PENN TOWNSHIP REVIEW CHECKLIST
STORMWATER CONTROL METHODS AND DESIGN STANDARDS

Name of Project: _____ Date Project Received by EADS: _____ Developer's Contact Person: _____

Project Plans Reviewed by: _____ Date of Review: _____ Review Acknowledged: _____ Date Acknowledged: _____ Developer's Email Address: _____

Code Section	Code Requirement	Plans Meet Code	Plans Do Not Meet Code	Other	Comments, if any	Sheet/s on which Requirement is Met	Developer's Comments, if any
144-12	Stormwater control methods; design standards.						
144-12 A	General criteria.						
144-12 A(1)	Applicants shall select runoff control techniques or a combination of techniques which are most suitable to control stormwater runoff from the development site. All controls must be subject to approval of the Township Engineer. The Township Engineer may request specific information on design and/or operating features of the proposed stormwater controls in order to determine their suitability and adequacy in terms of the standards of this chapter.						
144-12 A(2)	The applicant shall consider the effect of the proposed stormwater management techniques on any special soil conditions or geological hazards which may exist on the development site. In the event that such conditions are identified on the site, the Township Engineer may require in-depth studies by a competent geotechnical engineer. Not all stormwater control methods may be advisable or allowable at a particular development site.						
144-12 A(3)	Criteria order of preference.						
144-12 A(3)(a)	The stormwater management practices to be used in developing a stormwater management plan for a particular site shall be selected according to the following order of preference:						
144-12 A(3)(a)[1]	Infiltration of runoff on site.						
144-12 A(3)(a)[2]	Flow attenuation by use of open vegetated swales and natural depressions.						

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144-12 A(3)(a)[3]	Stormwater detention/retention structures.						
144-12 A(3)(b)	The applicant shall provide documentation of engineering studies which indicate that each of the above criteria has been considered. If the applicant does not design the stormwater management facility by applying the methods set forth above, using the highest order of preference, the applicant must justify the basis for using a different method of stormwater management practice.						
144-12 A(4)	Infiltration practices shall be used to the extent practicable to reduce volume increases and promote groundwater recharge. A combination of successive practices may be used to achieve the applicable minimum control requirements. Justification shall be provided by the applicant for rejecting each of the preferred practices based on actual site conditions.						
144-12 B	Criteria for infiltration systems.						
144-12 B(1)	Infiltration systems shall be sized and designed based upon local soil and groundwater conditions.						
144-12 B(2)	Infiltration systems shall be greater than three feet deep and shall be located at least 10 feet from basement walls.						
144-12 B(3)	Infiltration systems shall not be used to handle runoff from commercial or industrial working or parking areas. This prohibition does not extend to roof areas which are demonstrated to be suitably protected from the effects of the commercial/industrial activities.						
144-12 B(4)	Infiltration systems shall not receive runoff until the entire drainage area to the system has received final stabilization.						

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144-12 B(5)	The stormwater infiltration facility design shall provide an overflow system with measures to provide a nonerosive velocity of flow along its length and at the outfall.						
144-12 C	Criteria for stormwater detention facilities.						
144-12 C(1)	When detention facilities are utilized for the development site, the facility(ies) shall be designed such that postdevelopment peak runoff rates from the developed site are controlled to those rates defined by the subareas release rate percentage for the two-, ten-, twenty-five-, and one-hundred-year predevelopment storm frequencies.						
144-12 C(2)	All detention facilities shall be equipped with outlet structures to provide discharge control for the four designated storm frequencies. Provisions shall also be made to safely pass, at minimum, the postdevelopment one-hundred-year-storm runoff without breaching or otherwise damaging (i.e., impairing the continued function of) the facilities.						
144-12 C(3)	Shared storage facilities which provide detention of runoff for more than one development site within a single subarea shall be considered and are encouraged. Such facilities shall meet the criteria contained in this section. In addition, runoff from the development sites involved shall be conveyed to the facility in a manner that avoids adverse impacts (such as flooding or erosion) to channels and properties located between the development site and the shared storage facilities.						

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144-12 C(4)	Where detention facilities will be utilized, multiple use facilities, such as wetlands, lakes, ball fields, or similar recreational open space uses, are encouraged wherever feasible, subject to the approval of the Township and Pennsylvania Department of Environmental Protection's Chapter 105 regulations.						
144-12 C(5)	Other considerations which should be incorporated into the design of the detention facilities include the following:						
144-12 C(5)(a)	Inflow and outflow structures shall be designed and installed to prevent erosion, and bottoms of impoundment-type structures should be protected from soil erosion.						
144-12 C(5)(b)	Control and removal of debris both in the storage structure and in all inlet or outlet devices shall be a design consideration.						
144-12 C(5)(c)	Inflow and outflow structures, pumping stations, and other structures shall be designed and protected to minimize safety hazards.						
144-12 C(5)(d)	The water depth at the perimeter of a storage pond should be limited to that which is safe for children. This is especially necessary if bank slopes are steep or if ponds are full and recirculating in dry periods. Restrictions of access (fence, walls, etc.) shall be necessary, depending on the location of the facility.						
144-12 C(5)(e)	Side slope of storage ponds shall not exceed a ratio of 2-1/2 to 1 horizontal-to-vertical dimension.						
144-12 C(5)(f)	Landscaping shall be provided for the facility which harmonizes with the surrounding area.						

