STORMWATER MANAGEMENT ORDINANCE

SHENANGO TOWNSHIP

LAWRENCE COUNTY, PENNSYLVANIA

R.A.R. ENGINEERING GROUP

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October 2004

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ARTICLE I
GENERAL PROVISIONS

SECTION 101. STATEMENT OF FINDINGS

The governing body of Shenango Township finds that:

A. Inadequate management of accelerated runoff of stormwater resulting from development throughout a watershed increases flood flows and velocities, contributes to erosion and sedimentation, overtaxes the carrying capacity of streams and storm sewers, greatly increases the cost of public facilities to carry and control stormwater, undermines flood plain management and flood control efforts in downstream communities, reduces groundwater recharge, and threatens public health and safety.

B. A comprehensive program of stormwater management, including reasonable regulation of development and activities causing accelerated erosion, is fundamental to the public health, safety and welfare and the protection of the people of Shenango Township and all the people of the Commonwealth, their resources and the environment.

SECTION 102. PURPOSE

The purpose of this Ordinance is to promote the public health, safety and welfare by minimizing the damages described in Section 101(A) of this Ordinance by provisions designed to:

A. Manage accelerated runoff and erosion and sedimentation problems at their source by regulating activities that cause such problems.

B. Utilize and preserve the existing natural drainage systems.

C. Encourage recharge of groundwater where appropriate and prevent degradation of groundwater quality.

D. Maintain the existing flows and quality of streams and watercourses in the Township and the Commonwealth.

E. Preserve and restore the flood-carrying capacity of streams.

F. Provide proper maintenance of all permanent stormwater management structures that are constructed in Shenango Township.

G. Provide performance standards and design criteria for watershed-wide stormwater management and planning.

SECTION 103. STATUTORY AUTHORITY

The Township is empowered to regulate land use activities that affect runoff by the authority of the Act of October 4, 1978 32 P.S., P.L. 864 (Act 167) Section 680.1 et seq., as amended, the "Stormwater Management Act".

SECTION 104. APPLICABILITY

This Ordinance shall apply to those areas of the Township that are located within the Township.

A. This Ordinance shall only apply to permanent stormwater management facilities constructed as part of any of the Regulated Activities listed in this Section. Stormwater management and erosion and sedimentation control during construction and earth-moving activities are specifically not regulated by this Ordinance, but shall continue to be regulated under existing laws and ordinances.

   This Ordinance contains only the stormwater management performance standards and design criteria that are necessary or desirable from a watershed-wide perspective. Local stormwater management design criteria (e.g. inlet spacing, inlet type, collection system design and details, outlet structure design, etc.) shall continue to be regulated by the applicable Township Ordinances or at the Township engineer's discretion.

B. The following activities are defined as "Regulated Activities" and shall be regulated by this Ordinance: (Reference Section 402 for all "Exemption" criteria to Regulated Activities)

   1. Land development
   2. Subdivision
   3. Agricultural operations that are NOT operating under an approved soil erosion and sediment pollution control plan
   4. Construction of new or additional impervious or semi-pervious surfaces (driveways, parking lots, etc.)
   5. Construction of new buildings or additions to existing buildings
   6. Forest Management/Timber operations and Nursery operations that do NOT have an approved soil erosion and sediment pollution control plan
   7. Diversion or piping of any natural or man-made stream channel
   8. Installation of stormwater management facilities or appurtenances thereto
   9. Mining operations
   10. Earthmoving activities that involve 5 or more acres which do not fall under the above categories

SECTION 105. REPEALER

Any ordinance or ordinance provision of the Township inconsistent with any of the provisions of this Ordinance is hereby repealed to the extent of the inconsistency only.

SECTION 106. SEVERABILITY

Should any section or provision of this Ordinance be declared invalid by a court of competent jurisdiction, such decision shall not affect the validity of any of the remaining provisions of this Ordinance.

