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8.1. FINDING OF FACT

8.1.1. Land development activities and associated increases in site impervious cover often alter the hydrologic response of local watersheds and increase stormwater runoff rates and volumes, flooding, stream channel erosion, or sediment transport and deposition.

8.1.2. This stormwater runoff contributes to increased quantities of water-borne pollutants, including siltation of aquatic habitat for fish and other desirable species.

8.1.3. Improper design and construction of stormwater best management practices (BMPs) can increase the velocity of stormwater runoff thereby increasing stream bank erosion and sedimentation.

8.1.4. Impervious surfaces allow less water to percolate into the soil, thereby decreasing groundwater recharge and stream base flow.

8.1.5. Substantial economic losses can result from these adverse impacts on the waters of the municipality.

8.1.6. Stormwater runoff, soil erosion and nonpoint source pollution can be controlled and minimized through the regulation of stormwater runoff from land development activities.

8.1.7. The regulation of stormwater runoff discharges from land development activities in order to control and minimize increases in stormwater runoff rates and volumes, stream channel erosion, and nonpoint source pollution associated with stormwater runoff is in the public interest and will minimize threats to public health and safety.

8.1.8. Regulation of land development activities by means of performance standards governing stormwater management and site design will produce development compatible with the natural

functions of a particular site or an entire watershed and thereby mitigate the adverse effects of stormwater runoff from development.

8.1.9. Clearing and grading during construction tends to increase soil erosion and add to the loss of native vegetation necessary for terrestrial and aquatic habitat.

8.1.10. Illicit and non-stormwater discharges to the storm drain system can contribute a wide variety of pollutants to waterways, and the control of these discharges is necessary to protect public health and safety and water quality.

8.2. PURPOSE

8.2.1. The procedures and standards, as set forth in this manual for the regulation of stormwater in the City of Lebanon and its immediate environs (in which, under some circumstances, it may have influence and/or jurisdiction) are deemed necessary to promote the public health, safety, and general welfare of the citizens of Lebanon in and by the following methods:

8.2.1.1. To inhibit the deterioration of water resources resulting from development;

8.2.1.2. Regulating stormwater from areas of new development and redevelopment;

8.2.1.3. Defining appropriate stormwater management objectives for the quantity and quality of stormwater runoff in the City;

8.2.1.4. Providing requirements for the protection of water resources;

8.2.1.5. Requiring adherence to site stormwater management plans approved by the City Engineer;

8.2.1.6. Providing for maintenance of stormwater facilities and other City infrastructure that affects the quality and quantity of stormwater runoff;

8.2.1.7. Imposing application fees, establishing procedures for enforcement and penalties for violations, and providing for waivers where deemed appropriate in the opinion of the City Engineer.

8.2.1.8. Further, in order to protect, maintain, and enhance both the immediate and the long-term health, safety, and general welfare of the citizens of Lebanon, it is the intent of the City to accomplish the following objectives:

8.2.1.8.1. To provide drainage devices, structures, and systems that adequately convey stormwater runoff in the manner that best preserves and benefits properties within the City of Lebanon;

8.2.1.8.2. To prevent loss of life and property due to flooding;

8.2.1.8.3. To protect, restore, and maintain the chemical, physical, and biological quality of surface and ground waters;

8.2.1.8.4. To encourage the establishment, or reestablishment, and protection of a sustainable balance between the activities of the citizens of Lebanon and the natural environment in issues that affect stormwater runoff.

8.2.1.8.5. To prevent individuals, businesses, and governmental entities from causing harm to the community and its environment by activities which adversely affect water resources;

8.2.1.8.6. To encourage the protection of natural systems and the use of those natural systems in ways that will not impair their normal and beneficial functioning;

8.2.1.8.7. To minimize the transport of sediments and pollutants to surface waters and groundwater sources;

8.2.1.8.8. To protect and maintain habitat of and for fish and wildlife;

8.2.1.8.9. To help perpetuate natural groundwater recharge;

8.2.1.8.10. To encourage the use of natural drainage systems; and

8.2.1.8.11. To ensure the attainment of these objectives by requiring the approval and implementation of site stormwater management plans for all activities that may have an adverse impact upon surface waters and/or groundwater sources.

8.2.2. The City of Lebanon recognizes the establishment of design strategies and principles for Low Impact Development (LID). The City of Lebanon encourages owners/developers/designers to utilize these principles and strategies of LID within their development. These design elements will be reviewed by the City of Lebanon for possible inclusion into the development with the understanding the PUD process may need to be followed in order to incorporate comprehensive LID strategies and principles into the development.

8.3. JURISDICTION

8.3.1. The Stormwater Regulations shall apply in all areas within the development jurisdiction of the City of Lebanon.

8.4. AUTHORITY

8.4.1. The City Engineer, or his/her authorized designee, is authorized to administer the Stormwater Regulations. The City Engineer shall also maintain and update the Stormwater Management Plan. The City Engineer shall recommend to City Council, for adoption, modifications in the Stormwater Management Plan, detailed design studies, or modified procedures to reflect new construction and/or engineering design technology.

8.5. REQUIRED APPROVALS

8.5.1. Every development shall be provided with a storm drainage system that provides adequate, complete and satisfactory drainage service for the entire area being platted for all projected land uses and otherwise meeting the approval of the officials having jurisdiction. The system shall provide for draining the entire area of each and every lot. The drawing plans and specifications for such system, when finally approved by the City Engineer, shall be known as the Official Drainage Plan for such development.

8.5.2. The Official Drainage Plan shall be attached to, incorporated into by reference, and filed with the Final Plat of the subdivision or development in the Office of the Recorder of Warren County, Ohio, when such Final Plat is so recorded. The developer of the subdivision or other development shall thereafter include in each deed for the conveyance of such subdivision or development, or portion thereof, a covenant making such conveyance subject to the terms and conditions of the Official Drainage Plan. The Official Drainage Plan shall be signed and stamped by a Professional Engineer Registered in the State of Ohio.

8.5.3. The requirements of the Stormwater Regulations shall be implemented and shall be satisfied completely prior to final project approval by the City Engineer. No person shall conduct any development activity, or subdivide, or make any change in the use of land, or construct any stormwater management facility, system or structure, or change the size of an existing stormwater management facility, structure or system, except as may be exempted in Section 8.7. of this manual.

8.5.4. Any construction plans, specifications, or other documents approved by the City Engineer shall be constructed in accordance with all applicable local, state or federal permit requirements of the Ohio Environmental Protection Agency (OEPA), Ohio Department of Natural Resources (ODNR) and/or U.S. Army Corps of Engineers. No construction activity shall commence prior to obtaining applicable permits from these agencies.

8.6. EXPANSIONS/REDEVELOPMENT

8.6.1. If a site is redeveloped (demolition of existing structures and/or construction of new structures) or if the impervious area of any site is increased by an amount greater than or equal to 20 percent of

the original development of the site, the entire site shall be brought up to current stormwater standards.

8.6.1.1. Stormwater Detention

8.6.1.1.1. Stormwater detention must meet current standards. The calculations shall be based upon a virgin site, unless documentation can be provided indicating the amount of development that existed on the site prior to stormwater detention requirements.

8.6.1.2. Stormwater Quality

8.6.1.2.1. The entire site shall be treated for stormwater quality according to the regulations found in section 8.11. of this manual.

8.6.2. The exemptions found in section 8.7. of this manual apply to expansions and redevelopment.

8.7. EXEMPTIONS

8.7.1. With the approval of the City Engineer, the following activities may be exempted from on-site stormwater runoff control. An exemption shall apply only to the requirement for on-site stormwater detention or retention facilities. All other design elements such as the storm sewer system, road culverts, erosion and sedimentation control, and runoff quality shall not be exempted.

8.7.1.1. Emergency exemption: Emergency maintenance work performed for the protection of public health and welfare.

8.7.1.2. Maintenance exemption: Any maintenance to an existing system made in accordance with plans and specifications approved by the City Engineer.

8.7.1.3. Development related exemptions: The applicant shall provide to the City Engineer in writing a request for exemption which shall include a scaled site map, property tax number, and street address if applicable.

8.7.1.3.1. Single-family or duplex exemption: Single-family or duplex residential construction on a single lot that is not part of a new, residential subdivision or other common plan for new, residential development.

8.7.2. The following activities may be exempted from all Stormwater Regulations set forth elsewhere in this Ordinance, except those relating to the quality of stormwater runoff.

8.7.2.1. Historic Lebanon Central Business District exemption:

8.7.2.1.1. The City Engineer shall review and approve the expansion of existing parking lots and the construction of new parking lots of four spaces or more within the boundaries of the Historic Lebanon Central Business District, as identified in § 1132.02 and 1137.17 of the Codified Ordinances of Lebanon, consistent with the following standards:

8.7.2.1.1.1. Any new or expansion of any impervious area within the Historic Lebanon Central Business District shall be exempt from Stormwater Detention/Retention and Stormwater Quality requirements unless if, in the opinion of the City Engineer, the proposed use of an exempted property exhibits a significant environmental risk. If such a risk exists, stormwater detention and/or stormwater quality provisions shall be implemented as part of the improvements to the property.

8.7.2.1.1.1.1. One exemption is gravel parking lots. Any proposed expansion of an existing gravel parking lot will require both the existing lot as well as the proposed parking area to be paved or covered with an acceptable material as defined in the City of Lebanon Zoning Code.

8.7.2.1.1.2. A detailed plan, prepared by a professional engineer registered in the State of Ohio, shall be submitted for approval, which shall demonstrate that stormwater is conveyed in a manner that will not adversely impact adjacent and downstream properties.

8.7.2.1.1.3. Any new or expanded impervious areas shall not be exempt from compliance with other applicable City, state and federal codes and regulations.

8.7.3. The following activities may be exempted from regulations relating to the quality of stormwater runoff.

8.7.3.1. Properties less than one acre in area, unless they are part of a larger overall development.

8.7.3.2. Single-family or duplex residential construction on a single lot that is not part of a new, residential subdivision or other common plan for new, residential development.

8.7.4. If, in the opinion of the City Engineer, the proposed use of an exempted property exhibits a significant environmental risk, the stormwater quality provision exemption may be removed for said property. If the exemption is removed, all applicable stormwater regulations will be enforced.

8.8. GENERAL REQUIREMENTS

8.8.1. A stormwater management system that contains features that provide for flood protection, erosion control, and runoff pollution abatement, shall be designed and installed for any non-exempt development. The stormwater management system shall conform to the Stormwater Design Standards contained in this Section hereof, to the Stormwater Management Plan, and to other standards that may be specified by the City Engineer. The intent of these requirements is to encourage environmentally sound stormwater management practices that go beyond merely providing drainage facilities. The City's stormwater management perspective includes the management of both water quantity and water quality. Stormwater management design shall blend into the natural environment and be aesthetically integrated into site design.

8.8.2. All development activity within a special flood hazard area designated by the Federal Emergency Management Agency (FEMA) shall comply with Chapter 1308 of the Lebanon Code of Ordinances. All development shall be designed to maintain the flood carrying capacity of the floodway such that the base flood elevations are not increased, either upstream or downstream. Furthermore, no fill shall be placed or allowed to be placed in the 100-year floodplain, without an equivalent volume of soil removed to compensate for the consequent loss of flood storage. Compensating storage shall be determined by the volume of material removed above the ordinary high water table and below the 100-year flood elevation established for that area. Compensating storage shall be provided within the legal boundaries of the development.

8.8.3. The stormwater management system shall not create an adverse impact on stormwater quantity or quality in either upstream or downstream areas. The discharge from offsite areas which discharge onto or across a site proposed for development shall be accommodated in the site stormwater management plans for the development. No site stormwater management plan shall be approved until it is demonstrated that the runoff from the project will not overload or otherwise adversely impact any downstream areas.

8.8.4. Natural Wetlands shall not be used for stormwater management or stormwater runoff quality treatment. In some circumstances, Constructed Wetlands may be used for stormwater management or stormwater runoff quality treatment, subject to the approval of the City Engineer, or his/her authorized designee.

8.8.5. All proposed stormwater management systems shall be designed to minimize the pollution of groundwater resources by stormwater, promote safety, minimize health hazards, preserve natural features, and provide for recharge where appropriate. Neither submission of a plan under the provisions herein, nor compliance with the provisions of these regulations shall relieve any person from responsibility for damage to any person or property otherwise imposed by law.

8.8.6. Where deemed necessary by the City Engineer, the applicant shall construct storm drains to handle on-site runoff; provide on-site and off-site drainage easements; and provide for the conveyance of off-site runoff to an acceptable outlet in the same watershed.

8.9. REQUIRED SUBMITTALS

8.9.1. The following items shall be required unless otherwise indicated in writing by the City Engineer:

8.9.1.1. USGS topography map or similar type of topographic map with the area of the proposed development clearly indicated on the map. The map shall include all onsite and offsite drainage areas that will contribute stormwater to the proposed development. The purpose of this map is to allow for the entire drainage basin to be clearly identified.

8.9.1.2. Pre-development site drainage map with 4-foot maximum contours. The site drainage map shall show all onsite and offsite drainage areas that will contribute stormwater flow to the site.

8.9.1.3. Post-development drainage map with 2-foot maximum contours. This map is to delineate all drainage areas contributing to all catch basins and overland flow to detention ponds.

8.9.1.4. Stormwater piping calculations.

8.9.1.5. Stormwater detention volume and routing calculations.

8.9.1.6. Stormwater quality calculations.

8.9.1.7. As-Built Plans

8.9.1.7.1. As-built plans of all stormwater detention/retention and stormwater quality BMPs shall be submitted to the City of Lebanon prior to the release of any bonds.

8.10. STORMWATER DESIGN STANDARDS

8.10.1. General

8.10.1.1. Except where they might differ with requirements delineated herein, the ODOT Drainage Design Manual and any subsequent revisions thereto shall be used for the design of storm sewers, culverts, open channels, and permanent and temporary erosion and sedimentation control. Except where they might differ with requirements delineated herein, the latest edition of *The Water Environment Federation Manual of Practice, No. 23* and *American Society of Civil Engineers Manual and Report on Engineering Practice, No. 87* shall be used for the design of stormwater runoff quality control features of site development. The City Engineer shall recommend to City Council the adoption of any necessary modifications to the design standards of these documents.

8.10.2. Hydraulic design criteria.

8.10.2.1. Method

8.10.2.1.1. For areas up to and including 640 acres, the Rational Method shall be used. For areas in excess of 640 acres, the Soil Conservation Service (SCS) TR55 shall be used. The total area shall include offsite contributing areas in addition to the area to be developed.

8.10.2.1.1.1. Other methods may be acceptable upon approval by the City Engineer.

8.10.2.2. The design frequency for major drainage systems may be increased if deemed necessary by the City Engineer to protect upstream or downstream properties or to comply with other regulations.