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144-12 C(5)(g)	The principal spillway shall consist of a solid vertical pipe or box of corrugated metal, corrugated plastic pipe, or reinforced concrete joined by a watertight connection to a horizontal pipe (barrel), extending through the embankment and outletting beyond the downstream tow of the fill. The principal spillway shall have a minimum capacity of 0.2 cubic feet per second per acre of drainage area when the water surface is at the crest of the emergency spillway. The maximum capacity of the barrel will be the twenty-five-year predevelopment flow. The construction materials must be approved by the Township. Refer to Plate A.						
144-12 C(5)(h)	When the principal spillway is used in conjunction with an emergency spillway, the crest of the principal spillway shall be a minimum of 2.0 feet below the crest of the emergency spillway. The crest of the principal spillway shall be a minimum of three feet below the top of the embankment. Refer to Plate A.						
144-12 C(5)(i)	An anti-vortex device and trash rack shall be attached to the top of the principal spillway to improve the flow of water into the spillway and prevent floating debris from being carried out of the basins. The anti-vortex device shall be of the concentric type as sown in Plate B and Plate C or approved equal.						
144-12 C(5)(j)	The base of the principal spillway must be firmly anchored to prevent its floating. Computations must be made to determine the anchoring requirements. As a minimum, a factor of safety of 1.25 shall be used (downward forces = 1.25 x upward forces).						

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144-12 C(5)(k)	The barrel of the principal spillway, which extends through the embankment, shall be designed to carry the twenty-five-year predevelopment flow provided by the riser of the principal spillway with the water level at the crest of the emergency spillway. The connection between the riser and the barrel must be watertight. The outlet of the barrel must be protected to prevent erosion or scour of downstream area. This will include an end section or end wall with a designed riprap apron.						
144-12 C(5)(l)	Anti-seep collars.						
144-12 C(5)(l)[1]	Anti-seep collars shall be used on the barrel of the principal spillway within the normal saturation zone of the embankment to increase the seepage length by at least 10% if either of the following conditions is met:						
144-12 C(5)(l)[1][a]	The settled height of the embankment exceeds 10 feet.						
144-12 C(5)(l)[1][b]	The embankment has a low silt clay content and the barrel is greater than 10 inches in diameter.						

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144-12 C(5)(l)[2]	The anti-seep collars shall be installed within the saturation zone. The maximum spacing between collars shall be 14 times the projection of the collar above the barrel. Collars shall not be closer than two feet to a pipe joint. Collars should be placed sufficiently far apart to allow space for hauling and compacting equipment. Connections between the collars and the barrel shall be watertight. The length of the barrel within the saturation zone can be obtained by entering Plat E with variable Y. Y is the depth of water at the principal spillway crest, in feet. This chart will provide saturated length. This number is entered in Plat F to size the anti-seep collars. Refer to Plate G for details of the anti-seep collar.						

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144-12 C(5)(m)	The emergency spillway shall consist of an open channel having a control section at least 20 feet in length. The control section is a level portion of the spillway channel at the highest elevation in the channel. The emergency spillway shall be designed to carry the peak rate of runoff expected from a one-hundred-year storm, less any reduction due to the flow through the principal spillway. The spillway channel shall be located so as to avoid sharp turns or bends. The channel shall return the flow of water to a defined channel downstream from teh embankment. The maximum allowable velocities in this emergency spillway channel will depend on the type of lining used. For vegetated linings, allowable velocities are listed in Table 4. For nonerodible linings, such as concrete, asphalt paving, and riprap, design shall return the flow to the natural channel at noneroding velocities. See Plate H and Plate I for design of the emergency spillway.						
144-12 C(5)(n)	The material for the embankment shall consist of all excavation on the project, except such material as may be determined unsuitable by the Township's representative, which includes but is not limited to frozen material and excessively wet or dry material. Acceptable material shall conform to the current PennDOT Publication 408 section on embankment material or shall be as approved by the Township's representative.						
144-12 C(5)(o)	The rock lining material used in stormwater management facilities should be a minimum of Class R-5 to a nominal thickness of 24 inches, according to the PennDOT Publication 408 section on rock lining or as approved by the Township's representative.						

