RELEASE RATES (PERCENTAGE OF PRE-DEVELOPMENT PEAK)
MAUCH CHUNK CREEK WATERSHED

Subarea	Return Period (Years)	
	2-YEAR	10-YEAR
MCH-1	95%	95%
MCH-2	95%	95%
MCH-3	90%	90%
MCH-4	95%	95%
MCH-5	100%	100%
MCH-6	100%	100%
MCH-7	100%	100%
MCH-8	95%	95%
MCH-9	90%	90%
MCH-10	85%	85%
MCH-11	95%	95%

RELEASE RATES (PERCENTAGE OF PRE-DEVELOPMENT PEAK)
MAHONING CREEK WATERSHED

Subarea	Return Period (Years)	
	2-YEAR	10-YEAR
MHH-1	65%	65%
MHH-2	65%	70%
MHH-3	100%	65%
MHH-4	60%	85%
MHH-5	80%	75%
MHH-6	80%	70%
MHH-7	70%	90%
MHH-8	90%	95%
MHH-9	65%	60%
MHH-10	85%	85%
MHH-11	65%	65%
MHH-12	75%	70%
MHH-13	90%	90%
MHH-14	65%	65%
MHH-15	90%	90%
MHH-16	80%	80%
MHH-17	100%	100%
MHH-18	60%	60%
MHH-19	100%	100%
MHH-20	100%	100%
MHH-21	70%	80%
MHH-22	60%	95%
MHH-23	75%	75%

RELEASE RATES (PERCENTAGE OF PRE-DEVELOPMENT PEAK)
MAHONING CREEK WATERSHED

Subarea	Return Period (Years)	
	2-YEAR	10-YEAR
MHH-24	95%	95%
MHH-25	95%	95%
MHH-26	95%	95%
MHH-27	65%	95%
MHH-28	60%	60%
MHH-29	95%	80%
MHH-30	85%	80%
MHH-31	85%	75%
MHH-32	95%	85%
MHH-33	80%	90%
MHH-34	60%	60%
MHH-35	95%	95%
MHH-36	60%	95%
MHH-37	90%	60%
MHH-38	95%	85%
MHH-39	70%	60%
MHH-40	100%	90%
MHH-41	100%	95%
MHH-42	100%	95%
MHH-43	75%	65%
MHH-44	85%	80%
MHH-45	60%	60%
MHH-46	90%	95%
MHH-47	90%	95%
MHH-48	70%	75%
MHH-49	65%	60%

RELEASE RATES (PERCENTAGE OF PRE-DEVELOPMENT PEAK)
MAHONING CREEK WATERSHED

Subarea	Return Period (Years)	
	2-YEAR	10-YEAR
MHH-50	60%	75%
MHH-51	70%	90%
MHH-52	70%	80%
MHH-53	95%	90%
MHH-54	95%	75%
MHH-55	60%	80%
MHH-56	65%	85%
MHH-57	85%	75%
MHH-58	75%	75%
MHH-59	95%	95%
MHH-60	90%	90%
MHH-61	100%	100%
MHH-62	100%	75%
MHH-63	100%	100%
MHH-64	100%	100%
MHH-65	100%	100%
MHH-66	100%	100%
MHH-67	100%	100%
MHH-68	100%	100%
MHH-69	95%	95%
MHH-70	95%	95%
MHH-71	95%	95%
MHH-72	95%	95%
MHH-73	100%	100%
MHH-74	100%	100%
MHH-75	95%	95%

RELEASE RATES (PERCENTAGE OF PRE-DEVELOPMENT PEAK)
MAHONING CREEK WATERSHED

Subarea	Return Period (Years)	
	2-YEAR	10-YEAR
MHH-76	85%	95%
MHH-77	100%	75%
MHH-78	95%	90%
MHH-79	80%	75%
MHH-80	60%	95%
MHH-81	100%	100%
MHH-82	100%	100%
MHH-83	100%	95%
MHH-84	95%	80%
MHH-85	75%	100%
MHH-86	100%	95%
MHH-87	95%	90%
MHH-88	80%	100%
MHH-89	100%	100%
MHH-90	100%	100%
MHH-91	100%	100%
MHH-92	100%	100%
MHH-93	100%	100%