8.10.2.3. Rainfall volumes shall be in accordance with data for Southwest Ohio provided in the *Rainfall Frequency Atlas of the Midwest, Bulletin 71*, 1992 and any subsequent updates thereto.

8.10.2.4. Rainfall distribution for stormwater management systems is to be in accordance with SCS Type II Rainfall Distribution.

8.10.2.5. The following 'c' values shall be used in runoff calculations

8.10.2.5.1. The average acceptable runoff coefficient shall be as follows:

Commercial development:	0.90
Industrial development:	0.90
Residential development:	
Single-family:	0.65
Multi-family	0.75

8.10.2.5.2. Composite runoff coefficient (to be used when calculating weighted 'c' values):

Crop land (row crops)	0.45
Grass land:	0.30
Woodland:	0.25
Parks (open space):	0.30
Parking lots:	0.95
Roofs:	0.95
Asphalt and concrete:	0.95

8.10.2.5.3. Calculations used to determine composite 'c' values are subject to approval of the City Engineer.

8.10.3. Detention/retention facilities.

8.10.3.1. Types:

8.10.3.1.1. The following types of stormwater detention/retention will be acceptable:

8.10.3.1.1.1. Detention Basin - (dry basin). These surface storage basin areas are created by constructing earthen embankments to retain storm water. These basins may be designed in such a manner as to be multi-use, such as park and playground and open spaces.

8.10.3.1.1.2. Retention Basins - (ponds). These basins are permanent ponds where additional storm water storage capacity is provided above normal water level.

8.10.3.1.1.3. Subsurface Storage - Subsurface storage is a structure constructed below ground for the purpose of detaining storm water.

8.10.3.1.1.4. Other types of storage may be considered on a case-by-case basis.

8.10.3.2. A detention/retention facility shall be installed on all development projects, unless the applicant demonstrates that the project will not increase the peak rate of runoff; volume, or frequency of the runoff hydrograph of the site as it existed prior to the applicant's proposed development. Detention/retention facilities shall be designed in the following manner:

8.10.3.2.1. Determine the total volume of runoff from a 1-year, 24-hour storm occurring over each of the site's drainage areas before and after development. The total runoff in cubic feet shall be determined by using the following equation:

Equation 4 - Total Volume of Runoff

$$\text{Runoff} = (A * 43560)(c)\left(\frac{R}{12}\right)$$

Where:
A is the area in acres
c is the runoff coefficient for the area
R is the total rainfall for a 1-year, 24-hour event as found in the *Rainfall Frequency Atlas of the Midwest, Bulletin 71*, 1992 and any subsequent updates thereto

8.10.3.2.2. Determine the percent of increase in runoff volume due to development. Using this percentage, select the critical storm from Table 20.

8.10.3.2.3. Determine the peak rate of runoff for the 1-year, 2-year, 5-year, 10-year, 25-year, 50-year and 100-year, 24-hour storms occurring over each of the site's drainage areas before and after development.

8.10.3.2.4. The peak rate of runoff from the critical storm occurring over the developed site shall not exceed the peak rate of runoff from a 1-year, 24-hour storm occurring over the same area prior to development, as defined in the Stormwater Management Plan.

8.10.3.2.5. Storms of less frequent occurrence (longer return period) than the critical storm shall have the peak rate of runoff not greater than that for the same storm under pre-development conditions.

Table 20 - Critical Storm Determination

If The Percent Of Increase In Runoff Volume Is:		
Equal To Or Greater Than:	**And Less Than:**	**The Critical Storm Runoff Rate Will Be Limited To:**
>0	10	1 year
10	20	2 year
20	50	5 year
50	100	10 year
100	250	25 year
250	500	50 year
500	---	100 year

8.10.3.3. Stormwater Detention Basin Sizing

8.10.3.3.1. The following method shall be used in sizing detention basins:

8.10.3.3.1.1. Calculation of existing runoff generated by an one-year, 24 hour storm is determined using Equation 5the following equation:

Equation 5 - Pre-Development Runoff

$$q = Aci$$

Where:
q is the pre-development generated flow (allowable release rate)
A is the watershed area
c is the pre-development runoff coefficient for the watershed area
i is the rainfall intensity

8.10.3.3.1.2. i is calculated by using the following equation:

Equation 6 - Pre-Development Rainfall Intensity

$$i = \frac{a}{(t+b)^d}$$

Where:
i is the pre-development rainfall intensity in inches/hour
t is the pre-development time of concentration in minutes
a is constant a found in Table 21
b is constant b found in Table 21
d is constant c found in Table 21

Table 21 – Rainfall Intensity Formula Constants

Frequency (years)	Constant a	Constant b	Constant d
1	55.977	15.400	0.912
2	85.568	16.500	0.950
5	118.822	18.700	0.969
10	112.172	16.800	0.923
25	198.920	19.300	1.004
50	206.025	19.600	0.990
100	355.551	23.199	1.076

8.10.3.3.1.3. Calculate the runoff generated by the critical storm after development using the following equation:

Equation 7 - Post-Development Runoff

$$Q = ACI$$

Where:
Q is the post-development discharge rate in CFS
A is the watershed area in Acres
C is the runoff coefficient for the watershed area
I is the post-development maximum rainfall intensity in inches per hour

8.10.3.3.1.4. The post-development rainfall intensity is determined using Equation 8.

Equation 8 - Post-Development Rainfall Intensity

$$I = \frac{a}{(T+b)^d}$$

Where:
I is the post-development maximum rainfall intensity in inches/hour
T is the post-development maximum time of concentration
a is the design storm constant a found in Table 21
b is the design storm constant b found in Table 21
d is the design storm constant c found in Table 21

8.10.3.3.1.5. The post-development time of concentration is found using the following equation:

Equation 9 - Post-Development Time of Concentration

$$T = \sqrt{\frac{(A * C * a * b)}{\left(\frac{2 * q}{3}\right) - \left(\frac{q^2 * t}{6 * C * A * a}\right)}} - b$$

Where:
T is the post-development maximum time of concentration
A is the watershed area
C is the post-development runoff coefficient for the watershed area
t is the pre-development time of concentration in minutes
a is the 1-year storm constant a found in Table 21
b is the 1-year storm constant b found in Table 21
q is the pre-development generated flow

8.10.3.3.1.6. Minimum basin sizing is determined using the following equation:

Equation 10 - Required Storage Volume

$$Vol = (60 * Q * T) - \left(\frac{2 * q * (T + t) * 60}{3}\right) + \left(\frac{q^2 * t * 60}{6 * Q}\right)$$

Where:
Vol is the required detention volume in cubic feet
Q is the post-development discharge rate in CFS
T is the post-development maximum time of concentration
q is the pre-development generated flow
t is the pre-development time of concentration in minutes

8.10.3.4. The bottom of the facility shall be designed and constructed with sufficient slopes to drain properly. Slopes of less than 2.00% for grass areas shall not be permitted.

8.10.3.5. Basin Gutters

8.10.3.5.1. For all detention basins, gutters constructed of an open, porous paving system constructed of concrete units, whether hand laid or in prefabricated assemblies shall be installed from inlet pipes to the outlet structure. Two examples of acceptable materials are Armorflex produced by Armortec, or Geoblock produced by Presto Products Company, though other products can be used, subject to approval by the City Engineer. Where two or more gutters intersect, special attention must be given to the change in direction by using large radius curves or other means so the flow is controlled in a gradual manner

8.10.3.6. Seed, sod or other approved erosion control methods or devices shall be used to protect all basin slopes.

8.10.3.7. The side slopes of a retention facility shall be no steeper than 4:1 unless the existing topographic conditions of the development site make this impractical.

8.10.3.8. Anti-seep collars shall be used on all pipe outlets of all basins.

8.10.3.9. An overflow structure shall be provided at the 50-year frequency storm elevation with the capacity to handle any blockages in the outlet structures.

8.10.3.10. Aeration shall be provided for all retention ponds. The aeration shall be sufficient to prevent stagnation of the water. Multiple aerators may be necessary in large or unusually shaped ponds.

8.10.3.11. Stormwater detention and retention ponds which meet height and storage capacities as outlined in the Ohio Department of Natural Resources Department of Water Fact Sheet entitled: *Dam Safety: Construction Permits for Dams*, are considered by Ohio Department of Natural Resources (ODNR) to be dam structures and shall be designed to safely pass the maximum probable precipitation storm or flood event as defined by ODNR. Where fill berms are proposed, calculations supporting the stability of the fill berms are to be submitted by a Geotechnical Engineer. The applicant shall design all raised berm stormwater ponds, classified by ODNR as dam structures, according to probable maximum precipitation of flood storms.

8.10.3.12. The discharge route of the all detention basins shall be shown a minimum of 250 feet downstream of the outlet structure.

8.10.3.13. If the site has multiple drainage basins, the drainage basin divides that exist prior to development shall be used to determine predevelopment rates of discharge for each drainage area of the site.

8.10.3.14. An emergency spillway capable of discharging a 100-year storm event at a depth not to exceed one (1) foot and at non-erosive velocities (less than 5 feet per second) for the spillway lining materials and downstream surfaces over and through which the spillway discharge will flow, shall be constructed at the discharge end of every detention/retention facility upon unexcavated (undisturbed) material.

8.10.3.14.1. The downstream discharge path of emergency spillway flow shall be clearly indicated at least 250 feet downstream of the emergency spillway.

8.10.3.15. Fenced stormwater facilities are strongly discouraged within the City and shall only be permitted if approved by the City Engineer. The City will consider fencing stormwater facilities <u>only where steep slopes that potentially endanger human life are unavoidable</u>. If fencing is required, the design shall be six-foot high fence, or better (i.e., brick wall) along the easement boundary around the entire perimeter, including maintenance berms with access for maintenance vehicles. Other designs may be permitted subject to the review and approval of the City Engineer.

8.10.3.16. Areas adjacent to open channels and ponds shall be graded to restrict the entrance of stormwater except at planned locations. Where retention or detention areas are located on the project periphery, the developer may be required to provide additional landscaping or screening to adequately protect abutting properties as per the standards set forth by the City of Lebanon Planning and Development Department.

8.10.3.17. The minimum requirement for maintenance berms is found in the following table:

Table 22 - Minimum Requirement for Maintenance Berms

Maintenance Ponds	Access Way Required
With fenced perimeter	20 feet all around
Without fencing	15 feet all around

8.10.3.18. Detention/retention facilities shall be designed to meet the requirements of this Chapter and the Erosion and Sediment Control requirements of section 8.12. and the Stormwater Runoff Quality requirements of section 8.11.

8.10.3.19. Full headwalls are required at all storm sewer management inlets and outlets to and from open channels, structures pipes, culverts, ponds, lakes, or other bodies of water. Headwalls

shall be constructed of reinforced, Lebanon Standard Concrete, or natural stone or brick, as approved by the City Engineer.

8.11. STORMWATER QUALITY

8.11.1. Stormwater quality provisions are in addition to stormwater quantity provisions. Facilities can be designed to handle both stormwater quantity and quality concerns, but the volumes shall be additive.

8.11.2. No person shall:

8.11.2.1. Construct, maintain, operate, and continue to operate, or utilize in any way an illicit connection to the storm sewer system.

8.11.2.2. Cause, allow or facilitate any illicit or illegal discharge.

8.11.2.3. Act, cause, permit, or suffer any agent, employee, or independent contractor to construct, maintain, operate or utilize any illicit connection, or cause, allow or facilitate any prohibited discharge.

8.11.3. Outdoor activities that, in the judgment of the City Engineer, cannot be conducted indoors shall be conducted within specified areas of the site designed to control stormwater quality in the following manner:

8.11.3.1. Runoff from outdoor activity areas shall not be allowed to co-mingle with runoff from the remainder of the site.

8.11.3.2. Runoff from outdoor activity areas shall be directed to separate treatment systems able to adequately control stormwater pollutant concentrations, as approved by the City Engineer. These systems include, but are not limited to the following:

8.11.3.2.1. The City's separate sanitary sewer system, providing the discharge satisfies all applicable requirements of Chapter 914 of the Lebanon Code of Ordinances.

8.11.3.2.2. An oil/water separator to remove uncharacteristically high concentrations of oil and grease, with treated effluent discharged to the separate sanitary sewer system.

8.11.3.2.3. A system appropriate for the containment of hazardous material spills, designed as specified in the Fire Prevention Code.

8.11.3.2.4. An industrial treatment system covered by a discharge permit issued by Ohio EPA.

8.11.4. Every site, except those exempted in Section 8.7., shall be designed to direct runoff from areas other than outdoor activity areas to one or more of the following stormwater quality treatment best management practices (BMPs).

8.11.5. BMP Types

8.11.5.1. The following BMP Types are acceptable:

8.11.5.1.1. Hydrodrnamic Systems

8.11.5.1.2. Manufactured systems

8.11.5.1.3. Vegetated Biofilter

8.11.5.1.4. Extended Detention

8.11.5.1.5. Extended Retention Basin

8.11.5.1.6. Bioretention Cell

8.11.5.1.7. Infiltration Trench

8.11.5.1.8. Infiltration Basin

8.11.5.1.9. Constructed Wetlands

8.11.5.1.10. Other approved BMPs

8.11.5.1.10.1. Any alternative BMP shall be discussed with the City Engineer in the pre-planning phase to discuss applicability and feasibility of the desired method.

8.11.5.1.10.2. Other BMPs may be recommended to satisfy the requirements of this chapter of the Stormwater Management Plan if:

8.11.5.1.10.2.1. the site, or experience at the site fails to demonstrate that the above, original BMPs remove at least 85% of the average annual pollutant load contained in runoff from the site,

8.11.5.1.10.2.2. that these BMPs do not possess adequate provisions for long-term maintenance,

8.11.5.1.10.2.3. create a nuisance, or

8.11.5.1.10.2.4. fail to satisfy other sections of the Stormwater Regulations.

*NOTE: Wet extended and dry extended detention basins, in this context, refer to those intended for the control of the quality of stormwater runoff. Their purpose and function here is not to control the volume of runoff as in Paragraph 8.10.3., even though they do provide some measure of volume control. While detention basins designed for volume control afford a significant stormwater quality control function, they are always larger and their volume is determined by completely different criteria and methods.

8.11.5.1.10.3. The design stormwater quality event for these BMPs shall be the first three-quarters of an inch of rainfall of each and every storm event. BMPs shall also be designed to accommodate flows exceeding their design capacity, either bypassing excess flows, conveying excess flows through the facility without disrupting its stormwater quality control effectiveness, or storing excess flows as necessary to achieve the drainage, flood control, and erosion control objectives of this chapter.