SECTION 107. COMPATIBILITY WITH OTHER PERMIT AND ORDINANCE REQUIREMENTS

Permits and approvals issued pursuant to this Ordinance do not relieve the Applicant of the responsibility to secure required permits or approvals for activities regulated by any other applicable code, rule, act or ordinance.

If more stringent requirements concerning regulation of stormwater or erosion and sedimentation control are contained in the other code, rule, act, or ordinance, the more stringent regulation shall apply.

SECTION 108. LANDOWNER RESPONSIBILITY

The granting of an exemption, permit, or approval by the Township, does not relieve the applicant from assuring that stormwater runoff from the development site will not cause injury or damage to other persons or property.

ARTICLE II
DEFINITIONS AND WORD USAGE

A. For the purposes of this chapter, certain terms and words used herein shall be interpreted as follows:
   - i. Words used in the present tense include the future tense; the singular number includes the plural; and the plural number includes the singular; words of masculine gender include feminine gender; and words of feminine gender include masculine gender.
   - ii. The word "includes" or "including" shall not limit the term to the specific example but is intended to extend its meaning to all other instances of like kind and character.
   - iii. The word "person" includes an individual, firm, association, organization, partnership, trust, company, corporation or any other similar entity.
   - iv. The words "shall" and "must" are mandatory; the words "may" and "should" are permissive.
   - v. The words "used or occupied" include the words "intended, designed, maintained, or arranged to be used, occupied or maintained"

B. As used in this chapter, the following terms shall have the meanings indicated:

Accelerated Erosion – The removal of the surface of the land through the combined action of man's activities and natural process at a rate greater than would occur because of the natural processes alone.

Agricultural Activities – The work of producing crops and raising livestock including tillage, plowing, disking, harrowing, pasturing and installation of conservation measures. Construction of new buildings or impervious area is not considered an agricultural activity.

Alteration – As applied to land, a change in topography as a result of the moving of soil and rock from one location or position to another; also the changing of surface conditions by causing the surface to be more or less impervious; land disturbance.

Applicant – A landowner or developer who has filed an application for approval to engage in any regulated activities as defined in Section 104 of this chapter.

BMP (Best Management Practice) – Stormwater structures, facilities and techniques implemented to maintain or improve the water quality of surface runoff.

Buffer Area – Area that is protected from development in order to prevent degradation of water quality or a water body (as applied specifically to this Ordinance).

Channel – A perceptible natural or artificial waterway, which periodically or continuously contains moving water having a definite bed and banks, which confine the water.

Channel Erosion – The widening, deepening, and headward cutting of small channels and waterways, due to erosion caused by moderate to large floods.

Cistern – An underground reservoir or tank for storing rainwater.

Conservation District – The Lawrence County Conservation District.

Culvert – A pipe, conduit or similar structure including appurtenant works which carries surface water under or through an embankment or fill.

Dam – An artificial barrier, together with its appurtenant works, constructed for the purpose of impounding or storing water or another fluid or semifluid or a refuse bank, fill or structure for highway, railroad or other purposes which does or may impound water or another fluid or semifluid.

Design Storm – The magnitude and temporal distribution of precipitation from a storm event measured in probability of occurrence (e.g., 10-yr. storm) and duration (e.g., 24-hours), used in the design and evaluation of stormwater management systems.

Designee – The agent of the Township involved with the administration, review or enforcement of any provisions of this ordinance by contract or memorandum of understanding.

Detention Basin – An impoundment structure designed to manage stormwater runoff by temporarily storing the runoff and releasing it at a predetermined rate.

Developer – A person or persons, partnership, association, corporation or other entity, or any responsible person therein or agent thereof, that undertakes the activities covered by this Ordinance.

Development Site – The specific tract of land for which a regulated activity is proposed.

Diversion Terrace – A channel and a ridge constructed to a predetermined grade across a slope, and designed to collect and divert runoff from slopes that are subject to erosion.

Downslope Property Line – That portion of the property line of the lot, tract, or parcels of land being developed located such that all overland or pipe flow from the site would be directed towards it.

