 rainfall.
Village of Menomonee Falls	Reduce 100-yr. post-development discharge to 2-yr. pre-development discharge. Bulletin 71 rainfall.

A review of the various municipal management practices shows that the City's current stormwater management approach is among the leaders in stormwater management. Building on this existing framework, the proposed stormwater quantity management criteria provides additional flood protection to Franklin.

3.2.1. Proposed Stormwater Quantity Management Criteria

Any development or re-development activity that will result in the creation of 0.5 acres of impervious surface or more will be subject to stormwater quantity control regulations. The consistent application of the proposed rules will continue the well-established management practices currently in place in Franklin.

The Milwaukee Metropolitan Sewerage District has implemented an area-wide Surface Water and Stormwater Regulations that are implicitly included in the proposed management criteria for the City of Franklin.

Under the proposed stormwater quantity management rules, we recommend Franklin continue to require on-site management practices to control the peak flow rates of stormwater discharged from the site, such that the peak flow discharge rates of stormwater runoff under the post-development conditions shall be controlled and reduced as follows:

1. 100-year post-development peak runoff discharge shall not exceed the lesser of:
    - 2-year pre-development peak runoff discharge, or
    - 0.5 cubic feet per second per acre (cfs), or
    - Maximum hydraulic capacity of existing downstream conveyance facilities as determined by the City.
2. 2-year post-development peak runoff discharges shall not exceed 0.15 cfs per acre.

Stormwater quantity management practices should utilize the following techniques, in order of preference:

1. Preservation of the natural features of development sites, including natural storage and infiltration characteristics;
2. Preservation of existing wetlands, natural streams, channels, and drainage ways;
3. Minimization of new impervious surfaces;
4. Conveyance of storm water in open vegetated channels;
5. Construction of structures that provide both quantity and quality control, with structures serving multiple sites being preferable to structures serving individual sites; and

6. Construction of structures that provide only quantity control, with structures serving multiple sites being preferable to structures serving individual sites.

If the land development site or the proposed stormwater management facility currently receives or is proposed to receive surface runoff originating from off-site tributary watershed areas, the stormwater management criteria will only apply to the portion of the total runoff that originates from the land under developed.

If surface runoff leaves the site at more than one location, discharge at each location must individually meet the standards set forth in these proposed rules. The discharge comparisons should be made at stormwater conveyance facilities (i.e., ditches, culverts, storm sewers, stormwater detention ponds, channels, streams, etc.) located immediately downstream from each discharge location of the land development site.

The stormwater management pond should fully contain the runoff from the tributary watershed area during the 100-year 24-hour rainfall with a SCS TYPE II distribution under the post-development conditions. The tributary watershed area consists of all on-site and off-site areas draining to the pond.

Emergency overland flow for all stormwater facilities must be provided to prevent exceeding the safe capacity of downstream drainage facilities, and, prevent endangerment of downstream property or public safety.

Impacts to the hydraulic performance of downstream conveyance or storage facilities must be avoided. Where such changes are proposed, the impact of the proposal on the existing stormwater detention ponds should be assessed using a methodology acceptable to the City.

For storms exceeding the design capacity of the conveyance system within the development site, overland drainage routes should direct the excess runoff to the stormwater management pond proposed for the site.

3.3. Nonpoint Source Pollution Control

Pollutants can enter area creeks, rivers, ponds, and lakes from various sources including industrial discharges, overflow from sanitary and combined sewers, atmospheric deposition, and stormwater runoff. All sources must be addressed to find a balanced approach to reducing pollutant loads so that surface water standards are met.

Activities typically occurring in an urban area generate, expose and otherwise make available potential pollutants. This effect is magnified if the urban area is undergoing development. Substances having toxic, organic, nutrient, pathogenic, sediment, and aesthetic pollution potential are present in urban parking lots, streets, rooftops, lawns, and other areas. When it rains, these substances can be picked up and carried away by the resulting stormwater runoff. Although municipal storm sewer systems are efficient at controlling water volume to avoid flooding, they also transport polluted runoff directly into nearby lakes, rivers and streams without the benefit of wastewater treatment or filtration by

soil or vegetation. Furthermore, urbanization tends to increase the temperature of runoff and surface waters, which, in turn, has adverse effects such as reduced oxygen concentration.

To meet the requirements of the Federal Clean Water Act, the WDNR developed the Wisconsin Pollutant Discharge Elimination System Stormwater Discharge Permit Program (WPDES), which is regulated under the authority of Chapter NR 216, Wis. Adm. Code. As part of the EPA National Pollutant Discharge Elimination System, the WPDES Stormwater Program regulates discharge of stormwater in Wisconsin from construction sites, industrial facilities and selected municipalities. Within this program, the City of Franklin will soon be subject to permitting for the Root River watershed group of municipalities.