8.11.6. Water Quality Volume

8.11.6.1. Water Quality Volume Calculation

8.11.6.1.1. The following equation shall be used to calculate the water quality volume:

Equation 11 – Water Quality Volume Calculation

$$WQv = \frac{T(P * A * Cq)}{12} * 43{,}560$$

Where:

WQv = Water Quality Volume in Cubic-Feet

T =Treatment Percent (Refer to Paragraph 8.11.6.2)

P = Precipitation (0.75 inches)

A = Contributing Drainage Area to an Outfall in Acres

$Cq = 0.858i^3 - 0.78i^2 + 0.774i + 0.04$

i = impervious area divided by the total area

8.11.6.2. Treatment Percent

8.11.6.2.1. A contributing drainage area to an outfall that has both existing and new impervious areas requires a weighted average calculation to determine the percent of treatment required. Existing impervious area requires treatment of 20% of the area. New impervious area requires treatment of 100% of the area. This percent is multiplied by the calculated WQv

or the ExT length to determine the amount of treatment. Use the following equation to determine the percent of treatment:

Equation 12 – Treatment Percent

$$\text{Treatment} = \frac{[(\text{Aix} * 20) + (\text{Ain} * 100)]}{(\text{Aix} + \text{Ain})}$$

Where:
Treatment = Treatment Percentage (%)
Aix = Existing Impervious Area in Acres
Ain = New Impervious Area in Acres

8.11.6.3. Structural BMP Using the WQv

8.11.6.3.1. The water quality volume (WQv) is the treatment volume required for post construction BMP. Use the WQv for the following BMP:

8.11.6.3.1.1. Vegetated Biofilter

8.11.6.3.1.2. Extended Detention

8.11.6.3.1.3. Extended Retention Basin

8.11.6.3.1.4. Bioretention Cell

8.11.6.3.1.5. Infiltration Trench

8.11.6.3.1.6. Infiltration Basin

8.11.6.3.1.7. Constructed Wetlands

*NOTE: Wet extended and dry extended detention basins, in this context, refer to those intended for the control of the quality of stormwater runoff. Their purpose and function here is not to control the volume of runoff as in Paragraph 8.10.3., even though they do provide some measure of volume control. While detention basins designed for volume control afford a significant stormwater quality control function, they are always larger and their volume is determined by completely different criteria and methods.

8.11.7. Water Quality Flow

8.11.7.1. Water Quality Flow Calculation

8.11.7.1.1. The water quality flow (WQf) is the discharge that is produced by using an intensity of 0.65 in/hr in the rational equation. Use the entire contributing drainage for the WQf calculation. Once an area has been treated, remove this area from the next downstream WQf calculation.

8.11.7.2. Structural BMP Using the WQf

8.11.7.2.1. Use the WQF for the following BMP:

8.11.7.2.1.1. Manufactured System

8.11.8. BMP Toolbox

8.11.8.1. Hydrodynamic Systems

8.11.8.1.1. Hydrodynamic systems consist of underground structures that treat the WQf by removing particulate matter, floatables, and oil and grease in specially designed chambers or tanks. Hydrodynamic systems have high maintenance requirements.

8.11.8.1.2. Unless approved in writing by the City Engineer, hydrodynamic systems will not be permitted for new development. Unless otherwise approved, hydrodynamic systems shall only be used in retrofit situations.

8.11.8.1.3. Hydrodynamic systems shall be capable of treating the entire WQf as described in Paragraph 8.11.7.

8.11.8.2. Manufactured Systems

8.11.8.2.1. Manufactured systems consist of underground structures that treat the WQf by removing particulate matter through settlement.

8.11.8.2.2. Unless approved in writing by the City Engineer, manufactured systems will not be permitted for new development. Unless otherwise approved, manufactured systems shall only be used in retrofit situations.

8.11.8.2.3. ODOT Supplemental Specification 895 covers the material and performance criteria for these devices. They are placed in an off-line configuration with manholes to allow for routine maintenance procedures (see figure 1118-2 in the *ODOT Location and Design Manual – Volume 2*). Provide a No. 3 Manhole, With ___" Base ID and ___" Weir at this location. Furnish two lengths of 603, Type B Conduit placed perpendicular to the inflowing trunk sewer (see reserved area table for the total length required). Use the following table when placing a Manufactured System:

Table 23 - Manufactured Systems

Type	WQf (CFS)	ODOT No. 3 Manhole Inside Diameter (Inches)	603-Type B Conduit Diameter (Inches)
1	1	84	12
2	2	90	15
3	3	96	18
4	6	108	24

8.11.8.2.4. Reserve an area (as measured from the centerline of the No. 3 Manhole) according to the following table:

Table 24 - Reserved Area for Manufactured System

Type	Width (Feet)	Length (Feet)	603-Type B Total Conduit Length (Feet)	Weir Height (Inches)
1	15	30	20	6
2	20	32	30	8
3	25	33	40	9
4	25	37	40	12

8.11.8.2.5. Center the length of the area at the No. 3 Manhole. If this area is not attainable contact Central Office Hydraulics for further guidance. Ensure this area is void of all utilities and is accessible for routine cleanout and maintenance.

8.11.8.3. Vegetated Biofilter

8.11.8.3.1. This method has limited application and is not intended for use in residential areas. Vegetated biofilters shall only be used with approval of the City Engineer. If permitted, vegetated biofilters shall be designed in accordance with the current edition of the *ODOT Location and Design Manual – Volume 2*).

8.11.8.4. Extended Detention Basins

8.11.8.4.1. Extended detention is a method that captures storm water during rain events and slowly releases the captured volume over a period of time. The WQv is used to determine the storage volume of the detention basin. The WQv is discharged over a 48 hour time frame. Increase the WQv by 20% when sizing the BMP to allow for sedimentation to occur. Detention can be either above or below ground. Detention basins that are above ground are the preferred choice and shall be used when feasible . However, when project site parameters dictate, an underground system may be the optimum choice.

8.11.8.4.2. The following design criteria shall be observed:

8.11.8.4.2.1. Allow for 1 foot of freeboard above the storage volume.

8.11.8.4.2.2. A micropool shall be provided when feasible. Refer to Figure 1117-5 in the *ODOT Location and Design Manual – Volume 2*.

8.11.8.4.2.3. Use side slopes of 4:1 (max).

8.11.8.4.2.4. Ensure the design check discharge will safely pass through the structure

8.11.8.4.2.5. Vegetate the sides of the basin with ODOT Item 670 Slope Erosion Protection.

8.11.8.4.2.6. Do not locate on uncompacted fill or steep slopes (2:1 or more) or where infiltrating ground water could adversely impact slope stability.

8.11.8.4.2.7. Furnish an anti-seep collar around the outlet pipe.

8.11.8.4.2.8. Furnish gravel pack protection at the outlet structure (see ODOT Standard Drawing WQ1.1).

8.11.8.4.2.9. Place channel protection (RCP or Concrete Mat) at the entrance of the basin to minimize erosion and sediment resuspension.

8.11.8.4.2.10. Furnish a forebay that is approximately 10% of the total design volume.

8.11.8.4.2.11. The sediment storage volume shall not be less than 20 percent of extended detention volume.

8.11.8.4.2.12. The outlet shall also be designed to minimize clogging, vandalism, and maintenance.

8.11.8.4.2.13. The basin design shall incorporate the following features to maximize multiple uses, aesthetics, safety, maintainability, and compatibility with the urban landscape.

8.11.8.4.2.14. A stable vehicular (maintenance berm) access way shall be provided to forebays and outlets shall be provided.

8.11.8.4.2.15. Aeration shall be provided for extended detention basins.

8.11.8.4.3. Water Quality Basin Design

8.11.8.4.3.1. Furnish an outlet structure that fully drains the WQv within 48 hours or more. No more than 50% of the WQv shall be released from the detention basin in one-third of the drain time.

8.11.8.4.3.2. The outlet structure requires a flow control structure such as a perforated riser pipe to restrict the drainage discharge. Details of a perforated riser pipe outlet structure can be found on ODOT standard drawing WQ1.1.

8.11.8.4.3.3. Furnish a perforated riser pipe for detention basins. The outlet structure consists of a catch basin with a perforated riser pipe on the inlet side and a conduit on the outlet side. The perforated riser pipe is used for flow control to achieve the required discharge time. A gravel envelope surrounds the perforated riser pipe along the inlet side of the catch basin to prevent blockage of the orifice holes in the pipe.

8.11.8.4.3.4. When separate quality and quantity basins are provided, furnish a weir to allow the design check discharge to bypass the structure without damage to the detention basin or embankment of the basin. The design check discharge shall be determined per the following:

8.11.8.4.3.4.1. A design check discharge with the frequency of a 10-year event shall be used as calculated by the Rational Equation. Use the entire drainage area that contributes to the BMP to calculate the design check discharge.

8.11.8.4.3.5. The equation for a single orifice is as follows:

Equation 13 - Single Orifice Discharge Rate

$$Q = A * C * \sqrt{64.4 * H}$$

Where:

Q = Discharge Rate in Cubic Feet Per Second

A = Orifice Area in Square Feet

C = Orifice Coefficient as found in Table 25

H = Head on the Orifice as Measured from the Water Surface to the Centerline of the Orifice

Table 25 - Orifice Coefficient Determination

C	Description
0.66	Use for thin materials where the thickness is equal to or less than the orifice diameter.
0.80	Use when the material is thicker than the orifice diameter.

8.11.8.4.3.6. A hydrograph curve for the outlet will be required to calculate the discharge time of the WQv and the design check discharge. The discharge time shall correspond to the minimum drain time of 48 hours and no more than 50% of the WQv shall be released from the detention basin in less than one-third of the drain time.

8.11.8.4.3.7. An underdrain network shall be installed beneath the bottom of the dry extended detention basin to aid in proper water removal from the basin bottom and to allow an alternative method of water removal in the event the primary outlet structure becomes clogged. The underdrain network shall drain to the primary control structure.

8.11.8.4.4. Anti-Seep Collar Design

8.11.8.4.4.1. An anti-seep collar shall be installed on conduits through earth fills where water is being detained. The following criteria applies to anti-seep collars:

8.11.8.4.4.1.1. Furnish a minimum of 2 collars per outlet conduit. Increase the seepage length along the conduit by a minimum of 15%. This percentage is based on the length of the pipe in the saturation zone.

8.11.8.4.4.1.2. Anti-seep collars shall be placed equally within the saturation zone. Place one collar at the end of the saturation zone. In cases where the spacing limit will not allow this, place at least one collar within the saturation zone.

8.11.8.4.4.1.3. Maximum collar spacing shall be 14 times the minimum projection above the pipe, but not more than 25 feet. The minimum collar spacing shall be 5 times the minimum projection, but not less than 10 feet.

8.11.8.4.4.1.4. Extend the collar dimensions a minimum of 2 feet in all directions around the outside of the conduit, measured perpendicular to the conduit. Center the anti-seep collars around the conduit..

8.11.8.4.4.1.5. The top of collar shall not be less than 6 inches below, measured normal to, the finished groundline.

8.11.8.4.4.1.6. Minimum thickness shall be 6 inches.

8.11.8.4.4.1.7. The design procedure for anti-seep collars is as follows:

8.11.8.4.4.1.7.1. Determine the length of the conduit within the saturated zone. The assumed normal saturation zone can be determined by projecting a line through the embankment, with a 4:1 (H:V) slope, from the point where the normal water elevation (10-year) meets the upstream slope to a point where it intersects the invert of the conduit. This line, referred to as the "phreatic line", represents the upper surface of the zone of saturation within the embankment (See Figure 1117-11). The 10-year storm pool elevation is the phreatic line starting elevation.

Equation 14 – Length of Conduit in Saturated Zone

$$L_S = Y * (Z + 4)\left[1 + \frac{S}{0.25 - S}\right]$$

Where:
L_s = Length of the conduit in the saturated zone (feet)
Y = Depth of the water at the spillway crest, 10-year frequency stormwater elevation (feet)
Z = Slope of the upstream face of the embankment (Z feet horizontal to 1 foot vertical)
S = Slope of the conduit (feet per foot)

8.11.8.4.4.1.7.2. Determine the required seepage length increase.

Equation 15 – Required Seepage Length Increase

$$\Delta L_S = 0.15 * L_S$$

Where:
ΔL_S = Required seepage length increase (feet)
L_s = Length of the conduit in the saturated zone (feet)

8.11.8.4.4.1.7.3. Choose a collar height and width that is at least 4 feet larger than the outside diameter of the conduit (minimum projection of 2 feet from all sides of the conduit). Give collar sizes in one foot increments.

Equation 16 – Anti-Seep Collar Projection

$$P = W - D$$

Where:
P = Projection of collar (feet)
W = Height or width of collar (feet)
D = Inside diameter of conduit

8.11.8.4.4.1.7.4. Determine the total number of collars required. The collar size can be increased to reduce the number of collars. Alternatively, the collar size can be reduced by providing more collars. In any case, the seepage length shall be increased by a minimum of 15%.

Equation 17 – Number of Anti-Seep Collars Required

$$\text{Number of collars required} = \Delta L_S / P$$

Where:
ΔL_S = Required seepage length increase (feet)
P = Projection of collar (feet)

8.11.8.5. Underground Detention

8.11.8.5.1. Underground detention areas are made up of a series of conduits. They range from an oversized storm sewer to a series of conduits that are specifically used for storm water detention. The following criteria apply when designing underground detention:

8.11.8.5.1.1. Ensure the Hydraulic Grade Line design of the storm sewer will pass through the structure and meet the requirements of 1104.4.2. of the *ODOT Location and Design Manual – Volume 2.*

8.11.8.5.1.2. Consider access to the conduits for periodic maintenance.

8.11.8.5.1.3. If practical, provide pretreatment of the storm water with vegetation.

8.11.8.6. Design Check Discharge

8.11.8.6.1. A design check discharge with the frequency of a 10-year event shall be used. Use the entire drainage area that contributes to the BMP to calculate the design check discharge

8.11.9. Extended Retention Basins

8.11.9.1. A retention basin is a "wet" pond that has a minimum water surface elevation between storms that is defined as the permanent pool. Above the permanent pool is a detention pool that provides storage for 75% of the WQv and discharges within 24 hours or more. The full storage water depth is typically between 3-6 feet and the volume is less than 15 Ac-ft. The permanent pool is sized to provide storage for 75% of the WQv. A retention basin is ideal for large tributaries, but it may require a large amount of space.

8.11.9.2. The following Design Criteria shall be observed:

8.11.9.2.1. The basin design shall incorporate the following features to maximize multiple uses: aesthetics, safety, maintainability, and compatibility with the urban landscape:

8.11.9.2.1.1. Underlying soils shall be compacted to prevent infiltration of the permanent pool or an impervious liner shall be used.