Drainage Conveyance Facility – A Stormwater Management Facility designed to transmit stormwater runoff and shall include streams, channels, swales, pipes, conduits, culverts, storm sewers, etc.

Drainage Easement – A right granted by a landowner to a grantee, allowing the use of private land for stormwater management purposes.

Drainage Permit – A permit issued by the Township governing body after the drainage plan has been approved. Said permit is issued prior to or with the final Township approval.

Drainage Plan – The documentation of the stormwater management system, if any, to be used for a given development site, the contents of which are established in Section 403.

Earth Disturbance – Any activity including, but not limited to, construction, mining, timber harvesting and grubbing which alters, disturbs, and exposes the existing land surface.

Emergency Spillway – An earthen or structural spillway designed to convey large flood flows safely past earth embankments.

Erosion – The movement of soil particles by the action of water, wind, ice, or other geological agents or natural forces.

Erosion and Sediment Pollution Control Plan – A plan which is designed to minimize accelerated erosion and sedimentation pursuant to 25 Pa. Code, Chapter 102.

Exfiltration – The process by which water or moisture moves from a subsurface trench, bed, or other feature into the subsoil. Exfiltration is best measured by a soil's percolation rate.

Existing Conditions – The initial condition of a project site prior to the proposed construction or earthmoving. If the initial condition of the site is undeveloped land, the land use shall be considered as "forested" unless the natural land cover is proven to generate lower curve numbers or Rational "C" values, such as "brush".

Flood – A general but temporary condition of partial or complete inundation of normally dry land areas from the overflow of streams, rivers, and other waters of this Commonwealth.

Floodplain – Any land area susceptible to inundation by water from any natural source or delineated by applicable Department of Housing and Urban Development, Federal Insurance Administration Flood Hazard Boundary - Mapped as being a special flood hazard area. Also included are areas that comprise Group 13 Soils, as listed in Appendix A of the Pennsylvania Department of Environmental Protection (PADEP) Technical Manual for Sewage Enforcement Officers (as amended or replaced from time to time by PADEP).

Floodway – The channel of the watercourse and those portions of the adjoining floodplains which are reasonably required to carry and discharge the 100-year frequency flood. Unless otherwise specified, the boundary of the floodway is as indicated on maps and flood insurance studies provided by FEMA. In an area where no FEMA maps or studies have defined the boundary of the 100-year frequency floodway, it is assumed – absent evidence to the contrary – that the floodway extends from the stream to 50 feet from the top of the bank of the stream.

Forest Management/Timber Operations – Planning and activities necessary for the management of forest land. These include timber inventory and preparation of forest management plans, silvicultural treatment, cutting budgets, logging road design and construction, timber harvesting, site preparation and reforestation.

Freeboard – A vertical distance between the elevation of the design high-water and the top of a dam, levee, tank, basin, or diversion ridge. The space is required as a safety margin in a pond, basin or bank of a waterway.

Grade – A slope, usually of a road, channel or natural ground specified in percent and shown on plans as specified herein. (To) Grade – to finish the surface of a roadbed, top of embankment or bottom of excavation.

Grassed Waterway – A natural or constructed waterway, usually broad and shallow, covered with erosion-resistant grasses, used to conduct surface water from cropland.

Groundwater Recharge – Replenishment of existing natural underground water supplies.

Impervious Surface – A surface that prevents the percolation of water into the ground.

Impoundment – A retention or detention basin designed to retain stormwater runoff and release it at a controlled rate.

Infiltration Rate – The infiltration rate of a soil is related to the soil's final infiltration capacity and represents the rate at which water enters the soil/air interface at the top of the soil profile. Infiltration rates are measured in units of length / time.

Infiltration Structures – A structure designed to direct runoff into the ground (e.g. french drains, seepage pits, seepage trench).

Inlet – A surface connection to a closed drain. A structure at the diversion end of a conduit. The upstream end of any structure through which water may flow.