These permits include implementation of best management practices, annual pollutant load calculations, monitoring stormwater outfalls, creation and enforcement of local ordinances, annual reporting, development of a communications strategy for municipal residents, and other issues. WDNR municipal stormwater permits require implementation of best management practices for source-area control instead of numerical effluent limits.

Environmentally, WPDES Stormwater Permits help decrease the amount of polluted runoff entering the waters of the State by requiring the development and implementation of Industrial Stormwater Pollution Prevention Plans, Construction Site Erosion Control Plans, and Municipal Stormwater Management Plans. Less polluted stormwater means fewer chemicals, fewer heavy metals, and less sediment in Wisconsin waterways, making them healthier for people and wildlife.

As part of the required adoption of a nonpoint source pollution control plan, we recommend the City require structural and non-structural water quality enhancing measures in addition to water quantity control practices from development activity that meet the following criteria:

1. The water quality management duties apply to property development disturbing 5 or more acres or property development disturbing one or more acres after March 10, 2003, and the water quantity management duties apply to development that increases impervious surface by one-half acre or more, or,

2. Land development activity of any size that, in the opinion of the City, is likely to result in stormwater runoff, which exceeds the safe capacity of existing City-owned drainage facilities or receiving surface waters. (which causes undue channel erosion, unreasonably increases surface water pollution by scouring or the transportation of particulate matter, or endangers downstream property on a surface water).

In general, development activity meeting these criteria will be required to include water quality management practices through the use of structural pollution control measures that include wet ponds, constructed wetlands, bioretention areas, and other WDNR endorsed facilities constructed in accordance with the WDNR stormwater management guidelines. The following sections describe the main features of these practices.

Most communities in the Milwaukee Metropolitan area require the construction of wet detention ponds for water quality improvement purposes. As a reference, we have complied the following summary of management practices in the area:

Community	Stormwater Quality Criteria
City of Franklin (current rules)	Permanent pool, minimum depth of 2 to 4 feet.
City of Mequon	Permanent Pool, permanent volume to contain runoff from the 2.5 inch, 24-hour rain.
City of Brookfield	Minimum permanent volume to contain runoff from the 1.5 inch, 4-hour rain.
City of New Berlin	Permanent volume to contain 2-yr. rain.
City of Oak Creek	Minimum permanent pool, pond surface area, and forebays are required.
City of Muskego	Removal of 80% of TSS using SLAMM.
Waukesha County	Minimum permanent volume to contain runoff from the 1.5 inch, 4-hour rain.
Village of Germantown	Permanent pool, minimum depth of 4 feet.
Village of Menomonee Falls	Permanent pool, minimum depth of 4 feet.

A review of the various municipal management practices shows that the water quality management rules in Franklin should be expanded. More stringent regulations should be established to protect the City's waterways and wetlands against urban nonpoint source pollution.

As part of the stormwater management practices in Franklin, we recommend stormwater discharges be treated to remove, on an average annual basis, a minimum of 80% of total suspended solids in urban runoff.

For redevelopment or in-fill development under 5 acres, the total suspended solids load should be reduced by 40%, based on the average annual rainfall, as compared to no runoff management controls.

To achieve this level of control, stormwater practices should be designed in accordance with the methods set forth in the latest edition of the "Wisconsin Stormwater Manual, Part 2: Technical Design Guidelines for Stormwater Best Management Practices" as published and regularly amended by the WDNR.

3.3.1. Wet Detention Ponds

A wet detention pond (sedimentation basin) is a facility that traps suspended solids and buoyant debris transported by stormwater runoff. By trapping some suspended solids, the sedimentation basin also removes potential pollutants adsorbed onto or absorbed into the solids.

Wet detention ponds are effective in controlling particulate pollutants, and can be designed to control peak flow discharges. Consequently, they serve a variety of needs including pollution control, flood control and control of stormwater flows that may cause streambank erosion and streambed scour. Stormwater quality ponds shall be designed and constructed as follows:

- Permanent wet detention volume of the facility should be equal to or greater than the runoff volume resulting from a 1.5-inch, four-hour rainfall over the drainage area under post-development conditions.

- The pond outlet structure should be designed so that the post-development peak flow discharge during the two-year rainfall does not exceed the lesser of 0.15 cfs/acre or the one-year pre-development runoff.

- Water quality ponds larger than 0.5 acre of surface area must have a sediment forebay area at the pond inlet location, unless the City specifically waives this requirement due to either the pond having multiple cells, or due to the surface area of the pond being within 2,500 square feet of the 0.5 acre requirement.