8.11.9.2.1.2. Allow for a minimum of 1 foot of freeboard above the WQv.

8.11.9.2.1.3. Basin side slopes shall have a run to rise ratio of 10:1 or flatter, whenever practical, to promote growth of wetland vegetation over 25 to 50 percent of the pond surface area. Side slopes shall not exceed 4:1 run to rise ratio.

8.11.9.2.1.4. Ensure the design check discharge will safely pass through the structure.

8.11.9.2.1.5. Basin depth in the permanent pool shall not be less than 3 feet, and shall not exceed 12 feet in open water areas to prevent thermal stratification.

8.11.9.2.1.6. A forebay designed to allow larger sediment particles to settle shall be placed at basin inlets. The forebay shall be 10% of the total retention volume.

8.11.9.2.1.7. A length to width ratio at least 3:1 shall be used to prevent short-circuiting.

8.11.9.2.1.8. Provide anti seep collar(s) on principal outlet pipe. Refer to Section 8.11.8.4.4. for requirements.

8.11.9.2.1.9. Install rip rap or other suitable erosion control materials as required at all pipe outlets entering or exiting the pond.

8.11.9.2.1.10. Aeration shall be provided for all wet extended detention basins

8.11.9.2.1.11. Provisions shall be provided to drain the permanent pool volume for removal of accumulated sediments. Remove accumulated sediment when 20% of the design storage volume has been filled.

8.11.9.2.1.12. A stable vehicular access way shall be provided to forebays and outlets.

8.11.9.2.1.13. No retention basin shall be placed closer than 10,000 feet from any municipal airport runway.

8.11.9.3. Water Quality Basin and Weir

8.11.9.3.1. A retention basin outlet structure is designed similar to the outlet structure for a detention basin. The difference is that 75% of the WQv shall be discharged out of the basin in 24 hours or more. The outlet structures are of a similar type, except the openings will be set at a high enough elevation to maintain 0.75% of the WQv in the permanent pool (see ODOT standard construction drawing WQ-1.1).

8.11.10. Bioretention Cell

8.11.10.1. Bioretention Cells consist of a depressed low-lying area that treat storm water through evapotranspiration and filtering through a planting soil. As the storm water passes through the soil it is filtered. An underlying perforated storm sewer or underdrain captures the treated storm water and carries it to an outlet. Extensive vegetation assists in the filtration of the storm water prior to filtering through the soil. Vegetation shall consist of shrubs or grasses that are native to the area.

8.11.10.2. The existing soil must be removed and replaced when constructing a bioretention cell. The bioretention planting soil (ODOT plan note WQ101) shall consist of a mixture of sand, topsoil, and compost.

8.11.10.3. A bioretention cell is sized to store the WQv prior to filtration. Total filtration shall occur in 40 hours or more. The size of the bioretention cell shall be determined using the spreadsheet available from the Office of the City Engineer.

8.11.10.4. The following criteria apply when designing a bioretention BMP:

8.11.10.4.1. Do not place where snow may be stored.

8.11.10.4.2. Furnish 10 feet or less width between 4 inch underdrain laterals.

8.11.10.4.3. Furnish bypass or overflow for the design check discharge. Use a catch basin(s) in conjunction with an overflow weir as needed.

8.11.10.4.4. Furnish pretreatment of the storm water via vegetation.

8.11.10.4.5. Ensure the water table or bedrock is below the invert of the bioretention area.

8.11.10.4.6. Use side slopes of 4:1 (max).

8.11.10.4.7. Furnish a length to width ratio of 2:1 (min).

8.11.10.4.8. Use a minimum depth of 4 feet of planting soil. Provide at least 4 inches of depth deeper than the largest root ball.

8.11.10.4.9. Furnish an organic or mulching layer at the top of the planting soil.

8.11.10.4.10. Furnish a maximum depth of 1 foot to the riser pipe or catch basin outlet from the mulching layer for storage of the WQv.

8.11.11. Infiltration

8.11.11.1. Infiltration techniques treat storm water through the interaction of a filtering substrate that consists of soil, sand, or gravel. This technique discharges the treated storm water into the ground water rather than into surface waters. Typically infiltration practices are ionly suitable for Hydrologic Soil Group(HSG) Type A soils or in some cases, HSG Type B soils.

8.11.11.2. Infiltration methods require an extensive investigation of the existing soils and geology to ensure success. The investigation shall begin with a preliminary soil evaluation of the project

site early in the design process. In situ testing is not anticipated during the preliminary evaluation process. Use available soil and geology data found in the Soil and Water Conservation maps, United States Geological Survey (USGS), adjacent projects, or estimations from a geotechnical engineer shall be used. Material property tables for infiltration, permeability, and porosity have been provided for the preliminary evaluation (*ODOT Location and Design Manual – Volume 2* Table 1118-1 & 1118- 2).

8.11.11.3. If the preliminary evaluation yields favorable results a more detailed evaluation shall be performed. The detailed evaluation will require a geotechnical investigation of the underlying soils and geology. Soil borings shall be performed to a maximum depth of 20 feet (or refusal) with samples taken every 5 feet for laboratory testing. The number and location of soil borings shall correspond with the approximate size (as determined in the preliminary evaluation) of the infiltration BMP and shall be recommended by the geotechnical engineer.

8.11.11.4. If the detailed evaluation yields favorable results, the ground water depth must be verified. The geotechnical engineer shall provide the seasonal high ground water depth. In some cases, observation wells may be installed and static water levels may be observed over a dry and wet season for verification.

8.11.11.5. The infiltration and permeability rate of the soil shall be tested in the detailed soil evaluation at the discretion of the geotechnical engineer. In some cases, insitu testing at the proposed location of the infiltration BMP may be required.

8.11.11.6. The following criteria applies to infiltration methods and must be met to be considered a feasible alternative:

8.11.11.6.1. Design using the WQv as per 8.11.6.

8.11.11.6.2. Do not place infiltration BMP where snow may be stored.

8.11.11.6.3. The appropriate soil type must be present:

8.11.11.6.3.1. Infiltration must be greater than 0.50 in/hr and no greater than 2.4 in/hr.

8.11.11.6.3.2. Soils must have less than 30% clay or 40% of clay and silt combined.

8.11.11.6.4. The invert of the structure must be at least 4 feet above the seasonal high water table and any impervious layer.

8.11.11.6.5. Infiltration techniques are not suitable on fill soil, compacted soil, or steep slopes (greater than 4:1). Consideration should be given to the long term impacts upon hillside stability if applicable.

8.11.11.6.6. Pretreatment shall be provided to remove large debris, trash and suspended sediment to extend the service life. An example of pretreatment includes providing vegetated ditches prior to flow entering the infiltration facility.

8.11.11.7. Infiltration Trench

8.11.11.7.1. An infiltration trench is an excavated trench that has been lined with a geotextile fabric and backfilled with aggregate. The storm water is filtered through the aggregate and is stored within the pore volume of the backfill material. It is allowed to percolate through the sides and bottom of the trench. The drawdown time of the WQv is 24 hours or more. Consider the following when designing an Infiltration trench:

8.11.11.7.1.1. The minimum acceptable permeability of the surrounding soil is =6.5*10^-5 ft/sec (21.37 min/in) (see).

8.11.11.7.1.2. Design using the WQv as per 8.11.6.

8.11.11.7.1.3. Long and deep infiltration trenches are most efficient (3 feet bottom width and 3-6 feet deep).

8.11.11.7.1.4. Furnish a 6 inch layer of Item 601 Infiltration Basin Aggregate on the top of the trench.

8.11.11.7.1.5. The geometric shape of the trench is a trapezoid with sides at a 1:1 (H:V) slope due to constructability. The top width is calculated as: Top Width = Bottom Width + (2 * Depth)

8.11.11.7.1.6. Pretreatment using vegetation shall be provided to ensure longevity of the infiltration trench.

8.11.11.7.1.7. An observation well shall be provided to facilitate ground water level inspection.

8.11.11.7.1.8. Locate the infiltration trench at least 1,000 feet from any municipal water supply well and at least 100 feet from any private well, septic tank, or field tile drains.

8.11.11.7.1.9. Ensure the bottom of the trench is below the frost line (2.5 feet)

8.11.11.7.2. The length of the trench depends upon the depth and the bottom width. The required length is calculated by assuming a depth and bottom width. The length is calculated based upon the inflow (WQv) and the outflow (ground water recharge). The following equation calculates the required length in feet:

Equation 18 - Required Infiltration Trench Length

$$L_t = \frac{WQv}{3600 * K * T * (b + 2 * d) + .04 * \left[D^2 + (b * D)\right]}$$

where:
L_t = Required Length of Infiltration Trench in Feet
WQv = Water Quality Volume in Cubic Feet
K = Permeability of the Surrounding Soil in Ft/Sec (Refer to Table 26)
T = Drain Time Through the Sides of the Trench (24 Hours)
D = Trench Depth in Feet
b = Bottom Width of the Trench in Feet

Table 26 - Permeability of Soil Types

Soil Type	Rate K (Ft/Sec)	Percolation Rate (Min/In)
Gravel	$3.3x10^{-3}$ to $3.3x10^{-1}$	0.42 to .0042
Sand	$3.3x10^{-5}$ to $3.3x10^{-2}$	42.09 to 0.04
Silt	$3.3x10^{-9}$ to $3.3x10^{-5}$	420,875 to 42.09
Saturated Clay	$< 3.3x10^{-9}$	> 420,875
Till	$3.3x10^{-10}$ to $3.3x10^{-6}$	4,208,754 to 420.88

8.11.11.8. Infiltration Basin

8.11.11.8.1. An infiltration basin is an open surface pond that uses infiltration into the ground as the release mechanism. It is designed to store the WQv.

8.11.11.8.2. Depending on the soil permeability, it may be used to treat from 5 to 50 acres. Lower permeable soils may require an underdrain system as an additional outlet. The drawdown time of the WQv shall be between 24-48 hours. The following criteria applies when designing an infiltration basin:

8.11.11.8.2.1. Use an energy dissipater at the inlet.

8.11.11.8.2.2. Allow for 1 foot (min) freeboard above the WQv.

8.11.11.8.2.3. Vegetate the sides of the basin with ODOT Item 670 Slope Erosion Protection.

8.11.11.8.2.4. Furnish a 6 inch layer of ODOT Item 601 Infiltration Basin Aggregate on the bottom of the basin.

8.11.11.8.2.5. Use side slopes of 4:1 (max).

8.11.11.8.2.6. Use a length to width ratio of 3:1

8.11.11.8.2.7. Furnish bypass or overflow for the design check discharge (Paragraph 8.11.8.6.).

8.11.11.8.2.8. Consider vehicle access to the basin for periodic maintenance.

8.11.11.8.2.9. Locate basin at least 1,000 feet from any municipal water supply well and at least 100 feet from any private well, septic tank, or drain field.

8.11.11.8.2.10. Furnish 10 feet or less width between 4 inch underdrain laterals (if used in the design).

8.11.11.8.2.11. Do not locate the basin where infiltrating ground water may adversely impact slope stability.

8.11.11.8.2.12. Ensure the invert of any underdrain in the basin is below the frost line (2.5 feet).

8.11.11.8.3. The invert area of the infiltration basin can be calculated by the following equation:

Equation 19 – Required Invert Area of Infiltration Basin

$$A = \frac{(WQv * S.F. * 12)}{(k * t)}$$

Where:
A = Area of the Invert of the Basin in Square Feet
WQv = Water Quality Volume in Cubic Feet
S.F. = Safety factor of 1.5
k = Infiltration Rate in Inches per Hour as found in Table 27
t = Drawdown Time of 48 Hours

8.11.11.8.4. The required depth of the infiltration basin can be calculated by the following equation:

Equation 20 - Required Infiltration Basin Depth

$$D = \frac{WQv}{A}$$

Where:
D = Infiltration Basin Depth in Feet
WQv = Water Quality Volume in Cubic Feet
A = Area of the Invert of the Basin in Square Feet

Table 27 - Infiltration Rates

NRCS Soil Type (From Soil Maps)	HSG Classification	Rate (k) in In/Hr
Sand	A	8.0
Loamy Sand	A	2.0
Sandy Loam	B	1.0
Loam	B	0.5
Silt Loam	C	0.25
Sandy Clay Loam	C	0.15
Clay Loam & Silty Clay Loam	D	<0.09
Clays	D	<0.05

Infiltration Rate (k)
From Urban Runoff Quality Management WEF Manual of Practice No. 23, 1998, published jointly by the WEF and ASCE, chapter five

8.11.11.9. Constructed Wetlands

8.11.11.9.1. Constructed wetlands treat storm water through bio-retention. They are depressed, heavily planted areas that are designed to maintain a dry weather flow depth ranging between 0.5 to 2 feet. The surface area required for a wetland is usually quite large due to the limited allowable depth. The area is usually on the magnitude of 1% of the entire drainage area. They are designed in a similar manner as a retention basin. The wetland is sized to provide storage for the WQv for a time frame of at least 24 hours (above the permanent pool) while providing a bypass or overflow for larger design check discharge. The water depth shall be maintained by an outlet structure capable of providing the required water depth with the provision of a one foot freeboard. The following criteria applies when designing a wetland:

8.11.11.9.1.1. Do not place on a steep or unstable slope or at a location, which could induce short-term or long-term instability.

8.11.11.9.1.2. Constructed wetlands must be greater than 10,000 feet from a municipal airport runway.

8.11.11.9.1.3. Base flow must be present to maintain the constant water depth (such as ground water).

8.11.11.9.1.4. Furnish a forebay that is 7% of the total required volume at a depth between 3-6 feet to settle out sediments.

8.11.11.9.1.5. Furnish side slopes of 4:1 (max).

8.11.11.9.1.6. Consider access for maintenance to the forebay and the outlet structure.

8.11.11.9.1.7. Vegetate the sides and bottom with grass

8.11.11.9.1.8. Furnish an impervious liner. Use a compacted clay bottom or a geotextile fabric to prevent infiltration of the storm water.

8.11.11.9.1.9. Furnish a length to width ratio of 3:1 (min) to prevent short-circuiting.

8.12. EROSION AND SEDIMENTATION CONTROL

8.12.1. Erosion and sedimentation controls shall be applied to all parcels used or being developed, either wholly or partially, for new or relocated projects involving highways, underground cables, or

pipelines; subdivisions or larger common plans of development; industrial, commercial, institutional, or residential projects; building activities on farms; redevelopment activities; general clearing; and all other uses that are not specifically exempted in this Document.

8.12.2. Erosion and sedimentation controls do not need to be applied to activities regulated by, and in compliance with, the Ohio Agricultural Sediment Pollution Abatement Rules.