RELEASE RATES (PERCENTAGE OF PRE-DEVELOPMENT PEAK)
LIZARD CREEK WATERSHED

Subarea	Return Period (Years)	
	2-YEAR	10-YEAR
LZZ-1	80%	85%
LZZ-2	65%	60%
LZZ-3	65%	75%
LZZ-4	60%	60%
LZZ-5	60%	60%
LZZ-6	60%	60%
LZZ-7	60%	65%
LZZ-8	75%	80%
LZZ-9	60%	65%
LZZ-10	65%	60%
LZZ-11	70%	60%
LZZ-12	80%	75%
LZZ-13	60%	60%
LZZ-14	60%	70%
LZZ-15	70%	80%
LZZ-16	70%	70%
LZZ-17	70%	65%
LZZ-18	100%	65%
LZZ-19	60%	65%
LZZ-20	100%	100%
LZZ-21	95%	70%
LZZ-22	95%	60%
LZZ-23	75%	75%

RELEASE RATES (PERCENTAGE OF PRE-DEVELOPMENT PEAK)
LIZARD CREEK WATERSHED

Subarea	Return Period (Years)	
	2-YEAR	10-YEAR
LZZ-24	100%	70%
LZZ-25	100%	75%
LZZ-26	85%	70%
LZZ-27	100%	100%
LZZ-28	75%	60%
LZZ-29	85%	75%
LZZ-30	80%	90%
LZZ-31	60%	90%
LZZ-32	70%	60%
LZZ-33	70%	75%
LZZ-34	60%	75%
LZZ-35	60%	60%
LZZ-36	80%	70%
LZZ-37	60%	100%
LZZ-38	65%	60%
LZZ-39	60%	60%
LZZ-40	60%	75%
LZZ-41	90%	100%
LZZ-42	65%	90%
LZZ-43	80%	90%
LZZ-44	75%	65%
LZZ-45	60%	60%
LZZ-46	65%	60%
LZZ-47	60%	75%
LZZ-48	90%	90%
LZZ-49A	95%	95%

RELEASE RATES (PERCENTAGE OF PRE-DEVELOPMENT PEAK)
LIZARD CREEK WATERSHED

Subarea	Return Period (Years)	
	2-YEAR	10-YEAR
LZZ-49A	80%	80%
LZZ-50	75%	70%
LZZ-51	90%	90%
LZZ-52	70%	75%
LZZ-53	85%	90%
LZZ-54	75%	85%
LZZ-55	90%	90%
LZZ-56	95%	95%
LZZ-57	60%	60%
LZZ-58	60%	60%
LZZ-59	95%	95%
LZZ-60	95%	95%
LZZ-61	75%	70%
LZZ-62	75%	65%
LZZ-63	95%	95%
LZZ-64	95%	95%
LZZ-65	95%	90%
LZZ-66	90%	95%
LZZ-67	70%	60%
LZZ-68	65%	60%
LZZ-69	95%	95%
LZZ-70	95%	95%
LZZ-71	95%	95%
LZZ-72	90%	85%
LZZ-73	100%	100%
LZZ-74	100%	100%

RELEASE RATES (PERCENTAGE OF PRE-DEVELOPMENT PEAK)
LIZARD CREEK WATERSHED

Subarea	Return Period (Years)	
	2-YEAR	10-YEAR
LZZ-75	100%	100%
LZZ-76	85%	90%
LZZ-77	90%	85%
LZZ-78	90%	90%
LZZ-79	90%	90%
LZZ-80	65%	70%
LZZ-81	75%	75%
LZZ-82	60%	60%
LZZ-83	100%	100%
LZZ-84	100%	75%
LZZ-85	95%	95%
LZZ-86	80%	85%
LZZ-87	100%	100%
LZZ-88	100%	100%
LZZ-89	100%	100%
LZZ-90	100%	100%
LZZ-91	100%	100%
LZZ-92	100%	100%
LZZ-93	75%	85%
LZZ-94	75%	80%
LZZ-95	75%	75%
LZZ-96	95%	90%
LZZ-97	100%	100%
LZZ-98	100%	100%
LZZ-99	100%	100%
LZZ-100	100%	100%

SECTION 303. DESIGN CRITERIA FOR STORMWATER MANAGEMENT FACILITIES

A. Any stormwater management facilities required or regulated by this Ordinance shall be designed to meet the performance standards presented in Section 302 of this Ordinance. Compensatory stormwater management facilities shall not be permitted.