- The surface area of the forebay shall be about 12% of the total pond surface area as prescribed by the WDNR on page 8 of "Wisconsin Stormwater Manual: Wet Detention Basins (G3691-4)" (see Appendix D).

- Whenever and wherever possible and feasible, the water quality ponds should have multiple cells in addition to the forebay. When a pond surface area larger than one acre (not including the forebay) is indicated, the pond must have multiple cells.

- Minimum permanent pond surface area to be:
  - 1.0% of the drainage area for residential development,
  - 2.0% of the drainage area for business and commercial development,
  - 2.5% of the drainage area for manufacturing and industrial development.
- The following features are required:
  - Minimum depth of the permanent pond 6 (six) feet,
  - "Safety shelf", minimum 10 feet wide, with maximum slope of 10:1 around pond perimeter,
  - Maximum side slope of 5:1 to edge of pond,
  - Minimum 25 feet wide vegetated buffer strip (not mowed) around pond perimeter (normal water level),
  - Minimum distance, from the pond bottom to groundwater elevation, of three feet

For more information on the use of wet detention ponds for water quality, pollutant removal performance, and design guidance on wet detention basins, please refer to the "Wisconsin Stormwater Manual: Wet Detention Basins (G3691-4)", included here as Appendix D and "City of Franklin Storm Water Detention/Retention Basin Landscape Guidelines", included as Appendix F.

Due to the many physical processes that must be considered simultaneously, the design for water quality protection involves more complicated calculations. Designers often use guidelines that have been developed through academic and government research and made available to the engineering community by various agencies, like the Wisconsin Department of Natural Resources (WDNR).

When the design guidance is followed, the resulting basin size, volume, and features will meet a set of standards that constitute an appropriate and desirable level of pollution control in a watershed.

Water quality control design in Franklin is currently achieved through the use of WDNR recommended design of wet detention basins. The use of these design parameters result in basins that remove 80% of the total suspended solids in the runoff.

3.3.2. Constructed Wetlands

In some situations, a sedimentation basin followed by a natural, restored or constructed wetland can be an effective means of removing suspended solids, nutrients, and other potential pollutants from storm water runoff. The primary function of the sedimentation basin is, as already noted, to remove buoyant debris and suspended solids and the related potential pollutants. Stormwater then passes into the wetland where physical (e.g., settling) and biological (e.g., nutrient uptake by vegetation) processes remove additional potential pollutants. The wetland offers opportunities to develop wildlife habitat, education (e.g., self-guided tours), and aesthetic benefits.

In addition to regular maintenance activities, several design features can be incorporated to ease the maintenance burden of stormwater wetlands.One potential maintenance concern in stormwater wetlands is clogging of the outlet. Wetlands should be designed with a non-clogging outlet such as a reverse-slope pipe, or a weir outlet with a trash rack. A reverse slope pipe draws from below the micropool extending in a reverse angle up to the riser and establishes the water elevation of the micropool. Because these outlets draw water from below the level of the micropool, they are less likely to be clogged by floating debris.

Wetlands should incorporate design features that make sediment cleanouts of both the forebay and the shallow pool easier. Wetlands should have direct maintenance access to the forebay, to allow this relatively routine (five to seven year) sediment cleanouts. In addition, the shallow pool should generally have a drain to draw down the wetland for the more infrequent dredging of the main cell of the wetland.

In general, the introduction of natural features in constructed wet detention basins will not only increase pollutant removal capacity, but also result in a new water body that can potentially come to offer wildlife habitat values. In order to help this process, the wet detention ponds must be specially designed to have the appropriate geometry, location, size, and vegetation. Such facilities are called constructed wetlands and have been shown to be effective, successful, and reliable in the long run.

Because of their natural appearance, water quality benefits, and need for minimum maintenance, constructed wetlands are preferred and should be encouraged whenever appropriate and/or possible. However, it should be noted that Stormwater wetlands are designed specifically for the purpose of treating stormwater runoff, and typically have less biodiversity than natural wetlands both in terms of plant and animal life.

Some limitations of stormwater wetlands include:

- Wetlands consume a relatively large amount of space, making them an impractical option on many sites where surface land area is constrained or land prices are high.

- Although design features can minimize the potential of wetlands to become a breeding area for mosquitoes, there can be public perception that wetlands are a mosquito source. However, because constructed wetlands mimic the habitat values of natural wetlands, they are more likely to attract those species that are mosquito predators as well. This means that the balance between species at constructed wetlands can help maintain mosquito populations in check.

- Wetlands require careful design and planning to ensure that wetland plants survive and flourish after construction.

- Some evidence exists that stormwater wetlands can release some nutrients during the non-growing season.