Land Development –

1. The improvement of one (1) lot or two (2) or more contiguous lots, tracts or parcels of land for any purpose involving a group of two (2) or more buildings; or the division or allocation of land or space between or among two (2) or more existing or prospective occupants by means of, or for the purpose of streets, common areas, leaseholds, condominiums, building groups or other features.
2. Any subdivision of land.
3. Development in accordance with Section 503(1.1) of the PA Municipalities Planning Code.

Land/Earth Disturbance – Any activity involving grading, tilling, digging, or filling of ground, or stripping of vegetation, or any other activity that causes an alteration to the natural condition of the land.

Manning Equation in (Manning formula) – A method for calculation of velocity of flow (e.g. feet per second) and flow rate (e.g. cubic feet per second) in open channels based upon channel shape, roughness, depth of flow and shape. "Open Channels" may include closed conduits so long as the flow is not under pressure.

Municipality – Shenango Township, Lawrence County, Pennsylvania.

Nonpoint Source Pollution – Pollution that enters a watery body from diffuse origins in the watershed and does not result from discernible, confined, or discrete conveyances.

NRCS – Natural Resource Conservation Service (previously SCS).

Nursery – A tract of land on which trees and plants are raised or stored for transplanting and sale.

Open Channel – A drainage element in which stormwater flows with an open surface. "Open channels" include, but shall not be limited to, natural and man-made drainageways, swales, streams, ditches, canals and pipes flowing partly full.

Outfall – Point where water flows from a conduit, stream or drain.

Outlet – Points of water disposal from a stream, river, lake or artificial drain.

PA DEP – Pennsylvania State Department of Environmental Protection.

PA DOT or PennDOT – Pennsylvania State Department of Transportation.

Parking Lot Storage – Involves the use of impervious parking area as temporary impoundments with controlled release rates during rainstorms.

Peak Discharge – The maximum rate of stormwater runoff at a given point and time resulting from a specified storm event.

Penn State Runoff Model – A computer-based hydrologic modeling technique.

Percolation Rate – The rate at which water moves through a soil profile. Percolation rates are measured in units of time / length.

Pipe – A culvert, closed conduit or similar structure (including appurtenances) that conveys stormwater.

Plan Administrator – The entity set up specifically to review drainage plans, to inspect stormwater management structures and to otherwise enforce all regulations as outlined in this Stormwater Management Ordinance.

POI – Point of Interest – Downstream point for tributary or tributaries in which increased runoff must be analyzed for its potential impact.

Point Discharge – The discharge from a pipe or channel that concentrates runoff at a single area.

Principal Spillway – A pipe, weir or other appurtenant works designed to control the required detention storm.

Rational Formula – A rainfall-runoff relation used to estimate peak flow.

Regulated Activities – Actions or proposed actions that have an impact on stormwater runoff and that are specified in Section 104 of this Ordinance.

Release Rate – The percentage of the pre-development peak rate of runoff from a site or drainage subarea to which the post-development peak rate of runoff must be reduced to protect downstream areas.

Retention Basin – An impoundment in which stormwater is stored and not released during the storm event. Stored water may be released from the basin at some time after the end of the storm.

Return Period – The average interval, in years, within which a storm event of a given magnitude can be expected to recur. For example, the 10-year return period rainfall would be expected to recur on the average once every ten years.

Undetained Area – An area of a site that cannot be routed to a stormwater management facility because of its location. Generally small areas around access drives or below stormwater management facilities.

Watercourse – A stream of water; river; brook; creek; or a channel or ditch for water, whether natural or manmade.

Waters of the Commonwealth – Any and all rivers, streams, creeks, rivulets, ditches, watercourses, storm sewers, lakes, dammed water, wetlands, ponds, springs, and all other bodies or channels of conveyance of surface and underground water, orparts thereof, whether natural or artificial, within or on the boundaries of this Commonwealth.

Water Table – Upper surface of a layer of saturated material in the soil.