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144-12 C(5)(p)	A galvanized or rust-resistant chain link fence must be installed around the pond at a height of six feet, with a continuous rail top and bottom. A double four-foot-wide gate with lock and keys must be provided to allow a minimum eight-foot-wide clear access opening for future maintenance. Fence details and specifications shall be submitted to the Township for approval.						
144-12 C(5)(q)	A facility shall be located to facilitate maintenance, considering the frequency and type of equipment that will be required. The subdivider shall provide a ten-foot-wide access road constructed of 2B stone at a depth of six inches from the paved Township street to the retention pond.						
144-12 D	Criteria for collection/conveyance facilities.						
144-12 D(1)	All stormwater runoff collection or conveyance facilities, whether storm sewers or other open or closed channels, shall be designed in accordance with the following basic standards:						
144-12 D(1)(a)	All sites shall be graded to provide drainage away from and around the structure in order to prevent any potential flooding damage.						
144-12 D(1)(b)	Lots located on the high side of streets shall extend roof and french drains to the curbline (if applicable). Low side lots shall extend roof and french drains to a stormwater collection/conveyance/control system or natural watercourse in accordance with the approved stormwater management plan for the development site.						

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144-12 D(1)(c)	Collection/conveyance facilities should not be installed parallel and close to the top or bottom of a major embankment, to avoid the possibility of failing or causing the embankment to fail.						
144-12 D(1)(d)	All collection/conveyance facilities shall be designed to convey the twenty-five-year-storm peak flow rate from the contributing drainage area and to carry it to the nearest suitable outlet, such as a stormwater control facility, curbed street, storm sewer, or natural watercourse.						
144-12 D(1)(e)	Where drainage swales or open channels are used, they shall be suitably lined to prevent erosion and designed to avoid excessive velocities. Maximum allowable velocities of flow in swales, open channels, and ditches, as relating in slope and grass cover, are shown in Table 4. Higher velocities require invert stabilization. If they do not present a hazard, velocity dissipators may be approved by the Township or the Township's representative.						
144-12 D(2)	Wherever storm sewers are proposed to be utilized, they shall comply with the following criteria:						
144-12 D(2)(a)	Where practical, they shall be designed to traverse under seeded and planted areas. If constructed within 10 feet of road paving, walks or other surfaced areas, drains shall have a narrow trench and maximum compaction of backfill to prevent settlement of the superimposed surface or development.						

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144-12 D(2)(b)	They shall preferably be installed after excavating and filling in the area to be traversed is completed, unless the drain is installed in the original ground with a minimum of three feet cover and/or adequate protection during the fill construction.						
144-12 D(2)(c)	They shall be designed:						
144-12 D(2)(c)[1]	With cradle when traversing fill areas of indeterminate stability;						
144-12 D(2)(c)[2]	With anchors when gradient exceeds 20%; and						
144-12 D(2)(c)[3]	With encasement or special backfill requirements when traversing under a paved area.						
144-12 D(2)(d)	They shall be designed to adequately handle the anticipated stormwater flow and shall be economical to construct and maintain.						
144-12 D(2)(d)[1]	The minimum pipe size shall be 15 inches in diameter. Horizontal and vertical curves with radii of 100 feet or greater are allowed for all pipe sizes. Friction losses in the pipe shall be calculated using the Manning Formula (values for n are found in Table 2): $v = (1.49/n) R^{2/3} S^{1/2}$						
144-12 D(2)(d)[2]	The minimum value for v in pipes shall be 3.0 feet per second. The maximum value for v in pipes shall be based on engineering judgment and experience. Pressure flow is permitted in storm sewers. The elevation of the hydraulic gradient shall be at least one foot below ground level. Pressure heads up to 25 feet can be used with concrete pipe with rubber gasket joints.						
144-12 D(2)(e)	Drain pipe, trenching, bedding, and backfilling requirements shall conform to the requirements of PennDOT specifications, Form 408.						

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144-12 D(2)(f)	Pipe located within a municipal right-of-way shall be reinforced concrete pipe or smooth-lined corrugated plastic pipe, as approved by the Township Engineer, with a minimum diameter of 15 inches.						
144-12 D(2)(g)	The maximum spacing between stormwater inlets shall be designed according to the ten-year-storm flow and the capacity of the inlets, taking into account the gradient of roadway, maximum allowable street flooding, and drainageway capacity. When a possibility of clogging of grates, side openings, or a combination of inlets exists, use the capacity reduction factors shown in Table 1 applied to the theoretical capacity of the inlet. The maximum amount of water that should be bypassed on to the next downstream inlet for inlets on continuous grades is 10%. The maximum allowable spacing between structures to be used for inspecting and cleaning storm sewers shall be based on the pipe size and spacing shown in Table 3.						
144-12 D(2)(h)	Appropriate grates shall be designed for all catch basins, stormwater inlets, and other entrance appurtenances.						
144-12 D(2)(i)	Manholes shall be designed so that the top shall be at finished grade and sloped to conform to the slope of the finished grade. Top castings of structures located in roads or parking areas shall be machined or installed to preclude rattling.						

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144-12 D(2)(j)	Where a proposed sewer and/or detention or retention pond discharge connects with an existing storm sewer system and/or a natural drainage course, the applicant shall demonstrate that sufficient capacity exists in the downstream system to handle the additional flow.						
144-12 D(2)(k)	Storm sewer outfalls shall be equipped with energy dissipation devices to prevent erosion and conform with applicable requirements of the Pennsylvania DEP for stream encroachments (Chapter 105 of Pennsylvania DEP rules and regulations).						
Reviewer's Additional Comments, Questions, or Concerns							