- Designers should ensure that wetlands are not built in natural wetlands or high quality forest.

3.3.3. Bioretention Facilities

Bioretention areas are landscaping features adapted to treat stormwater runoff on the development site. They are commonly located in parking lot islands or within small pockets in residential land uses. Surface runoff is directed into shallow, landscaped depressions. These depressions are designed to incorporate many of the pollutant removal mechanisms that operate in forested ecosystems. During storms, runoff ponds above the mulch and soil in the system. Runoff from larger storms is generally diverted past the facility to the storm drain system. The remaining runoff filters through the mulch and prepared soil mix. Typically, the filtered runoff is collected in a perforated underdrain and returned to the storm drain system.

Bioretention systems are generally applied to small sites, but can be applied to a wide range of development. Bioretention can be applied in many climate and geologic situations, with some minor design modifications. In cold climates, bioretention areas can be used as a snow storage area. When used for this purpose, or if used to treat parking lot runoff, the bioretention area should be planted with salt tolerant, and non-woody plant species.

3.3.4. Forebays (pre-settlement basins)

Pre-settlement basins or forebays consist of additional storage space located near a stormwater practice inlet that serves to trap incoming coarse sediments before they accumulate in the main treatment area. In general, the surface area of the forebay is typically about 10% of the volume of the main pool.

The forebay is designed to settle out coarse sediment particles before they reach the main pool. By trapping these sediments in the forebay, it is possible to greatly reduce the maintenance burden of the pond. Coarse sediments are trapped in the forebay, and these sediments are removed from the smaller pool on a five to seven year cycle.

It is recommended that wet detention ponds or constructed wetlands with a total main pool area of greater than 0.5 acres should have a forebay area to create an additional level of sediment removal and maintenance reduction.

3.4. Requirements From New Development

The practical application, guidance and enforcement of the proposed stormwater management standards will be requirements of a formal Stormwater Management Plan for all new development proposed for Franklin. In order to streamline the submittal and review process, we recommend the Plan contents be clearly defined, and that the submittal format be standardized to the greatest extent possible. To this end, a sample **Stormwater Management Checklist** is included in this report as Appendix E.

We further recommend the Stormwater Management Plan required under this recommendation contain: any information the City may need to evaluate the environmental characteristics of the area affected by land development activity; the potential impacts of the proposed development upon the quality and quantity of stormwater discharges; the potential impacts on water resources and drainage utilities; and, the effectiveness and acceptability of proposed stormwater management measures in meeting the performance standards set forth in City Ordinances. At a minimum, the following four components should be submitted with each development proposal:

A. PRE-DEVELOPMENT SITE CONDITIONS, a description of the existing conditions of the site, including:

1. A topographic and cadastral map of the site at a scale of one inch equals 100 feet or larger,

2. The hydrologic and hydraulic characteristics of the site including drainage flow paths and directions of flow onto, through, and out of the site; related drainage basin boundaries, including off-site tributary areas; times of concentration,

3. The location of areas where stormwater may collect or percolate into the ground,

4. Locations where runoff enters the site from adjacent tributary areas together with the size of those areas, expressed in acres,

5. Locations where runoff leaves the site and the contributing watersheds to each of these locations, expressed in acres,

6. Two-year, 24-hour, SCS TYPE II peak runoff rate at each location where runoff leaves the site, expressed in cubic feet per second,

7. Ground water elevations,

8. Soils by hydrologic group,

9. Cover type and condition,

10. Location and extent of impervious surfaces, including type and condition of the surfaces,

11. Locations and outlines of all buildings or other structures,

12. Location of all receiving bodies of surface water on or within 100 feet of the site into which stormwater flows,

13. Locations and sizes of wetlands on or within 100 feet of the site, as well as the person delineating and the date of delineation,

14. Location and extent of the 100-year recurrence interval flood hazard area associated with any perennial stream or watercourse on or within 100 feet of the site,

15. Information regarding current water quality objectives and current water quality conditions in any perennial watercourses located on or within 100 feet to the site,

16. Locations, sizes, and elevations of all existing storm sewers, channels, ditches, detention or retention ponds, or other engineered drainage facilities on or within 100 feet of the site, and,

17. Locations of any existing water supply wells and wellhead protection areas.

B. PROPOSED POST-DEVELOPMENT SITE CONDITIONS, describing the alterations proposed at to the site and the resulting proposed post-development conditions, including:

1. Explanation of the provisions to preserve and use natural topography and land cover features to minimize changes in peak flow runoff rates and volumes to surface waters,

2. Explanation of any restrictions on stormwater management measures in the development area imposed by wellhead protection plans and ordinances,