Wetland – Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions, including swamps, marshes, bogs, fens and similar areas.

ARTICLE III
STORMWATER MANAGEMENT REQUIREMENTS

SECTION 301. GENERAL REQUIREMENTS

A. All regulated activities in the Township which do not fall under the exemption criteria listed in Section 402 shall submit a drainage plan consistent with this Ordinance to the Township for review. This criteria shall apply to the total proposed development(s) even if the development(s) are to take place in stages or phases. Impervious cover shall include, but not be limited to, any roof, parking or driveway areas and any new streets and sidewalks. Any areas designed to initially be gravel or crushed stone shall be assumed to be impervious for the purposes of comparison to the waiver criteria.

B. Stormwater drainage systems shall be provided in order to permit unimpeded flow along natural watercourses, except as modified by stormwater management facilities or open channels consistent with this Ordinance.

1. Design Storms: The 1, 10, 25 and 100-year design storm frequencies shall be used (as a minimum) for analyzing all peak discharge-rates and volumes of stormwater runoff for all sites.

C. The existing points of concentrated drainage that discharge onto adjacent property shall not be altered without permission of the altered property owner(s) and shall be subject to any applicable discharge criteria specified in this Ordinance.

D. All stormwater management plans shall be designed and certified by individuals registered in the Commonwealth of Pennsylvania and qualified to perform such duties.

E. Stormwater runoff from a project site shall flow directly into a natural watercourse or into an existing storm sewer system, or onto adjacent properties in a manner similar to the runoff characteristics of the Pre-development flow. If diffused flow is proposed to be concentrated and discharged onto adjacent property, the Developer must document that adequate downstream conveyance facilities exist to safely transport the concentrated discharge, or otherwise prove that no erosion, sedimentation, flooding or other harm will result from the concentrated discharge. In some cases this may require cooperation between land owners.

F. Where a development site is traversed by watercourses, drainage easements shall be provided conforming to the line of such watercourses. The terms of the easement shall prohibit excavation, the placing of fill or structures, and any alterations that may adversely affect the flow of stormwater within any portion of the easement. Also, maintenance, including mowing of vegetation within the easement shall be required, except as approved by the appropriate governing authority.

G. Stormwater runoff shall not be transferred from one drainage area to another unless: i) the drainage areas are subareas of a common drainage area which join together within the perimeter of the property; or ii) the effect of the transfer does not alter the peak discharge onto adjacent lands; or iii) the necessary drainage easement(s) from the affected landowners are provided.

H. All stormwater runoff flowing over the project site shall be considered in the design of the stormwater management facilities.

I. Maintenance of natural drainageways – All natural streams, channels, swales, drainage systems and/or areas of surface water concentration shall be maintained in their existing condition unless the Township approves an alteration. Clearing or restoring of natural waterways is not considered an alteration. All encroachment activities shall comply with the requirements of Chapter 105 (Water Obstructions and Encroachments) of Title 25, Rules and Regulations of the Pennsylvania Department of Environmental Protection (PADEP).

J. Stormwater management facilities regulated by this Ordinance that would be located on State highway rights-of-way shall be subject to approval by the Pennsylvania Department of Transportation (PennDOT).

K. For any stormwater management facility requiring a permit to be issued by the PADEP, said permit along with supporting report and plans used to secure the permit shall also be submitted. Where there is a question whether wetlands may be involved, it is the responsibility of the Developer or his agent to show that the land in question cannot be classified as wetlands, otherwise approval to work in the area must be obtained from the PADEP.

L. Roof drains and foundation drains shall NOT be allowed to discharge overland onto neighboring down-slope properties. All roof drains must be connected directly to storm sewers or stormwater channels/swales/ditches as applicable. Roof drains and foundation drains shall NOT be connected to sanitary sewers. When it is more advantageous to NOT connect directly to storm sewers or open channels (to promote infiltration/percolation of stormwater), then the Township shall permit it on a case-by-case basis.