8.12.3. Compliance with State and Federal Regulations

8.12.3.1. Approvals issued in accordance with this regulation do not relieve the applicant of responsibility for obtaining all other necessary permits and/or approvals from the Ohio EPA, the US Army Corps of Engineers, and other federal, state, and/or county agencies. If requirements vary, the most restrictive requirement shall prevail. These permits may include, but are not limited to, those listed below. All submittals required to show proof of compliance with these state and federal regulations shall be submitted with Storm Water Pollution Prevention Plans or Abbreviated Storm Water Pollution Prevention Plans.

8.12.3.1.1. Ohio EPA NPDES Permits authorizing storm water discharges associated with construction activity or the most current version thereof

8.12.3.1.1.1. Proof of compliance with these requirements shall be the applicant's Notice of Intent (NOI) number from Ohio EPA, a copy of the Ohio EPA Director's Authorization Letter for the NPDES Permit, or a letter from the site owner certifying and explaining why the NPDES Permit is not applicable.

8.12.3.1.2. Section 401 of the Clean Water Act

8.12.3.1.2.1. Proof of compliance shall be a copy of the Ohio EPA Water Quality Certification application tracking number, public notice, project approval, or a letter from the site owner certifying that a qualified professional has surveyed the site and determined that Section 401 of the Clean Water Act is not applicable. Wetlands, and other waters of the United States, shall be delineated by protocols accepted by the U.S. Army Corps of Engineers at the time an application is made under this regulation.

8.12.3.1.3. Ohio EPA Isolated Wetland Permit

8.12.3.1.3.1. Proof of compliance shall be a copy of Ohio EPA's Isolated Wetland Permit application tracking number, public notice, project approval, or a letter from the site owner certifying that a qualified professional has surveyed the site and determined that Ohio EPA's Isolated Wetlands Permit is not applicable. Isolated wetlands shall be delineated by protocols accepted by the U.S. Army Corps of Engineers at the time an application is made under this regulation.

8.12.3.1.4. Section 404 of the Clean Water Act

8.12.3.1.4.1. Proof of compliance shall be a copy of the U.S. Army Corps of Engineers Individual Permit application, public notice, or project approval, if an Individual Permit is required for the development project. If an Individual Permit is not required, the site owner shall submit proof of compliance with the U.S. Army Corps of Engineer's Nationwide Permit Program. This shall include one of the following:

8.12.3.1.4.1.1. A letter from the site owner certifying that a qualified professional has surveyed the site and determined that Section 404 of the Clean Water Act is not applicable.

8.12.3.1.4.1.2. A site plan showing that any proposed fill of waters of the United States conforms to the general and special conditions specified in the applicable Nationwide Permit. Wetlands, and other waters of the United States, shall be delineated by protocols accepted by the U.S. Army Corps of Engineers at the time an application is made under this regulation.

8.12.3.1.5. Ohio Dam Safety Law

8.12.3.1.5.1. Proof of compliance shall be a copy of the ODNR Division of Water permit application tracking number, a copy of the project approval letter from the ODNR Division of Water, or a letter from the site owner certifying and explaining why the Ohio Dam Safety Law is not applicable.

8.12.4. Development of Storm Water Pollution Prevention Plans

8.12.4.1. This regulation requires that a Storm Water Pollution Prevention Plan be developed and implemented for all parcels disturbing one (1) acre or more and on which any regulated activity is proposed.

8.12.4.2. The following activities shall submit an Abbreviated Storm Water Pollution Prevention Plan:

8.12.4.2.1. New single-family residential construction regardless of parcel size. If such activities disturb one (1) acre or more, or are part of a larger common plan of development or sale disturbing one (1) acre or more, an Ohio EPA Construction Site General Permit and a Storm Water Pollution Prevention Plan may be required.

8.12.4.2.2. Additions or accessory buildings for single-family residential construction regardless of parcel size. If such activities disturb one (1) acre or more, or are part of a larger common plan of development or sale disturbing one (1) acre or more, an Ohio EPA Construction Site General Permit and a Storm Water Pollution Prevention Plan may be required.

8.12.4.2.3. All non-residential construction on parcels of less than one (1) acre.

8.12.4.2.4. General clearing activities not related to construction and regardless of parcel size. If such activities disturb one (1) acre or more, or are part of a larger common plan of development or sale disturbing one (1) acre or more, an Ohio EPA Construction Site General Permit and a Storm Water Pollution Prevention Plan may be required.

8.12.4.3. Activities disturbing 1/10th (one tenth) or less of an acre are not required to submit a Storm Water Pollution Prevention Plan or an Abbreviated Storm Water Pollution Prevention Plan, unless required by the City Engineer. These activities must comply with all other provisions of this regulation.

8.12.5. Application Procedures

8.12.5.1. Soil Disturbing Activities Submitting A Storm Water Pollution Prevention Plan: The applicant shall submit two (2) sets of the SWP3 and the applicable fees to the City of Lebanon and two (2) sets of the SWP3 as follows:

8.12.5.1.1. For subdivisions: After the approval of the preliminary plans and with submittal of the improvement plans.

8.12.5.1.2. For other construction projects: Before issuance of a zoning permit by the Planning and Development Department.

8.12.5.1.3. For general clearing projects: Prior to issuance of a zoning permit by the Planning and Development Department.

8.12.5.2. Soil Disturbing Activities Submitting An Abbreviated Storm Water Pollution Prevention Plan: The applicant shall submit two (2) sets of the ASWP3 and the applicable fees to the City of Lebanon and two (2) sets of the ASWP3 as follows:

8.12.5.2.1. For single-family home construction: Before issuance of a zoning permit by the Planning and Development Department.

8.12.5.2.2. For other construction projects: Before issuance of a zoning permit by the Planning and Development Department.

8.12.5.2.3. For general clearing projects: Prior to issuance of a zoning permit by the Planning and Development Department.

8.12.5.3. The City of Lebanon shall review the plans submitted for conformance with these regulations and approve, or return for revisions with comments and recommendations for revisions. A plan rejected because of deficiencies shall receive a narrative report stating specific problems and the procedures for filing a revised plan.

8.12.5.4. Soil disturbing activities shall not begin and zoning permits shall not be issued without an approved SWP3 or ASWP3.

8.12.5.5. SWP3 for individual sublots in a subdivision will not be approved unless the larger common plan of development or sale containing the sublot is in compliance with this regulation.

8.12.5.6. Approvals issued in accordance with this regulation shall remain valid for one (1) year from the date of approval.

8.13. STORM WATER POLLUTION PREVENTION PLAN (SWP3)

8.13.1. In order to control sediment pollution of water resources and wetlands, the applicant shall submit a SWP3 in accordance with the requirements of this regulation.

8.13.2. The SWP3 shall be certified by a professional engineer, a registered surveyor, certified professional erosion and sediment control specialist, or a registered landscape architect.

8.13.3. The SWP3 shall incorporate measures as recommended by the most current edition of *Rainwater and Land Development* as published by the Ohio Department of Natural Resources and shall include the following information:

8.13.3.1. Site description: The SWP3 shall provide:

8.13.3.1.1. A description of the nature and type of the construction activity (e.g. residential, shopping mall, highway, etc.).

8.13.3.1.2. Total area of the site and the area of the site that is expected to be disturbed (i.e., grubbing, clearing, excavation, filling or grading, including off-site borrow areas).

8.13.3.1.3. An estimate of the impervious area and percent of imperviousness created by the soil-disturbing activity.

8.13.3.1.4. Existing data describing the soil and, if available, the quality of any known pollutant discharge from the site such as that which may result from previous contamination caused by prior land uses.

8.13.3.1.5. A description of prior land uses at the site.

8.13.3.1.6. An implementation schedule which describes the sequence of major soil-disturbing operations (i.e., grubbing, excavating, grading, utilities and infrastructure installation) and the implementation of erosion and sediment controls to be employed during each operation of the sequence.

8.13.3.1.7. The location and name of the immediate receiving stream or surface water(s) and the first subsequent receiving water(s).

8.13.3.1.8. The aerial (plan view) extent and description of wetlands or other special aquatic sites at or near the site which will be disturbed or which will receive discharges from disturbed areas of the project.

8.13.3.1.9. For subdivided developments where the SWP3 does not call for a centralized sediment control capable of controlling multiple individual lots, a detail drawing of a typical individual lot showing standard individual lot erosion and sediment control practices.

8.13.3.1.10. Location and description of any storm water discharges associated with dedicated asphalt and dedicated concrete plants associated with the development area and the best management practices to address pollutants in these storm water discharges.

8.13.3.1.11. Site map showing:

8.13.3.1.11.1. Limits of soil-disturbing activity of the site, including off site spoil and borrow areas.

8.13.3.1.11.2. Soils types shall be depicted for all areas of the site, including locations of unstable or highly erodible soils.

8.13.3.1.11.3. Existing and proposed one-foot (1') contours. This must include a delineation of drainage watersheds expected during and after major grading activities as well as the size of each drainage watershed in acres.

8.13.3.1.11.4. Surface water locations including springs, wetlands, streams, lakes, water wells, etc., on or within 200 feet of the site, including the boundaries of wetlands or stream channels and first subsequent named receiving water(s) the applicant intends to fill or relocate for which the applicant is seeking approval from the Army Corps of Engineers and/or Ohio EPA.

8.13.3.1.11.5. Existing and planned locations of buildings, roads, parking facilities, and utilities.

8.13.3.1.11.6. The location of all erosion and sediment control practices, including the location of areas likely to require temporary stabilization during the course of site development.

8.13.3.1.11.7. Sediment ponds, including their sediment settling volume and contributing drainage area.

8.13.3.1.11.8. Areas designated for the storage or disposal of solid, sanitary and toxic wastes, including Dumpster areas, areas designated for cement truck washout, and vehicle fueling.

8.13.3.1.11.9. The location of designated stoned construction entrances where the vehicles will ingress and egress the construction site.

8.13.3.1.11.10. The location of any in-stream activities including stream crossings.

8.13.4. Soils Engineering Report

8.13.4.1. The City Engineer may require the SWP3 to include a Soils Engineering Report based upon his/her determination that the conditions of the soils are unknown or unclear to the extent that additional information is required to protect against erosion or other hazards. This report shall be based on adequate and necessary test borings, and shall contain all the information listed below. Recommendations included in the report and approved by the City Engineer shall be incorporated in the grading plans and/or other specifications for site development.

8.13.4.1.1. Data regarding the nature, distribution, strength, and erodibility of existing soils.

8.13.4.1.2. If applicable, data regarding the nature, distribution, strength, and erodibility of the soil to be placed on the site.

8.13.4.1.3. Conclusions and recommendations for grading procedures.

8.13.4.1.4. Conclusions and recommended designs for interim soil stabilization devices and measures, and for permanent soil stabilization after construction is completed.

8.13.4.1.5. Design criteria for corrective measures when necessary.

8.13.4.1.6. Opinions and recommendations covering the stability of the site.

8.14. ABBREVIATED STORMWATER POLLUTION PREVENTION PLAN (ASWP3)

8.14.1. The ASWP3 shall be certified by a professional engineer, a registered surveyor, certified professional erosion and sediment control specialist, or a registered landscape architect.

8.14.2. The ASWP3 shall include a minimum of the BMPs found in Section 8.15. The City of Lebanon may require other BMPs as site conditions warrant.

8.14.3. Internal Inspection and Maintenance. All controls on the development area shall be inspected at least once every seven calendar days and within 24 hours after any storm event greater than one-half inch of rain per 24 hour period. Maintenance shall occur as detailed below:

8.14.3.1. When practices require repair or maintenance

8.14.3.1.1. If the internal inspection reveals that a control practice is in need of repair or maintenance, with the exception of a sediment-settling pond, it must be repaired or maintained within three (3) days of the inspection. Sediment settling ponds must be repaired or maintained within ten (10) days of the inspection.

8.14.3.2. When practices fail to provide their intended function

8.14.3.2.1. If the internal inspection reveals that a control practice fails to perform its intended function and that another, more appropriate control practice is required, the ASWP3 must be amended and the new control practice must be installed within ten (10) days of the inspection.

8.14.3.3. When practices depicted on the ASWP3 are not installed

8.14.3.3.1. If the internal inspection reveals that a control practice has not been implemented in accordance with the schedule, the control practice must be implemented within ten (10) days from the date of the inspection. If the inspection reveals that the planned control practice is not needed, the record must contain a statement of explanation as to why the control practice is not needed.

8.14.3.4. Final Stabilization

8.14.3.4.1. Final stabilization shall be determined by the City Engineer.

8.15. EROSION AND SEDIMENTATION CONTROL BMPS

8.15.1. The following BMPs shall be implemented on any construction site as applicable. The City of Lebanon may require other BMPs as site conditions warrant.

8.15.1.1. Construction Entrances

8.15.1.1.1. Construction entrances shall be built and shall serve as the only permitted points of ingress and egress to the development area. These entrances shall be built of a stabilized pad of aggregate stone or recycled concrete or cement sized greater than 2" in diameter, placed over a geotextile fabric, and constructed in conformance with specifications in the most recent edition of the *Rainwater and Land Development Manual.*

8.15.1.2. Street Sweeping

8.15.1.2.1. Streets directly adjacent to construction entrances and receiving traffic from the development area, shall be cleaned daily to remove sediment tracked off-site. If applicable, the catch basins on these streets nearest to the construction entrances shall be cleaned weekly.

8.15.1.3. Temporary Stabilization

8.15.1.3.1. The development area shall be temporarily stabilized as detailed in the following table:

Table 28 – Temporary Stabilization

Area requiring stabilization	Time frame to apply erosion controls
Any disturbed area within 50 feet of a stream and not at final grade.	Within 2 days of the most recent disturbance if that area will remain idle for more than 21 days
For all construction activities, any disturbed area, including soil stockpiles, that will be dormant for more than 21 days but less than one year, and not within 50 feet of a stream.	Within 7 days of the most recent disturbance within the area
Disturbed areas that will be idle over winter	Prior to November 1.
Note: Where vegetative stabilization techniques may cause structural instability or are otherwise unobtainable, alternative stabilization techniques must be employed. These techniques may include mulching or erosion matting.	

8.15.1.4. Topsoiling

8.15.1.4.1. The application of at least a minimum depth of topsoil may be required for those critical areas, such as within open channels and fill slopes, where glacial till material is left on the surface after final grading. Unweathered glaciated till is that material located approximately 30 inches to 40 inches below the soil surface, and can be found at the ground surface in highly eroded areas. The subgrade shall be raked and all rubbish, sticks, roots, and stones larger than 2-inch shall be removed. Subgrade surfaces shall be raked or otherwise loosened immediately prior to being covered with topsoil.

8.15.1.4.2. Topsoil shall be evenly spread to a minimum depth of four (4) inches. All areas to be utilized for soil stockpiles shall be clearly identified on the approved erosion control plan. The topsoil stockpile shall be located so as not to interfere with site work, and shall be provided with adequate temporary erosion control measures according to those guidelines specified herein, and shown on the approved erosion control plan. Surface roughening must be completed to allow proper bonding of topsoil to the soil material below.