3. Proposed changes in the planimetry of the site, and in the topography of the site by contours having the same contour interval and referred to the same datum as used to present the topography of the existing site conditions,

4. The location and outline of all proposed buildings or other structures,

5. Changes in the location, extent and type of impervious surfaces,

6. The location, type, and extent of areas where vegetation is to be disturbed or planted,

7. Impacts on existing natural storage or infiltration areas,

8. Changes in the drainage flow paths into, through, out of the site, and related changes in drainage basin boundaries,

9. The location, elevations and sizes of all proposed minor and major stormwater management facilities; the former including all storm sewers and inlets, the latter including curbed roadways, roadway ditches, culverts, storage facilities, and interconnected flow paths,

10. Any changes to lakes, streams, watercourses, or wetlands on or within 100 feet of the site, and,

11. The location and widths of required public rights-of-way or easements needed to accommodate the recommended stormwater management facilities.

C. ANTICIPATED IMPACTS, a description of the following anticipated impacts of stormwater runoff from the proposed development, redevelopment or land division as managed by the facilities and measures recommended in the plan:

1. Computed 100-year, 24-hour, SCS TYPE II peak runoff rate at each location where runoff leaves the site, expressed in cubic feet per second,

2. Computed two-year, 24-hour, SCS TYPE II peak runoff rate at each location where runoff leaves the site, expressed in cubic feet per second,

3. Computed peak runoff rate corresponding to 0.15 cfs/acre,

4. Computed peak runoff rate corresponding to 0.5 cfs/acre,

5. Computed runoff volume for the 1.5-inch, four-hour rainfall using the Huff Distribution,

6. All major assumptions used in developing input parameters shall be clearly stated. The computations shall be made for each discharge point into and out of the site, and the geographic areas used in making the calculations shall be clearly cross-referenced to the required map(s), including off-site tributary watershed areas,

7. Changes in the locations and conveyance capacities of stormwater discharge points from and to the site concerned,

8. Adequacy of receiving storm sewer engineered stormwater management facility or watercourse to convey or store the anticipated peak rate of stormwater discharge from the site concerned, giving due consideration to existing and off-site flows,

9. Changes in the location and extent of the 100-year recurrence interval flood hazard area of any perennial watercourse location within, through, or within 100 feet of the site,

10. Results of investigations of soils and groundwater required for the placement and design of stormwater management measures, and,

11. Changes in ground water elevations.

D. PROPOSED STORMWATER MANAGEMENT FACILITIES AND MEASURES, a definitive description of the proposed stormwater management facilities and measures for the control of the quantity and quality of the anticipated stormwater runoff from the proposed development, redevelopment or land division. The description of the proposed management facilities shall include:

1. For detention and retention facilities: locations, areas, depths, volumes, inlet and outlet configurations (and elevation of the bottoms), and of key inlet and outlet control structures,

2. For conveyance facilities: locations of inlets and manholes and associated rim and invert elevations, and pipe sizes, slope and materials; locations, elevations, and cross sections of ditches, swales and channels; and culvert sizes, inlet and outlet configurations and elevations,

3. Design computations and all applicable assumptions for the stormwater conveyance (open channel, closed pipe, etc.) system,

4. Detailed drawings including cross-sections and profiles of all permanent stormwater conveyance and treatment practices,

5. Design computations and all applicable assumptions for stormwater quality practices (sedimentation type, filtration type, infiltration type) as needed to show that practices are appropriately sized to accommodate runoff from the 1.5-inch rainfall,

6. For practice designs that depart from those specified in the "Wisconsin Stormwater Manual, Part 2: Technical Design Guidelines for Stormwater Best Management Practices", the results of continuous simulation modeling, conducted according to the guidelines established in that manual, shall be presented in such a way as to show the reduction in average annual total suspended solids loading from the developed site,

7. Erosion Control Plan in accordance with the "Wisconsin Construction Site Best Management Practices Handbook", published and periodically updated by the Wisconsin Department of Natural Resources,

8. Measures to abate any potential pollution of surface and ground waters,

9. A schedule for the construction of the recommended stormwater management facilities and estimates of attendant capital and operation and maintenance costs,

10. A maintenance plan developed for the life of each stormwater management practice, including the designated and reserved maintenance access route(s), required maintenance activities and maintenance schedule,

11. A landscaping plan in accordance with "The City of Franklin Unified Development Ordinance – Pond Landscaping Guidelines" (included herein as Appendix F), and,

12. Other information as needed by the City to determine compliance of the proposed stormwater management measures with the provisions of this Section.

3.5. Stormwater Pond Maintenance Guidelines

In the last seven to eight years, more than 100 stormwater management ponds have been constructed in Franklin. As development continues, it is foreseeable that the number and complexity of stormwater management ponds will continue to increase. It is therefore important that a rigorous Pond Maintenance plan be implemented to ensure the continued operation of these facilities.