B. Any stormwater management facility required or regulated by this ordinance shall be designed to provide an emergency spillway to handle flow up to the 100 year post-development conditions. The height of embankment must be set as to provide a minimum 1.0 foot of freeboard above the maximum pool elevation computed when the facility functions for the 100 year post-development inflow. However, criteria for design and construction of stormwater management facilities are not the same criteria that are used in the permitting of dams under the Dam Safety Program. Depending upon the physical characteristics of a dam, a dam permit may be required and the design will have to meet the provisions of Chapter 105 of the Dam Safety and Encroachments Act. Depending on the physical characteristics of a dam, the design could require that anywhere from a 50 year to a PMF storm event be considered.

C. Any hydraulic capacity analysis conducted in accordance with this Ordinance shall use the following criteria to determine if adequate hydraulic capacity exists:

1. Open channels must be able to convey post-development runoff from a 10-year design storm within their banks with a minimum 1.0 foot of freeboard at velocities that would not erode the channel bed or banks. Acceptable velocities shall be based on criteria included in the PA DER Soil Erosion and Sedimentation Control Manual (as amended or replaced from time to time by PA DER) and presented in Table C-4 in Appendix C of this Ordinance.

2. Open channels must be able to convey post-development runoff from a 100-year design storm within their banks and not create a hazard to any persons or property.

3. Any facilities that constitute water obstructions (e.g., culverts, bridges, outfalls, or stream enclosures), as described in PA DER Chapter 105 regulations (as amended or replaced from time to time by PA DER), shall be designed in accordance with Chapter 105 and will require a permit from PA DER. Any other drainage conveyance facility that doesn't fall under Chapter 105 regulations must be able to convey, without damage to the drainage structure or roadway, runoff from the 25-year design storm with a minimum 1.0 foot of freeboard measured below the lowest point along the top of the roadway. Roadway crossings located within designated floodplain areas must be able to convey runoff from a 100-year design storm with a minimum 1.0 foot of freeboard measured below the lowest point along the top of the roadway. Any facility that constitutes a dam as defined in PA DER Chapter 105 regulations may require a permit under dam safety regulations. Any facility located within a PADOT right-of-way must

meet PADOT minimum design standards and permit submission requirements.

4. Storm sewers must be able to convey post-development runoff from a 10-year design storm without surcharging inlets.

5. Storm sewer inlet spacing and road cross-section design must ensure that post-development runoff resulting from a 10-year design storm does not flood more than one half of a driving lane.

D. Easements along open channels shall be provided. The minimum width of the required easement shall be equal to the width of the 100-year water surface (for post-development conditions).

E. In subareas where individual stormwater management facilities would be provided for each development site, the individual stormwater management facilities shall be designed to ensure that the post-development peak discharge for the 2- and 10-year storms at the mouth of the subarea does not exceed the arithmetic product of the applicable release rate, specified in Section 302 of this Ordinance, and the pre-development peak discharge at the mouth of the subarea.

F. For development sites that would be located in two or more subareas, the applicable release rates for the portions of the site located in different subareas shall be based on natural subarea drainage boundaries. The natural drainage boundaries between subareas shall not be modified, nor shall drainage from a development site be diverted or otherwise conveyed from one subarea to another subarea, except where runoff naturally crosses subarea drainage boundaries.