8.15.1.5. Mulching and Erosion Control Blankets

8.15.1.5.1. Application of mulching material immediately after temporary and permanent seeding will be required. Seed mixtures may be applied as part of a hydroseeder slurry containing wood fiber on slopes less than 4 (horizontal) to 1 (vertical), and less than 300 feet in length, or with straw mulch. Straw mulch and seeding is required to be placed the first 2 feet behind curbs.

8.15.1.5.2. Straw mulching shall be at a rate of 1.5 to 2 tons per acre, and shall be anchored utilizing nylon 1-inch square mesh netting installed according to manufacturer's recommendations, or a liquid binder. Binding of straw mulch may be accomplished as follows:

8.15.1.5.2.1. Any liquid asphalt or asphalt emulsion material that is thin enough to be adequately blown from spray equipment, applied at a rate of 0.10 gallon per square yard. Synthetic binders may be used as recommended by the manufacturer.

8.15.1.5.3. Installation of erosion control blankets according to manufacturer's specifications will be required within the flowline of all drainage swales, on all retention/detention pond banks and on all fill slopes of 4 (horizontal) to 1 (vertical) or steeper.

8.15.1.6. Sodding

8.15.1.6.1. Establishment of permanent vegetation by sodding will not generally be required by the City, except on basin side slopes. In those areas where the immediate establishment of permanent turf is deemed necessary, sodding will be an acceptable means of providing vegetative cover for erosion control. When placed within the flowlines of defined drainage ways, staking of sod to prevent undermining will be required. Sod in good condition must be placed on a roughened surface and kept watered for a minimum of two weeks. The preparation of areas to be sodded and the placement of sod shall conform to ODOT item 660.

8.15.1.7. Dumping and Unstable Water Banks

8.15.1.7.1. No soil, rock, debris, or any other material shall be dumped or placed into a water resource or into such proximity that it may readily slough, slip, or erode into a water resource unless such dumping or placing is authorized by the City Engineer, and, when applicable, the U.S. Army Corps of Engineers, for such purposes as, but not limited to, constructing bridges, culverts, and erosion control structures.

8.15.1.7.2. Unstable soils prone to slipping or landsliding shall not be graded, excavated, filled, or have loads imposed upon them unless the work is done in accordance with a qualified professional engineer's recommendations to correct, eliminate, or adequately address the problems.

8.15.1.8. Cut and Fill Slopes

8.15.1.8.1. Cut and fill slopes shall be designed and constructed in a manner which will minimize erosion. Consideration shall be given to the length and steepness of the slope, soil type, upslope drainage area, groundwater conditions, and slope stabilization. The angle of vegetated cut and fill slopes shall not exceed 3 (horizontal) to 1 (vertical) unless a detailed slope stability plan is provided. Slope protection shall be provided by use of temporary and permanent diversion dikes, vegetative cover, and slope drains. Concentrated stormwater flow shall not be allowed to flow down cut or fill slopes without proper slope stabilization.

8.15.1.9. Stabilization of Channels and Outlets

8.15.1.9.1. All constructed channels and outlets associated with a development must be constructed so that they remain stable during all phases of the construction activities. All channel lining must be designed for construction and final conditions. Grass channel shall be limited to a maximum two percent slope under bare earth conditions. Natural channels should be left undisturbed whenever possible. If the minimum slope cannot be maintained then temporary ditch checks shall be constructed consisting of straw or hay bales or coarse aggregate to minimize erosion. Temporary ditch lining shall meet the requirements of ODOT Item 667, 668, or 670.

8.15.1.10. Outlet channel Protection

8.15.1.10.1. Concentrated stormwater runoff leaving a development site shall be discharged to an open channel, storm sewer pipe inlet or culvert that is capable of receiving this discharge. Runoff velocities shall be controlled during all storm events, up to the 100-year return interval storm, so that the peak runoff velocity during and after the completion of the land alteration approximates existing conditions.

8.15.1.11. Inlet Protection

8.15.1.11.1. Erosion and sediment control practices, such as boxed inlet protection, shall be installed to minimize sediment-laden water entering active storm drain systems. Straw or hay bales are not acceptable forms of inlet protection.

8.15.1.12. Temporary Sediment Traps/Basins

8.15.1.12.1. Concentrated stormwater runoff from disturbed areas flowing at rates that exceed the design capacity of sediment barriers**,** stormwater runoff from drainage areas that exceed the design capacity of sediment barriers and/or stormwater runoff from 10-acres of disturbed land shall pass through a sediment-settling facility. The sediment-settling pond shall provide both a sediment storage zone and a dewatering zone. The volume of the dewatering zone shall be at least 67 cubic yards of storage per acre of total contributing drainage area and have a minimum of 48-hour drain time for sediment basins serving a drainage area over 5 acres.

8.15.1.12.2. The volume of the sediment storage zone shall be calculated by one of the following methods:

8.15.1.12.2.1. The volume of the sediment storage zone shall be 1000 cubic feet per disturbed acre within the watershed of the basin.

8.15.1.12.2.2. The volume of the sediment storage zone shall be the volume necessary to store the sediment as calculated with a generally accepted erosion prediction model.

8.15.1.12.3. When determining the total contributing drainage area, off-site areas and areas which remain undisturbed by construction activity must be included unless runoff from these areas is diverted away from the sediment settling pond and is not comingled with sediment-laden runoff. The depth of the dewatering zone must be less than or equal to five (5) feet. The configuration between the inlets and the outlet of the basin must provide at least two units of length for each one unit of width (> 2:1 length: wide ratio), however a length to width ratio of 4:1 is recommended. Sediment must be removed from the sediment-settling pond when the design capacity has been reduced by 40 percent. This limit is typically reached when sediment occupies one-half of the basin depth. When designing sediment settling ponds, the applicant must consider public safety, especially as it relates to children, as a design factor for the sediment basin and alternative sediment controls must be used where site limitations would preclude a safe design. The use of a combination of sediment and erosion control measures in order to achieve maximum pollutant removal is encouraged.

8.15.1.12.4. The facility's storage capacity shall be sixty-seven cubic yards per acre of drainage area. Temporary sediment basins shall be constructed by methods described in ODOT Item 203 Excavation and Embankment or Item 601 Rock Channel Protection, Type C without filter. Sand or filter fabric may be required. The purpose for installation of temporary sediment traps/basins is to detain sediment-laden runoff from small disturbed areas for a length of time sufficient to allow the majority of sediment to settle out.

8.15.1.12.5. Temporary sediment traps, along with the other pertinent controls, shall be installed as shown on the approved erosion control plan prior to the initiation of any land disturbing activities. Sediment traps and basins shall be inspected routinely and after each rain event and shall be cleaned of sediment deposits and repaired as necessary to maintain their operating efficiency.

8.15.1.12.6. The ability of the contractor to install on-site soil stabilization and sedimentation practices such as temporary and permanent seeding, sediment barriers, and flow diversion in a timely manner may be used to determine the need for installation of sediment basins. Effective use of these other available erosion and sediment control practices within a defined construction sequence may be considered by the designer when evaluating potential site applications for sediment basins.

8.15.1.13. Silt fence

8.15.1.13.1. The purpose of fabric fencing is to intercept and retain sediment from disturbed areas of limited size and preventing this sediment from leaving the construction site. Sheet flow

runoff from denuded areas shall be intercepted by silt fence or diversions to protect adjacent properties, water resources, and wetlands from sediment transported via sheet flow Fabric fences may also be used to decrease the velocity of sheet flows and moderate velocity channel flows.

8.15.1.13.2. Where intended to provide sediment control, silt fence shall be placed on a level contour and shall be capable of temporarily ponding runoff.

8.15.1.13.3. The relationship between the maximum drainage area to silt fence for a particular slope range is shown in Table 29.

8.15.1.13.4. Table 29Storm water diversion practices shall be used to keep runoff away from disturbed areas and steep slopes. Such devices, which include swales, dikes or berms, may receive storm water runoff from areas up to 10 acres. Placing silt fence in parallel does not extend the permissible drainage area to the silt fence. See the following table for maximum drainage areas to silt fence.

Table 29 - Maximum Drainage Area to Silt Fence

Maximum Drainage Area (acres) to 100 linear feet of silt fence	Range of Slope for a drainage area (%)
0.5	<2%
0.25	≥ 2% but < 20%
0.125	≥ 20% but < 50%

8.15.1.13.5. Synthetic filter fabric barriers shall be provided with wooden or reinforcement bar stakes at a maximum spacing of six (6) feet for reinforced barriers and four (4) feet for non-reinforced barriers. The City may require the use of fence backed (reinforced) silt fencing.

8.15.1.13.6. Sediment barriers shall be inspected after each rainfall, and at least daily during periods of prolonged rainfall. Barriers that become decomposed or inoperable prior to the end of their effective use shall be promptly replaced.

8.15.1.13.7. Sediment deposits shall be removed upon reaching approximately one-half of the height of the barrier at its lowest point or if it causes a silt fence to bulge. Sediment should be deposited at a controlled fill area. During clean-out operations, the fence must not be undermined.

8.15.1.14. Diversions

8.15.1.14.1. Diversion terraces are temporary or permanent channels constructed with a ridge along their downstream side, placed across the slope, in order to reduce the slope length and intercept and divert stormwater runoff to a stabilized outlet.

8.15.1.14.2. Diversion terraces shall be installed where sheet flow must be diverted from disturbed areas so that permanent vegetation may be established, or where slope lengths must be reduced in order to prevent sheet, rill, and gully erosion.

8.15.1.14.3. Stabilization of all disturbed areas upstream of the diversion dike must be completed concurrently with installation of the diversion dike and flow channel.

8.15.1.14.4. The flow velocity of open channels may be determined utilizing Manning's equation. Permissible velocities are given in Table 30. Alternately, the designer can provide calculations to prove that the channel has been designed to be non-eroding.

Table 30 - Permissible Velocities for Diversions

Soil Texture	Bare Channel (FPS)	Fair Vegetative Cover (FPS)
Sand, Silt, Sandy Loam, Silty Loam	1.5	2.5
Silty Clay Loam, Sandy Clay Loam	2.0	3.5
Clay	2.5	4.5

8.15.1.14.5. Diversion channels shall be provided with adequate outlets that convey concentrated flow without erosion. This outlet may be provided as a properly stabilized developed stormwater conveyance channel, storm sewer pipe, or culvert.

8.15.1.14.6. The diversion channel, dike, stabilized upstream areas, and outlet channel shall be inspected after every rainfall. Sediment deposits shall be removed, damaged and eroded areas repaired, and reseeding accomplished within either twenty-four (24) hours, or as soon as the soil dries sufficiently to allow work to proceed.

8.15.1.15. Riprap/Rock Channel Protection

8.15.1.15.1. The installation of rock riprap provides a permanent, erosion-resistant ground cover through use of large, loose, angular stone. Note that approved commercial products may be used in place of rock riprap where applicable.

8.15.1.15.2. Rock riprap shall be required by the City as a means of protecting the soil surface from the erosive forces of concentrated stormwater runoff, as a sediment filtering device, and as a means of stabilizing eroding stream banks and slopes with seepage problems and/or non-cohesive soils. Some examples of where rock riprap may be utilized would include at storm sewer outlets, at culvert ends, on channel banks and/or bottoms, within roadside ditches, as temporary sediment barriers, as rock chute structures, and for slope stabilization.

8.15.1.15.3. Placement of the rock riprap must follow immediately after installation of the filter fabric layer, and a dense, well-graded mass of stone with minimal voids must be produced. Riprap shall be placed to its full thickness in one operation, avoiding the segregation of the various stone sizes.

8.15.1.15.4. With the approval of the City Engineer, crushed, discarded concrete may be an acceptable alternative to rock riprap provided it is well graded, a density adjustment is made, and it meets all other requirements of this policy. The minimum thickness of the riprap layer shall be no less than 6 inches. Temporary rock check dams will be accepted as sediment barriers within minor drainage channels that drain to abutting off-site properties and/or drainage facilities, in minor swales and ditch lines that have been rough graded, around activated storm sewer inlets, and at the outlet ends of storm sewer pipes.

8.15.1.15.5. Rock riprap installations shall be inspected after every rainfall to determine if high flows have caused undermining, or if stones have been dislodged. Needed repairs shall be accomplished within twenty-four (24) hours, or as soon as the soil dries sufficiently to allow work to proceed.

8.15.1.16. Temporary Stream Crossings

8.15.1.16.1. Due to the potential for significant erosion and sediment suspension, construction activities in and around streams shall be kept to a minimum. Streams including bed and banks shall be restabilized immediately after in-channel work is completed, interrupted, or stopped. To the extent practicable, construction vehicles shall be kept out of streams. Where in-channel work is necessary, precautions shall be taken to restabilize the work area during

construction to minimize erosion. If a live (wet) steam must be crossed by construction vehicles during construction, a temporary stream crossing shall be provided.

8.15.1.16.2. The purpose of temporary stream crossings is to provide a means for construction traffic to cross-flowing streams without damage to the channel or banks, and to keep sediment generated by construction traffic out of the stream.

8.15.1.16.3. Multiple culvert installations shall be approved on a case basis, provided the minimum pipe diameter proposed is eighteen (18) inches, and sufficient space is provided between culverts to allow for soil compaction.

8.15.1.16.4. Culverts shall have a slope greater than or equal to the stream bed being crossed, and extend the full width of the crossing, including side slopes.

8.15.1.16.5. Temporary stream crossings shall be inspected after every rainfall, and at least weekly for assessment of damages due to stormwater flows or construction equipment. Necessary repairs shall be accomplished within twenty-four (24) hours, or as soon as the soil dries sufficiently to allow work to proceed.

8.15.1.17. Non-Structural Preservation Measures

8.15.1.17.1. The ASWP3 or SWP3 must make use of practices that preserve the existing natural condition to the maximum extent practicable. Such practices may include preserving riparian areas, preserving existing vegetation and vegetative buffer strips, phasing of construction operations in order to minimize the amount of disturbed land at any one time, and designation of tree preservation areas or other protective clearing or grubbing practices.

8.15.1.18. Non-Sediment Pollution Controls

8.15.1.18.1. No solid or liquid waste, including building materials, shall be discharged in storm water runoff. The applicant must implement site Best Management Practices (BMPs) to prevent toxic materials, hazardous materials or other debris from entering water resources or wetlands. These practices shall include but are not limited to the following:

8.15.1.18.1.1. Waste Materials: A covered Dumpster shall be made available for the proper disposal of garbage, plaster, drywall, grout, gypsum, and other water materials.