Pond Maintenance Guidelines include the areas of vegetation and planting inspection, structural inspection, sediment removal, and nuisance waterfowl control. It is recommended that the following items are included in a regularly scheduled maintenance plan.

Vegetation Maintenance

Trees and Brush

Trees and brush will not be permitted on structural berms or embankments engineered for runoff storage purposes. Extensive root systems can provide seepage paths for water. Trees that blow down or fall over can leave large holes in the slope or berm surface that will cause instability can lead to increased erosion. Brush obscures the surface limiting visual inspection, provides a haven for burrowing animals, and retards growth of grass vegetation. Tree and brush growth adjacent to concrete walls and structures may eventually cause damage to the concrete and therefore will be removed.

Stump Removal and Sprout Prevention

Stumps of trees should be removed so vegetation can be established and the surface mowed. Stumps can either be removed by pulling or with machines that grind them down. All woody material should be removed to about 6 inches below the ground surface. The cavity should be filled with well-compacted soil and grass vegetation established.

Stumps of trees in riprap cannot usually be pulled or ground down, but can be chemically treated so they will not continually form new sprouts. Certain herbicides are effective for this purpose and can even be used at water supply reservoirs if applied by licensed personnel. These products should be painted, not sprayed, on the stumps. Other instructions found on the label should be strictly followed when handling and applying these materials. Only a few commercially available chemicals can be used along shorelines or near water.

Landscaping

Vegetation shall be examined regularly, at least twice during the first two growing seasons, and then on a yearly basis after that. Stunted growth of pond vegetation or growth and excessive invasive species indicate that increased maintenance and intervention will be necessary.

The prairie area will be managed by mowing, hand removal of invasive species, or burning, which should take place every two years. Emergent and submergent vegetation around the perimeter of the pond areas will be inspected annually and any non-native and invasive species be removed. Herbicides should not be used near open water areas.

Maintenance of Structural Embankment Slopes and Berms

Structural embankments or berm slopes, areas adjacent to outlet structures, vegetated channels, and other areas associated with the pond will require continual maintenance of the vegetated cover. Grass mowing, brush cutting, and removal of woody vegetation (including trees) are all necessary for the proper maintenance of the pond. If structural berms or embankments are present, the slopes should be mowed at least twice a year, if not more often. It is important to remember not to mow when the slope is wet. It is also important to use proper equipment for the slope and type of vegetation to be cut. Aesthetics, unobstructed viewing during inspections, and discouragement of groundhog habitation are reasons for proper maintenance of the vegetated cover.

Methods used in the past for control of vegetation, but are now considered unacceptable include chemical spraying. More acceptable methods include the hand removal of invasive species, use of weed whips or power brush-cutters and mowers. Chemical spraying to first kill small trees and brush is acceptable if precautions are taken to protect the local environment.

Going one step beyond controlling vegetation, a lack of vegetation may produce erosion. All areas experiencing erosion should be repaired immediately. The area should be filled with compacted cohesive soils, topping off with 4 to 6 inches of topsoil.
Seed, fertilize, and mulch promptly to reestablish vegetation as defined in the City of Franklin Storm Water Detention/Retention Basin Landscaping Guidelines as included in Appendix F.

Sediment Removal - Dredging

One of the chief goals of inspection, operation, and maintenance practices is the preservation of the storage volume in ponds. Sedimentation below the normal water elevation reduces the volume of the permanent pool and thereby reduces water quality benefits. Any sediment accumulation above the normal water elevation will reduce the available flood storage capacity.

Excessive sediment buildup at the pond bottom required pond dredging as part of the regular maintenance of the facility. It is expected that under normal operation and circumstances, dredging will be required approximately every 15 to 20 years. The following practices help ensure dredging is not warranted prematurely:

- Construction site erosion control,
- As-built survey of the pond at time of completion,
- Successful re-vegetation and/or restoration of pond surroundings.

Unusual circumstances, very high flows, flooding, or slope instabilities may result in higher than normal sediment buildup. If such build up is observed or

measured, dredging on a limited basis may be necessary. No buildup of sediment above the normal water level will be allowed and such buildup will be removed as soon as practically possible to do so.

Mechanical Maintenance

Galvanized Steel Grating

The galvanized steel grating should require minimal maintenance. Maintenance should be scheduled as the result of deficiencies found in the detailed inspections. Possible maintenance includes replacement of the steel hold-down clips, cleaning, treating, and applying surface finishes.