M. Minimization of impervious surfaces and infiltration of runoff through seepage beds, infiltration trenches, etc., are encouraged, where soil conditions permit, to reduce the size or eliminate the need for detention facilities.

N. All sites shall be graded to provide drainage away from and around structures to prevent potential flooding damage.

O. Methods of stormwater runoff detention and control – The following is a listing of detention and control methods which may be utilized in stormwater management systems, if appropriate. The choice of control techniques is not limited to the ones appearing on this list.

1. Detention/Retention basins
2. Roof-top storage
3. Parking lot and private street ponding
4. Seepage pits, seepage trenches or other infiltration structures
5. Porous pavement and concrete lattice block surfaces
6. Grassed channels and vegetated strips
7. Dry wells, cisterns and underground reservoirs
8. Routed flow over pervious areas (grass filter strips)
9. Low-impact design techniques that decrease impervious area coverage
10. Natural area conservation

The use of other control methods that meet the criteria in this section will be permitted when approved by the Township engineer. Various combinations of methods should be tailored to suit the particular requirements of the type of development and the topographic features of the project area.

SECTION 302. GENERAL STANDARDS

A. General - In order to implement the provisions of the stormwater management plan, the Township is hereby divided into one (1) stormwater management district.

B. Off-Site Areas - Off-site areas that drain through a proposed development site are not subject to release rate criteria when determining allowable peak runoff rates. However, on-site drainage facilities shall be designed to safely convey off-site flows through the development site.

C. Site Areas - Where the site area to be impacted by a proposed development activity differs significantly from the total site area, only the proposed impact area shall be subject to the release rate criteria.

D. Runoff - Post development runoff from the site shall not be concentrated or have increased runoff discharged onto adjacent property without the written consent of the adjacent landowners in the form of a drainage easement.

E. The design of all stormwater management facilities shall incorporate sound engineering principles and practices. The Township shall reserve the right to disapprove any design that would result in the occupancy or continuation of an adverse hydrologic or hydraulic condition within the Township.

F. "No-Harm Option" – For any proposed development site located in the Township, the developer has the option of using a less restrictive runoff control (including no detention) if the developer can prove that "no harm" would be caused by discharging at a higher runoff rate than that specified by the Plan. The "no-harm" Option is used when a developer can prove that the post-development hydrographs can match pre-development hydrographs, or if it can be proved that the post-development conditions will not cause increases in peaks at all points downstream. Proof of "no-harm" shall include a "downstream hydraulic capacity analysis" to determine if adequate hydraulic capacity exists. The developer shall submit to the Township (as part of the Drainage Plan submission per Article IV) this evaluation of the impacts due to increased downstream stormwater flows in the watershed.

- The evaluation shall continue downstream until the increase in flow diminishes due to additional flow from tributaries and/or stream attenuation.
- A financial distress shall not constitute grounds for granting a no-harm exemption.
- Capacity improvements may be provided as necessary to implement the "no-harm" option, which proposes specific capacity improvements to provide that a less stringent discharge control would not create any harm downstream.

SECTION 303. DESIGN CRITERIA

A. Drainage Area Management Standards

1. Design Storms: The 1, 10, 25 and 100-year design storm frequencies shall be used (as a minimum) for analyzing all peak-discharges and volumes of stormwater runoff for all sites.

2. Peak Flow Rates: The calculated peak rates of runoff for stormwater originating on the project site must meet the following conditions, for all drainage areas flowing from the project site:

a. All post-development peak flow(s) must be less than or equal to the pre-development peak flow(s) for the following storm frequencies : 1-YR, 10-YR, 25-YR and 100-YR.

b. A 100% release rate will be used for the basis of peak flow comparison. Where conditions exist such that the additional volume of stormwater runoff will cause detrimental downstream impact, the post-development peak flow shall be required to be reduced to less than the pre-development peak flow. This circumstance shall be determined on a case-by-case basis.