8.15.1.18.1.2. Concrete Truck Wash Out: The washing of concrete material into a street, catch basin, or other public facility or natural resource id prohibited. A designated area for concrete washout shall be made available.

8.15.1.18.1.3. Fuel/Liquid Tank Storage: All fuel/liquid tanks and drums shall be stored in a marked storage area. A dike shall be constructed around this storage area with a minimum capacity equal to 110% of the volume of all containers in the storage area.

8.15.1.18.1.4. Toxic or Hazardous Waste Disposal: Any toxic or hazardous waste shall be disposed of properly.

8.15.1.18.1.5. Contaminated Soils Disposal and Runoff: Contaminated soils from redevelopment sites shall be disposed of properly. Runoff from contaminated soils shall not be discharged from the site. Proper permits shall be obtained for development projects on solid waste landfill sites or redevelopment sites.

8.15.1.19. Permanent Stabilization

8.15.1.19.1. Disturbed areas must be stabilized as specified in the following table:

Table 31 - Permanent Stabilization

Area requiring permanent stabilization	Time frame to apply erosion controls
Any area that will lie dormant for one year or more.	Within 7 days of the most recent disturbance.
Any area within 50 feet of a stream and at final grade.	Within 2 days of reaching final grade.
Any area at final grade.	Within 7 days of reaching final grade within that area.

8.15.1.20. Permanent stabilization of conveyance channels

8.15.1.20.1. Applicants shall undertake special measures to stabilize channels and outfalls and prevent erosive flows. Measures may include seeding, dormant seeding, mulching, erosion control matting, sodding, riprap, natural channel design with bioengineering techniques, or rock check dams, all as defined in the most recent edition of *Rainwater and Land Development* or the Field Office Technical Guide available at www.nrcs.usda.gov/technical/efotg/.

8.16. EROSION AND SEDIMENTATION CONTROL PERFORMANCE STANDARDS

8.16.1. The SWP3 or ASWP3 must contain a description of the controls appropriate for each construction operation and the applicant must implement such controls. The SWP3 or ASWP3 must clearly describe for each major construction activity the appropriate control measures; the general sequence during the construction process under which the measures will be implemented; and the contractor responsible for implementation (e.g., contractor A will clear land and install perimeter controls and contractor B will maintain perimeter controls until final stabilization). The SWP3 or ASWP3 shall identify all subcontractors engaged in activities that could impact storm water runoff. The SWP3 or ASWP3 shall contain signatures from all of the identified subcontractors indicating that they have been informed and understand their roles and responsibilities in complying with the SWP3 or ASWP3.

8.16.2. General Regulations

8.16.2.1. All development activity greater than 0.10 acre shall be provided with erosion and sedimentation control devices during all phases of construction. Development activity less than or equal to 0.10 acres may be required to have erosion and sedimentation control provided during all construction phases if determined to be necessary by the City Engineer.

8.16.2.1.1. All developments requiring erosion and sedimentation control shall post an Erosion and Sedimentation Control Bond with the City of Lebanon as described in Section 2.10 of this Manual.

8.16.2.2. No construction or other development activity such as grading, cutting, or filling for site development shall be started or continued unless erosion and sedimentation control devices have been installed and maintained to the satisfaction of the City Engineer.

8.16.2.3. All roadways shall be kept clean of mud, dirt, gravel, and debris. Any debris in the roadway shall be promptly cleaned.

8.16.2.4. All erosion control measures shall be maintained throughout construction and after construction activities have been completed until final sustainable cover has been established.

8.16.2.5. Stormwater discharges that are released to natural channels shall be at non-erosive velocities unless the channel is stabilized or otherwise able to withstand higher velocities, as determined by the City Engineer.

8.16.2.6. As delineated in Sections 8.13. and 8.14., a SWP3 or ASWP3 plan shall be submitted to the City Engineer, which incorporates current BMPs for construction site runoff control.

8.16.2.7. Truck washout facility for mud on tires, etc shall be required for all construction sites unless otherwise approved by the City Engineer.

8.16.3. Runoff Control Practices

8.16.3.1. The SWP3 or ASWP3 shall incorporate measures that control the flow of runoff from disturbed areas so as to prevent erosion. Such practices may include rock check dams, pipe slope drains, diversions to direct flow away from exposed soils and protective grading practices. These practices shall divert runoff away from disturbed areas and steep slopes where practicable.

8.16.4. Sediment Control Practices

8.16.4.1. The SWP3 or ASWP3 shall include a description of, and detailed drawings for, all structural practices that shall store runoff, allowing sediments to settle and/or divert flows away from exposed soils or otherwise limit runoff from exposed areas. Structural practices shall be used to control erosion and trap sediment from a site remaining disturbed for more than 14 days. Such practices may include, among others: sediment settling ponds, silt fences, storm drain inlet protection, and earth diversion dikes or channels which direct runoff to a sediment settling pond. All sediment control practices must be capable of ponding runoff in order to be considered functional. Earth diversion dikes or channels alone are not considered a sediment control practice unless used in conjunction with a sediment settling pond.

8.16.5. Surface Waters of the State protection

8.16.5.1. Construction vehicles shall avoid water resources and wetlands. If the applicant is permitted to disturb areas within 50 feet of a water resource or wetland, the following conditions shall be addressed in the SWP3:

8.16.5.1.1. All BMPs and stream crossings shall be designed as specified in the most recent edition of the Rainwater and Land Development Manual.

8.16.5.1.2. Structural practices shall be designated and implemented on site to protect water resources or wetlands from the impacts of sediment runoff.

8.16.5.1.3. No structural sediment controls (e.g., the installation of silt fence or a sediment settling pond in-stream) shall be used in a water resource or wetland.

8.16.5.1.4. Where stream crossings for roads or utilities are necessary and permitted, the project shall be designed such that the number of stream crossings and the width of the disturbance are minimized.

8.16.5.1.5. Temporary stream crossings shall be constructed if water resources or wetlands will be crossed by construction vehicles during construction.

8.16.5.1.6. Construction of bridges, culverts, or sediment control structures shall not place soil, debris, or other particulate material into or close to the water resources or wetlands in such a manner that it may slough, slip, or erode.

8.16.6. Modifying controls

8.16.6.1. If periodic inspections or other information indicates a control has been used inappropriately or incorrectly, the applicant shall replace or modify the control for site conditions.

8.16.7. Compliance With Other Requirements

8.16.7.1. The SWP3 shall be consistent with applicable State and/or local waste disposal, sanitary sewer, or septic system regulations, including provisions prohibiting waste disposal by open burning, and shall provide for the proper disposal of contaminated soils located within the development area.

8.16.8. Trench And Ground Water Control

8.16.8.1. There shall be no sediment-laden or turbid discharges to water resources or wetlands resulting from dewatering activities. If trench or ground water contains sediment, it must pass through a sediment-settling pond or other equally effective sediment control device, prior to being discharged from the construction site. Alternatively, sediment may be removed by settling in place or by dewatering into a sump pit, filter bag or comparable practice. Ground water dewatering which does not contain sediment or other pollutants is not required to be treated prior to discharge. However, care must be taken when discharging ground water to ensure that it does not become pollutant-laden by traversing over disturbed soils or other pollutant sources.

8.16.9. Internal Inspections

8.16.9.1. All controls on the site shall be inspected at least once every seven calendar days and within 24 hours after any storm event greater than one-half inch of rain per 24 hour period. The inspection frequency may be reduced to at least once every month if the entire site is temporarily stabilized or runoff is unlikely due to weather conditions (e.g., site is covered with snow, ice, or the ground is frozen). A waiver of inspection requirements is available until one month before thawing conditions are expected to result in a discharge if prior written approval has been attained from the City Engineer and all of the following conditions are met:

8.16.9.1.1. The project is located in an area where frozen conditions are anticipated to continue for extended periods of time (i.e. more than one (1) month).

8.16.9.1.2. Land disturbance activities have been suspended, and temporary stabilization is achieved.

8.16.9.1.3. The beginning date and ending dates of the waiver period are documented in the SWP3.

8.16.9.2. The applicant shall assign qualified inspection personnel to conduct these inspections to ensure that the control practices are functional and to evaluate whether the SWP3 is adequate, or whether additional control measures are required. Qualified inspection personnel are individuals with knowledge and experience in the installation and maintenance of sediment and erosion controls. These inspections shall meet the following requirements:

8.16.9.2.1. Disturbed areas and areas used for storage of materials that are exposed to precipitation shall be inspected for evidence of or the potential for, pollutants entering the drainage system.

8.16.9.2.2. Erosion and sediment control measures identified in the SWP3 shall be observed to ensure that they are operating correctly. The applicant shall utilize an inspection form provided by the City of Lebanon or an alternate form acceptable to the City Engineer. The inspection form shall include:

8.16.9.2.2.1. The inspection date.

8.16.9.2.2.2. Names, titles and qualifications of personnel making the inspection.

8.16.9.2.2.3. Weather information for the period since the last inspection, including a best estimate of the beginning of each storm event, duration of each storm event and approximate amount of rainfall for each storm event in inches, and whether any discharges occurred.

8.16.9.2.2.4. Weather information and a description of any discharges occurring at the time of the inspection.

8.16.9.2.2.5. Locations of:

8.16.9.2.2.5.1. Discharges of sediment or other pollutants from site.

8.16.9.2.2.5.2. BMPs that need to be maintained.

8.16.9.2.2.5.3. BMPs that failed to operate as designed or proved inadequate for a particular location.

8.16.9.2.2.5.4. Where additional BMPs are needed that did not exist at the time of inspection.

8.16.9.2.3. Corrective action required including any necessary changes to the SWP3 and implementation dates.

8.16.9.2.4. Discharge locations shall be inspected to determine whether erosion and sediment control measures are effective in preventing significant impacts to the receiving water resource or wetlands.

8.16.9.2.5. Locations where vehicles enter or exit the site shall be inspected for evidence of off-site vehicle tracking.

8.16.9.2.6. The applicant shall maintain for three (3) years following final stabilization the results of these inspections, the names and qualifications of personnel making the inspections, the dates of inspections, major observations relating to the implementation of the SWP3, a certification as to whether the facility is in compliance with the SWP3, and information on any incidents of non-compliance determined by these inspections.

8.16.10. Maintenance

8.16.10.1. The SWP3 shall be designed to minimize maintenance requirements. All control practices shall be maintained and repaired as needed to ensure continued performance of their intended function until final stabilization. All sediment control practices must be maintained in a functional condition until all up slope areas they control reach final stabilization. The applicant shall provide a description of maintenance procedures needed to ensure the continued performance of control practices and shall ensure a responsible party and adequate funding to conduct this maintenance, all as determined by the City Engineer.

8.16.10.1.1. When inspections reveal the need for repair, replacement, or installation of erosion and sediment control BMPs, the following procedures shall be followed:

8.16.10.1.1.1. When practices require repair or maintenance

8.16.10.1.1.1.1. If an internal inspection reveals that a control practice is in need of repair or maintenance, with the exception of a sediment-settling pond, it must be repaired or maintained within three (3) days of the inspection. Sediment settling ponds must be repaired or maintained within ten (10) days of the inspection.

8.16.10.1.1.2. When practices fail to provide their intended function

8.16.10.1.1.2.1. If an internal inspection reveals that a control practice fails to perform its intended function as detailed in the SWP3 and that another, more appropriate control practice is required, the SWP3 must be amended and the new control practice must be installed within ten (10) days of the inspection.

8.16.10.1.1.3. When practices depicted on the SWP3 are not installed

8.16.10.1.1.3.1. If an internal inspection reveals that a control practice has not been implemented in accordance with the schedule, the control practice must be implemented within ten (10) days from the date of the inspection. If the internal inspection reveals that the planned control practice is not needed, the record must contain a statement of explanation as to why the control practice is not needed.

8.17. STORMWATER QUALITY BMP MAINTENANCE REQUIREMENTS

8.17.1. Stormwater quantity provisions and stormwater quality BMPs that are constructed on privately-owned land shall be maintained by a Homeowners Association or if no Homeowner's Association is established, the owner of the subject property. In the case of a TIF property, the provisions

shall be maintained by the building owner. The following requirements shall be met for all stormwater quantity provisions and stormwater quality BMPs that have been constructed on privately-owned property.

8.17.2. Minimum maintenance requirements

8.17.2.1. At a minimum, the following maintenance requirements found in the following two tables shall be performed on all BMPs:

Table 32 - Preventive BMP Maintenance Schedule for Typical Routine Tasks

BMP Structure Type	Routine Task	Frequency
Wet Ponds/Dry Ponds/Infiltration Basins/Infiltration Trenches	Remove Trash/Debris for BMP and contributing area	Quarterly
	Mow to 6”-8” grass height	Quarterly
	Remove wood vegetation from dam and banks	Spring/Fall
	Stabilize/Revegetate side areas	As needed
	Repair embankment and side slopes	As needed
	Fill animal burrows	ASAP
Wet Pond	Lubricate mechanical components	Annually
Bioretention Cells	Remove Trash/Debris from contributing area	Quarterly
	Ensure contributing areas are not sources of vehicle fluids	Quarterly
	Stabilize/Revegetate cell area	Quarterly
	Replace mulch layer	Annually or as needed
	Stabilize/Revegetate contributing areas	As needed

Table 33 - BMP Preventive Maintenance Schedule for Typical Non-Routine Tasks

BMP Structure Type	Task	Frequency
Wet Ponds	Remove accumulated sediment/pollutants	5-15 years
	Replace mechanical components	20 yrs
	Reconstruct spillways and embankments	20-50 years
	Control algae	When Identified
	Remove noxious weeds	When Identified
	Repair fencing	When Identified
Dry Ponds/Infiltration Trenches	Remove accumulated sediment/pollutants	2-10 years
	Dethatch grass to remove sediment buildups	2 years
	Aerate compacted area to promote infiltration	2-3 years
	Replace components, reconstruct embankments	20-50 years
Infiltration Basins/Infiltration Trenches	Remove/replace top 6" of gravel	2 years
	Remove accumulated sediment from main cells	20 years
Bioretention Cells	Removed accumulated sediments	1-2 years
	Remove and replace top few inches of mulch/media	1-2 years
	Replace filter media, replace underdrains	20 years

8.17.3. Maintenance Covenants

8.17.3.1. Prior to approval of a Final Plat for an Subdivision/PUD and/or the issuance of an Occupancy Permit for any building within a permitted development served by stormwater quantity detention and retention basins and stormwater quality BMPs, the applicant or owner of the stormwater quantity provisions and stormwater quality BMPs shall establish a formal Maintenance Covenant approved by the City of Lebanon and recorded in the Warren County Recorder's Office in which the owner acknowledges the duty of the owner and all subsequent owners of the property to maintain the stormwater quantity provisions and stormwater quality BMPs in accordance with the terms of the covenant.