Concrete

During inspections, the concrete portions of the outlet box structure should be examined for spalling, cracking, slipped joints or other movements, erosion, etc. Cracking can indicate excessive stress and can lead to seepage. Seepage through cracks and joints promotes further deterioration of concrete through freeze-thaw cycles. If ignored, these conditions can lead to exposure of reinforcing steel, which in turn can lead to failure of the structure. The speed at which the cracks widen should be tracked and documented with photographs or instrumentation records. Any cracks or displacement of joints in the concrete require the immediate attention of a qualified engineer. Do not attempt repair of cracks.

Other observed surface deterioration should be repaired/filled in with a concrete patching material. In areas that may be submerged during flooding conditions, the material should be a polymer-modified, Portland cement-based, two component, fast setting, trowel grade patching mortar suitable for continuously submerged applications. For applications greater than 1 inch in thickness, aggregate should be added per manufacturer's recommendations. Prior to application, a bonding agent compatible with the patching mortar should be used to prepare the existing concrete surface. Consult an engineer if you have any questions.

Miscellaneous Maintenance

Debris and Obstructions

It is important to regularly remove any accumulation of debris, which may act to block the primary outlet, the trash rack leading into the outlet pipe, or the outlet pipe itself. If any of these items become obstructed, a rise in the pond level could occur, creating undue stress and endangering the slopes and berms. In addition, debris can promote deterioration of the slopes through abrasive actions.

Animal Burrows

Animal burrows provide a seepage path for water through the berms. Concentrated seepage can result in slope failure. All burrows should be filled in with soil or grout, topped and seeded for erosion protection.

Riprap

Riprap protection against scouring and erosion shall be provided at pond inlet and outlet pipe discharge locations. Riprap can also be placed at overflow berms and emergency overflow locations to ensure the structural stability of berms and embankments.
Maintenance of riprap areas should be relatively minor. Any displaced riprap should be replaced. This may be occurring near the water surface, when ice accumulation can move riprap.

The riprap at the site shall be placed over geotextile fabric. Roots from vegetation may act to compromise this fabric, thereby reducing its effectiveness. Therefore, all vegetation in riprap areas should be removed using methods described in Vegetation Maintenance.

Nuisance Waterfowl Control
Nuisance waterfowl control is generally achieved through the use of upland or shoreland buffers consisting of un-mowed tall vegetation. The buffer zone can be mowed in the early summer of the second full growing season to the maximum height achievable by mowing equipment. No further maintenance flowing the third growing should be necessary. However, the waterfowl buffer shall continue be subject to the yearly inspection and maintenance requirements as described in Vegetation Maintenance.

3.6. Stormwater Management Ordinance

The City of Franklin, along with most communities in the Metropolitan area, is required to enact a Stormwater Management Ordinance to comply with the flood control objectives of (1) the MMSD's Chapter 13 rules, and (2), the nonpoint source pollution control objectives of Wisconsin's Pollution Discharge Elimination System (WPDES) through the NR216 Stormwater Discharge Permit.

Because of their highly simplified and streamlined nature, the flood control provisions of the MMSD Chapter 13 rules can be easily incorporated into the existing stormwater management practice in Franklin. The adoption of best management practices as a way to enforce nonpoint pollution reduction is also quite similar to Franklin's existing water quality pond requirements. In fact, the recommended management and design criteria presented in Sections 3.1 and 3.2 follow and comply with both of these requirements.

In addition, the Ordinance must also include additional provisions that are not directly related to the construction of stormwater detention basins. Through the NR 216 Stormwater Discharge Permit, the State requires the adoption of an Ordinance that will allow the City to:

1. Control the contribution of pollutants to the municipal separate storm sewer system from stormwater discharges associated with industrial activity,
2. Prohibit illicit discharges to the municipal separate storm sewer system,
3. Control the discharge of spills, dumping or disposal of materials other than stormwater into the municipal separate storm sewer system,

4. Control (through inter-municipal agreements) the contribution of pollutants from one municipality to another,
5. Require compliance with conditions in ordinance, permits, contracts, or orders,
6. And, allow inspections, surveillance and monitoring of storm sewer systems.

A sample ordinance that meets these requirements is included in Appendix G. The Village of Whitefish Bay developed this document for adoption for compliance with the MMSD Chapter 13 and NR 216 regulations.

The adoption of an Ordinance of this content means that long term water quality, drainage and flood control requirements of any new development or re-development in the City will be available as a comprehensive document. The Ordinance will cover long term stormwater discharges after construction has been completed. Note that the Ordinance will not overlap with the construction site erosion control regulations already adopted by the City. To the contrary, the new Stormwater Ordinance will complement the existing construction site erosion control practices.