G. "No Harm" Option - For any development site, the developer has the option of discharging post-development runoff at a higher rate than pre-development runoff if the Developer can prove that "no harm" would be caused to any person or property located upstream or downstream of the development site. The Developer must assume that the entire subarea in which the site is located is developed. The type and amount of development that the Developer must consider shall be either based on current zoning or established by the Plan Administrator, whichever results in a greater amount of imperviousness. Proof of no harm must demonstrate conformance with the hydraulic capacity criteria specified in this Ordinance. Proof of no harm must also demonstrate that post-development peak flows at the mouth of the subarea would not exceed the arithmetic product of the applicable release rate, specified in Section 302 of this Ordinance, and the pre-development peak flow at the mouth of the subarea. Areas that drain through documented drainage problem areas would be precluded from any no harm based peak runoff increases, except where hydraulic capacity improvements would be provided, consistent with this Ordinance.

H. Regional or Sub-Regional Stormwater Management Facilities - For certain areas within the watershed, it may be more cost-effective to provide one stormwater management facility for an entire subarea, group of subareas, or portion of a subarea incorporating more than one development site than to provide an individual stormwater management facility for each development site. The initiative and funding for any regional or sub-regional stormwater management alternatives are the responsibility of prospective developers. The design of any regional stormwater management facilities must assume development of the entire area that would drain to the regional facility. The type and amount of development that the Developer(s) must consider shall be either based on current zoning or established by the Plan Administrator, whichever results in a greater amount of imperviousness. The peak outflow from a regional stormwater management facility would be determined on a case-by-case basis using TR-20, as developed for the Combined Watersheds Act 167 Stormwater Management Plan. When regional or sub-regional stormwater management facilities are utilized, the effect of phased growth on stormwater runoff flows must be considered. At no time from the initial phase through ultimate development shall the peak runoff flows exceed the pre-development peak multiplied by the applicable release rate.

I. Capacity Improvements - If the Developer could prove that it would be feasible to provide capacity improvements to relieve the capacity deficiency in the existing drainage network, then adequate capacity improvements could be provided by the Developer in lieu of stormwater management facilities on the development site. Any capacity improvements would be designed based on development of all areas tributary to the improvement and the capacity criteria specified in this Ordinance. The type and amount of development that the Developer must consider shall be either based on current zoning or established by the Plan Administrator, whichever results in a greater amount of imperviousness. It shall be assumed that all new development upstream of a proposed capacity improvement would implement applicable stormwater management techniques, consistent with this Ordinance.

J. Adequate erosion protection shall be provided along all open channels, and at all points of discharge.

K. Ponds and other similar water features that are not designed as stormwater management facilities shall be designed in accordance with U.S. Department of Agriculture, Soil Conservation Service (SCS), Ponds - Planning, Design, Construction (as amended or replaced from time to time by SCS), and shall be treated as impervious surfaces for stormwater runoff computations.

L. The design of all stormwater management facilities shall incorporate sound engineering principles and practices. The Plan Administrator shall reserve the right to disapprove any design that would result in the occurrence or perpetuation of an adverse hydrologic or hydraulic condition within the watershed.

SECTION 304. CALCULATION METHODOLOGY

A. Any stormwater runoff calculations involving drainage areas greater than 20 acres, including on- and off-site areas, shall use any generally accepted calculation technique that is based on the SCS soil cover complex method. Table 1 below summarizes acceptable computation methods. It is assumed that all methods will be selected by the design professional based on the individual limitations and suitability of each method for a particular site.

The Plan Administrator may approve the use of the Rational Method to estimate peak discharges from drainage areas that contain less than 20 acres.

TABLE 1

ACCEPTABLE COMPUTATION METHODOLOGIES FOR STORMWATER MANAGEMENT PLANS

Method	Developer	Applicability
TR-20 (or commercial package based on TR-20)	USDA SCS	Applicable where use of full hydrologic computer model is desirable or necessary.
TR-55 (or commercial package based on TR-55)	USDA SCS	Applicable for land development plans within limitations described in TR-55.
HEC-1	US Army Corps of Engineers	Applicable where use of full hydrologic computer model is desirable or necessary.
PSRM	Penn State University	Applicable where use of a hydrologic computer model is desirable or necessary; simpler than TR-20 or HEC-1.
Rational Method (or commercial package based on Rational Method)	Emil Kuichling (1889)	For sites less than 20 acres, or as approved by the Plan Administrator and Municipal Engineer.
Other Methods	Varies	Other computation methodologies approved by the Plan Administrator and Municipal Engineer.