8.17.3.1.1. For existing facilities, copies of recorded maintenance covenants shall be provided by the responsible entity to the City within 90 days from a written request of the City of Lebanon.

8.17.3.2. Maintenance Covenants shall also specify the Homeowners Association or other party responsible for maintenance of the stormwater quantity provisions and stormwater quality BMPs. A Homeowners Association or similar legal entity has the power to compel contributions from residents of a development to cover their proportionate shares of the costs associated with stormwater quantity provision and stormwater quality BMP maintenance.

8.17.3.3. A maintenance plan, schedule, and responsible party contact information shall be provided to the City when the copy of the recorded covenant is provided to the City.

8.17.4. Requirements for the Maintenance Covenants

8.17.4.1. Stormwater quantity provisions and stormwater quality BMPs shall be periodically inspected as described in the Maintenance Covenant to identify maintenance and repair needs and to ensure compliance with the requirements of these regulations. Any identified maintenance and/or repair needs shall be addressed in a timely manner.

8.17.4.2. The inspection and maintenance requirement may be increased as deemed necessary by the Office of the City Engineer to ensure proper functioning of the stormwater quantity provisions and stormwater quality BMPs.

8.17.5. Records of Installation and Maintenance Activities

8.17.5.1. Parties responsible for the inspection, operation, and maintenance of a stormwater quantity provisions and stormwater quality BMPs shall make records of the installation of all the maintenance and repairs and shall retain the records for at least five years. Those records shall be made available to the Office of the City Engineer upon request and/or as specifically outlined in the Maintenance Covenant.

8.17.6. Failure to Maintain Practices

8.17.6.1. It is unlawful for a property owner to fail to meet the requirements of the Maintenance Covenant. Any person or association that fails to meet the requirements of the Maintenance Covenant shall be subject to a civil penalty payable to the City of Lebanon as defined in Section 931 of the City of Lebanon Codified Ordinances Each day that the violation continues shall constitute a separate violation.

8.17.6.2. No penalties shall be assessed until the person alleged to be in violation has been notified in writing of the violation by registered or certified mail, return receipt requested, or by other means which are reasonably calculated to give actual notice.

8.17.6.3. The notice shall describe the nature of the violation with reasonable particularity, specify a reasonable time period within which the violation must be corrected, and warn that failure to correct the violation within the time period will result in assessment of a civil penalty or other enforcement action.

8.17.6.4. In the event that a stormwater quantity provisions and stormwater quality BMPs becomes a danger to public safety or public health, the City of Lebanon, after reasonable notice as described above, may seek a mandatory or prohibitory injunction and order of abatement commanding the property owner to correct a violation of the design criteria standards or maintenance needs contained in the Maintenance Covenants by performing all necessary work to place the stormwater quantity provisions and stormwater quality BMPs in proper working condition.

8.17.6.5. If the property owner fails to take corrective action as ordered by the Court, the City of Lebanon may seek an order holding the property owner in contempt of court and for authority to execute the order of abatement by taking the corrective action. If the City of Lebanon executes the order of abatement it shall have a lien upon the property for the cost of executing the order of abatement.

8.18. DEDICATION OF EASEMENTS AND RIGHTS-OF-WAY

8.18.1. The applicant shall, at no expense to the City, convey drainage easements or rights-of-way required in the Stormwater Regulations for the public stormwater facilities within the development.

8.18.2. The owner or applicant shall secure the offsite drainage easements required by the Stormwater Regulations when a proposed drainage system will carry water across private land outside the development.

8.18.3. When a development is bisected by a watercourse or open channel, the applicant shall provide a drainage easement, or right-of-way, conforming substantially to the alignment of such watercourse or open channel, and of the minimum width indicated in Paragraph 8.18.6. below.

8.18.4. Easements and rights-of-way shall include suitable access for maintenance equipment from public rights-of-way as specified herein.

8.18.5. All drainage easements, both on and off-site, shall be recorded on a final plat or other separate recorded document approved by the City.

8.18.6. Outfall ditches and channels shall have sufficient rights-of-way and/or easements for the facility itself and an unobstructed and approved maintenance access way on one or both sides. The access way portion of said rights-of-way and/or easements shall connect to a public right-of-way or easement in ways sufficient to allow for suitable access by maintenance equipment. The total width of said easements shall be the width of the facility in addition to the amount determined from the criteria given in Table 34.

Table 34 - Minimum Easement Requirements

Ditch Or Channel Top Of Bank Width	Minimum Maintenance Easement Required
Less than 16 feet	20 feet one side
16 feet to 32 feet	20 feet both sides
32 feet to 55 feet	20 feet one side and 30 feet opposite side
Over 55 feet	30 feet both sides

8.18.7. Detention/retention facilities, stilling basins, ponds or other drainage related structures or facilities shall have sufficient rights-of-way and/or easements for the facility itself and its maintenance, and an unobstructed and approved maintenance access way that connects to a public right-of-way or easement in ways sufficient to allow for suitable access by maintenance equipment, including sufficient space at cul-de-sacs for turning maintenance vehicles around.

8.18.8. Where the right-of-way and/or easement is provided for access only, the minimum width shall be 20 feet, or wider if deemed necessary by the City Engineer.

8.18.9. Responsibility for the private maintenance of all such facilities shall be delineated in a legally binding document which shall be approved by the City Engineer prior to granting record plat approval.

8.18.10. Maintenance access ways shall be sloped at 1/4-inch per foot across their entire width, or crowned at the centerline and sloped at 1/4-inch per foot in both directions.

8.18.11. A 20-foot minimum easement centered on a storm sewer shall be conveyed to the City when the storm sewer is not located within dedicated rights-of-way. Such easements shall cross or be connected to public rights-of-way in ways that will allow suitable access by maintenance equipment.

8.18.12. Overland flood routing paths shall be used to convey stormwater runoff from the 100-year, 24-hour storm event to an adequate receiving water body, stormwater system or stormwater detention basin such that the runoff is contained within an easement for the flood routing path and does not cause flooding of residential or commercial buildings or related structures. When designing the flood routing paths, the conveyance capacity of the area's storm sewers shall be taken into consideration.

8.19. ACCEPTANCE OF STORMWATER IMPROVEMENTS

8.19.1. Subsequent to satisfying the requirements of the Stormwater Regulations, other applicable ordinances, and the issuance of appropriate permits and/or approvals, the applicant shall,

immediately prior to and during construction, arrange for and schedule the following inspections by the City:

8.19.1.1. During clearing operations and early excavation activities to assure that effective control practices relative to erosion and sedimentation are being followed.

8.19.1.2. All public underground conveyance and control structures prior to backfilling, and all taps of private underground conveyance systems into public conveyance systems.

8.19.1.3. Final inspection when all public systems required under the approved Site stormwater management plan have been installed. Prior to final acceptance, a video inspection in accordance with the requirements set forth in Section 2.13. of all storm sewer pipe and structures shall be conducted at the Contractor's expense by a professional inspection firm. Copies of all video and written reports shall be provided to the City of Lebanon for review and approval prior to the acceptance of the improvements or the release of bonds.

8.19.2. The Professional Engineer for the project shall submit a signed and sealed set of as-built plans, on electronic disk and in reproducible form on Mylar brand polyester film drawing sheets, certifying that the system has been constructed as designed, and that it satisfies all conditions of the site stormwater management plan. Where changes have been made which deviate from the approved construction plans for the stormwater management system, the Professional Engineer shall submit supporting documentation along with the as-built plans that proves, to the satisfaction of the City Engineer, that the stormwater system is in compliance with the Stormwater Regulations. All as-built plans shall be in accordance with the current City of Lebanon As-Built Drawing Requirements.

8.19.3. Maintenance and compliance inspections of stormwater management systems will also be conducted on a routine, periodic, or random basis as deemed appropriate by the City or other agency(s) having jurisdiction, or as complaints arise concerning the system. By seeking and obtaining plan approval under the Stormwater Regulations, the owner/applicant and his/her/their contractor shall be deemed to have consented to such inspections by the City and/or other appropriate regulatory agencies or departments, upon presentation of proper identification by their representative(s) conducting the inspections.

8.19.4. Public improvements, in the form of public stormwater conveyance and control systems, may be accepted for public use after the following minimum conditions have been met:

8.19.4.1. The applicant shall provide to the City Engineer proof of security as required by the City Engineer;

8.19.4.2. The applicant shall provide to the City Engineer as-built plans according to Paragraph 8.19.2. of the Stormwater Regulations; and

8.19.4.3. The as-built plans have been reviewed and approved by the City Engineer.

8.19.5. Private improvements in the form of private stormwater conveyance and control systems may be approved for use after the following minimum conditions have been met:

8.19.5.1. The applicant shall provide to the City Engineer as-built plans according to Paragraph 8.19.2. of the Stormwater Regulations; and

8.19.5.2. The as-built plans have been reviewed and approved by the City Engineer. Until said as-built plans have been approved, no conditional occupancy or final occupancy permit shall be issued.

8.19.5.3. No act of review, approval, permitting, inspection(s), or the like, including associated activities shall be construed as acceptance of private improvements by the City.

8.20. MAINTENANCE RESPONSIBILITY

8.20.1. The installed stormwater management system shall be maintained by the legal entity responsible for maintenance. All site stormwater management plan applications shall contain documentation sufficient to demonstrate that the operation and maintenance entity is the legal entity empowered and obligated to perpetually maintain the stormwater management facilities. The City considers the following entities acceptable to operate and maintain stormwater management facilities:

8.20.1.1. Local governmental units, including the county, municipalities, or Municipal Service Taxing Units;

8.20.1.2. Non-profit corporations, including homeowners associations, property owners associations or condominium owners associations, under certain conditions which ensure that the corporation has the financial, legal, and administrative capability to provide for the long-term operation and maintenance of the facilities.

8.20.2. The property owner or developer is normally not acceptable as a responsible entity, especially when the property is to be sold to various third parties. However, the property owner or developer may be acceptable under one of the following circumstances:

8.20.2.1. Said applicant wholly owns the property and the ownership is intended to be retained. This would apply to a farm, corporate office, or single industrial facility, for example.

8.20.2.2. The ownership of the property is retained by the applicant and is either leased to third parties (such as in some shopping centers), or rented to third parties (such as in some mobile home parks), for example.

8.20.3. It is the policy of the City of Lebanon that all stormwater quality BMPs and all stormwater detention facilities shall be maintained by the property owner or other approved and legally empowered entity as defined in Paragraph 8.20.1. The City maintains an inventory of all such BMPs and detention facilities and performs regular inspections thereof. If, in the course of said inspections, it is determined that any such stormwater quality assurance facility is not performing as originally designed, the City Engineer shall issue an order requiring the responsible person or entity to make whatever repairs are necessary to restore it to function as originally intended.

8.20.4. The following statements shall be added to all construction plans and plats:

8.20.4.1. "The City of Lebanon assumes no legal obligation to maintain or repair any stormwater detention/retention facilities, open drainage ditches, or open channels, areas designated as "drainage easements", stormwater quality provisions, or BMPs. The easement area of each lot and all improvements within it shall be maintained continuously by the lot owner. Within the easements, no structure, planting, fencing, culvert, or other material shall be placed or permitted to remain which may obstruct, retard, or divert the flow through the watercourse."

8.20.4.2. In the case of a development with a Homeowner's Association:

8.20.4.2.1. "Detention/retention & stormwater quality structures and facilities shall be maintained in perpetuity by the Homeowner's Association."

8.20.4.3. In the case of a development or property without a Homeowner's Association:

8.20.4.3.1. "Detention/retention & stormwater quality structures and facilities shall be maintained in perpetuity by the lot owners of the development."

8.20.5. Public improvements shall have adequate easements, in accordance with Paragraph 8.17., to permit the City to inspect and, if necessary, to take corrective action shall the responsible legal entity fail to maintain the system properly.

8.20.6. Maintenance of stormwater facilities shall allow the stormwater management system to function and perform as originally designed and permitted by the City, other appropriate governmental agencies, and as set forth in the site stormwater management plan.

8.20.7. Maintenance shall comply with City building and construction codes, and all other applicable codes and regulations.

8.20.8. Enforcement of these maintenance responsibilities shall be subject to the provisions of Paragraph 8.22., ENFORCEMENT and to Paragraph 8.23., PENALTIES.

8.21. WATERCOURSE PROTECTION

8.21.1. Every person owning property through which a watercourse passes, or such person's lessee, shall keep and maintain that part of the watercourse within the property reasonably free of trash, debris, excessive vegetation, and other obstacles that would pollute, contaminate, or significantly retard the flow of water through the watercourse. In addition, the owner or lessee shall maintain existing privately owned structures within or adjacent to a watercourse, so that such structures will not become a hazard to the use, function, or physical integrity of the watercourse. The owner or lessee shall not remove healthy bank vegetation beyond that actually necessary for maintenance, nor remove said vegetation in such a manner as to increase the vulnerability of the watercourse to erosion

8.22. ENFORCEMENT

8.22.1. If at any time the City Engineer determines that the project is not in accordance with the approved site stormwater management plan, or if any project subject to the Stormwater Regulations is carried out without an approved plan, the City Engineer is authorized to take corrective action.

8.22.1.1. In the event of performing a project subject to the Stormwater Regulations without an approved plan, give the owner, person(s) in possession, or other applicable legal entity, written notice of the corrective action required. Should the owner/legal entity fail to complete such corrective action within 15 days of the date of the notice, the City Engineer may enter upon the property, take the necessary corrective action, bill the violator for the cost thereof and, if the bill is not paid within 90 days, file a lien against the property for the cost of such corrective action.

8.22.1.2. With or without an approved plan, take appropriate corrective action in the event of an emergency situation determined by the City Engineer to exist that endangers persons, property, or both.

8.22.1.3. In the event of noncompliance with an approved plan, issue written notice to the applicant/owner/legal entity specifying the nature and location of the alleged noncompliance, with a description of the remedial actions necessary to bring the project into compliance within five working days.

8.22.2. Failure to comply with any of these enforcement provisions, including failure to complete the prescribed remedial work within the specified time, shall result in the issuance of a stop-work order directing the applicant, owner, or person(s) in possession to cease and desist all or any portion of development work in the area that violates the provisions of the Stormwater Regulations. The applicant shall then bring the project into compliance with the Stormwater Regulations before said stop work order is released and development work can proceed on the project

8.22.3. Failure to carry out the provisions of the maintenance commitment plan portion of the site stormwater management plan during and after completion of construction activities, shall result in the same enforcement sanctions prescribed in Paragraphs 8.22.1. through 8.22.1.2.

8.23. PENALTY

8.23.1. Whoever violates any provisions of this section is subject to penalties as described in the City of Lebanon codified Ordinances.