Note that, under the Root River NR 216 Permit Group agreement, SEWRPC will develop a model ordinance to address the requirements of NR 216 rules. It is expected that Franklin, along with the other communities in the Group, will have an opportunity to customize and adopt a version of the model ordinance that best suits its needs and long term goals.

The recommended Ordinance requirements are presented in Section 3.4 – "Requirements From New Development" of this Report.

3.7. Additional Resource Management Concepts

As stormwater runoff management practices are established, it is important to note that environmental protection and preservation in urbanizing areas involve more than the control of runoff discharge rates or the removal of nonpoint source pollutants from runoff.

The health and well being of the natural systems in Franklin can also include upland management, forestry management, environmental corridors, and environmentally sensitive development patterns. While stormwater management is sometimes an important part of this overall stewardship, it is by no means the only one.

It is therefore our recommendation that the stormwater management component of proposed development in Franklin be incorporated into a larger and more comprehensive approach that will fulfill the City's long term environmental stewardship objectives.

The present Stormwater Management Plan Update presents technical and administrative guidance to construct best management practices to prevent (or reduce) flooding and maintain and improve water quality in receiving water bodies. In addition to this guidance, we recommend additional procedures be established to address the following issues to the greatest extent possible:

Preservation of Upland Buffers

Upland buffers surrounding wetlands or waterways provide a transition zone and prevent direct urban encroachment on natural waters. The width of the buffer zone depends on the characteristics of the water body; ecologically sensitive waters would need wider upland buffers. Current and proposed upland buffer requirements in Franklin reflect this reality in natural resource management.

Preservation/Creation of Environmental Corridors

In addition to the primary environmental corridors designated by SEWRPC, it is important to identify, delineate, inventory, and protect secondary environmental corridors. The movement of wildlife depends on the existence of continuous natural areas. Therefore, ecological values of individual water bodies or open areas will be significantly increased if these are part of a corridor. It is important that the establishment and preservation of environmental corridors be undertaken as a planning task so that future development in Franklin does not compromise the continuity of these corridors. As in the case of the primary corridors, all corridors should be assessed and evaluated by SEWRPC at regular intervals. The City should recognize this and make the process a part of the Franklin Land Use planning cycle.

Natural Resource Impact Reviews of Proposed Development

Along with the review of the infrastructure and engineering aspects of proposed development, it is important to conduct a natural resource impact review of proposed development activity. This Review should include downstream water body assessment and classification, assessment of ecological value of the site and its surroundings, investigation of endangered or threatened species on site, determination of upland vegetation values, evaluation of forestry impacts and so forth. The Impact Review should be conducted early in the process, so that developers have the opportunity to tailor the site within the natural resource values of the site.

Construction and Post Construction Evaluation of Development

While it is important to establish procedures for stormwater management and natural resource preservation, the success of any management program is in its implementation. Because of this, we recommend the construction and post construction inspection and evaluation of management practices be used to enforce existing and future municipal regulations. This evaluation should include engineered systems as well as the natural environment, so that the measures are imposed on developers are in fact effective in fulfilling their intent and purpose. Detention pond as built review, landscape plan success review, sampling of sediment, or monitoring of wildlife in downstream water bodies can all be used to evaluate the effectiveness of the measures installed by developers.

Milwaukee Metropolitan Sewerage District Conservation Plan

In October 2001, the Conservation Fund published a Conservation Plan that identifies undeveloped private properties that could be used for flood control. The Plan also assesses the funding entities that could assist the MMSD in acquisition, management and maintenance of the properties. The entities would also aid in determining how ecological restoration of the identified properties could be used for flood control.

The Conservation Plan Executive Summary is included as Appendix H, along with a map that shows several properties in the City identified as potential sites for purchase and/or restoration.

According to the current MMSD conservation policy, the City of Franklin is eligible to identify other qualifying conservation sites for potential inclusion on the MMSD site list. To qualify, a potential site must be 25 acres or larger, have hydric soils, and be owned privately. If found, such sites may be included in the District's Conservation Plan and become eligible for funding assistance for purchase.

3.8. Management Program Schedule

We anticipate that the stormwater quantity and quality management practices will largely be driven by development activity in the City. Because of this, the schedule of implementation for stormwater detention facilities is not addressed in this report. It is understood that, from time to time, and as necessary, the City will undertake flood control projects in various problem spots. When this is the case, we recommend that the facilities under consideration include regional ponds that have both flood control and water quality benefits to the greatest extent possible.

We also note that a nonpoint source control program in addition to the water quality pond requirement, will need to be developed and adopted as part of Franklin's NR 216 Stormwater Discharge permit. The program components developed under the NR 216 permit will have a recurring five-year cycle implementation schedule that will be approved and enforced by the WDNR when the permit is issued at the beginning of 2003.