B. The design of any stormwater detention facilities intended to meet the performance standards of this Ordinance shall be verified by routing the design storm hydrograph through these facilities using the Storage-Indication Method. For drainage areas greater than 20 acres in size, the design storm hydrograph shall be computed using a calculation method that produces a full hydrograph. The Plan Administrator may approve the use of any generally accepted full hydrograph approximation technique for drainage areas that contain less than 20 acres. Any full hydrograph approximation technique shall use a total runoff volume that is consistent with the volume from a method that produces a full hydrograph.

C. All calculations consistent with this Ordinance using the soil cover complex method shall use the appropriate design rainfall depths for the various return period storms presented on Figure C-1 in Appendix C of this Ordinance. If a hydrologic computer model such as PSRM or HEC-1 is used for stormwater runoff calculations, then the duration of rainfall shall be 24 hours.

D. All calculations using the Rational Method shall use rainfall intensities consistent with appropriate times of concentration for overland flow and return periods from the Design Storm Curves for Combined on Figure C-1 in Appendix C of this Ordinance. Times of concentration for overland flow shall be calculated using the methodology presented in Chapter 3 of Urban Hydrology for Small Watersheds, SCS, TR-55 (as amended or replaced from time to time by SCS). Times of concentration for channel and pipe flow shall be computed using Manning's equation.

E. Runoff Curve Numbers (CN) for both existing and proposed conditions to be used in the soil cover complex method shall be obtained from Table C-1 in Appendix C of this Ordinance.

F. Runoff coefficients (c) for both existing and proposed conditions for use in the Rational Method shall be obtained from Table C-2 in Appendix C of this Ordinance.

G. Where uniform flow is anticipated, the Manning equation shall be used for hydraulic computations, and to determine the capacity of open channels, pipes, and storm sewers. Where non-uniform flow is anticipated, the hydraulic effects of "backwater" caused by hydraulic obstructions (e.g., culverts, bridges, dams, reservoirs, etc.) shall be evaluated using the standard step method for determining water surface profiles. Values for Manning's roughness coefficient (n) shall be consistent with Table C-3 in Appendix C of this Ordinance.

H. Outlet structures for stormwater management facilities shall be designed to meet the performance standards of this Ordinance using any generally accepted hydraulic analysis technique or method.

ARTICLE IV
DRAINAGE PLAN REQUIREMENTS

SECTION 401. GENERAL REQUIREMENTS

For any of the activities regulated by this Ordinance, the final approval of subdivision and/or land development plans, the issuance of any building or occupancy permit, or the commencement of any land disturbance activity may not proceed until the Property Owner or Developer or his/her agent has received written approval of a Drainage Plan from the Plan Administrator.

SECTION 402. EXEMPTIONS

Any Regulated Activity that meets the following exemption criteria in Appendix F is exempt from the Drainage Plan preparation provisions of this Ordinance. This criteria shall apply to the total development even if development is to take place in phases. Exemption shall not relieve the applicant from providing adequate stormwater management to meet the purpose of this Ordinance.

Land disturbance associated with the construction or alteration of one and two family dwellings, provided that the disturbance does not alter any stormwater conditions beyond the boundaries of the lot or alter provisions of a previously approved stormwater management plan for the lot or encompassing subdivision.

Use of land for gardening for home consumption.

No exemption shall be provided for Regulated Activities as defined in Section 104.E and 104.F of this Ordinance.

SECTION 403. DRAINAGE PLAN CONTENTS

The Drainage Plan shall consist of all applicable calculations, maps, and plans. A note on the maps shall refer to the associated computations and erosion and sedimentation control plan by title and date. The cover sheet of the computations and erosion and sedimentation control plan shall refer to the associated maps by title and date. All Drainage Plan materials shall be submitted to the Plan Administrator in a format that is clear, concise, legible, neat, and well organized; otherwise, the Drainage Plan shall be disapproved and returned to the Applicant.

The following items shall be included in the Drainage Plan:

A. General