3. For the purposes of calculating Pre-development peak flow rates, all undeveloped lands shall be considered as "forested" (at a minimum) in good condition. In general, Post-development time-of-concentrations (T_C's) shall not be less than Pre-development T_C's.

4. For development sites that are located in two or more separately draining watershed divides, the applicable release rates for the portions of the site located in different drainage divides shall be based on natural drainage area boundaries. The natural drainage boundaries between watersheds shall not be modified, nor shall drainage from a development site be diverted or otherwise conveyed from one drainage divide to another drainage divide, except where runoff naturally crosses drainage divide boundaries.

5. For sites employing multiple storm detention facilities, peak flows from each detention facility shall be composited (where applicable) for determination of the net peak storm flow leaving the site.

B. Methods of Runoff

1. The NRCS Soil-Cover-Complex Method shall be the method of computation used to determine peak discharge and runoff for sites (Pre and Post Development comparison). NRCS 24-Hour, Type II Rainfall Distributions shall be used with the following rainfall depths in inches:

Design Storm Frequency	Rainfall Depth in Inches
1 Year	2.2
2 Year	2.5
5 Year	3.2
10 Year	3.7
25 Year	4.2
50 Year	4.7
100 Year	4.8

For additional information or data on other return periods, consult "Rainfall Duration Frequency Tables for Pennsylvania" (Research Publication No. 70) as published by the Pennsylvania Department of Environmental Protection; or contact the U.S. Department of Commerce, National Weather Service.

2. The "Rational Method" of analysis (**Q=CIA**) shall be used for design of all stormwater collection and conveyance facilities. In this method of analysis, ***Q*** is the peak discharge of the drainage area in cubic feet per second, ***C*** is the coefficient of surface runoff, ***I*** is the intensity of rainfall in inches per hour, and ***A*** is the area of the watershed in acres. The value of ***I*** shall be obtained from the Pennsylvania Rainfall Intensity - Duration - Frequency Chart, Region No. 1, as shown in the Pennsylvania Department of Transportation, Design Manual, Part 2.

3. Runoff calculations shall include a hydrologic and hydraulic analysis indicating volume and velocities of flow and the grades, sizes, and capacities of water carrying structures, sediment basins, retention and detention structures and sufficient design information to construct such facilities. Runoff calculations shall also indicate both pre-development and post-development rates for peak discharges and volumes of stormwater runoff from the project site.

4. Alternative calculation methods and procedures shall be handled on a case-by-case basis.

C. Design Standards - Water Carrying Facilities

1. All storm sewer pipes and culverts (excluding detention and retention basin outfall structures) conveying water originating only from within the boundaries of the project site shall be designed for a minimum ten (10) year storm event. All storm sewer pipes and culverts (excluding detention and retention basin outfall structures) conveying water originating from offsite shall be designed for a minimum fifty (50) year storm event, unless it can be demonstrated that said facilities will not create a hazard. Natural drainage easement(s) shall be provided to contain and convey the 50-YR frequency flood throughout the project site. Where required, drainage easements shall begin at the furthest upstream property line of the proposed development.

2. The capacities of storm sewers and open swales or channels shall be computed from the Manning Equation. Storm sewers shall be designed to pass the design flow rate without surcharging inlet structures (the hydraulic grade line elevation must remain below the ground surface at all inlets). All open swales and channels must have an erosion resistant lining in place along the full length of each swale or channel, and must be designed with a minimum six inches (6") of freeboard.

3. Additional engineering analyses may be required by the Township engineer for special circumstances.

4. Discharging stormwater off the property to an existing Facility will require supporting calculations to prove the adequacy of the downstream facilities. The developer, subject to Township approval, may elect to upgrade downstream facilities to accommodate the generated runoff.

5. All storm sewer pipes, culverts, bridges, outlet structures and emergency spillways shall include an energy dissipater or stilling basin at its outlet to prevent scour. Whenever possible, all pipes shall be provided with end section or end wall.

6. The maximum spacing between stormwater inlets shall be designed according to the 10-YR post development storm flow and the capacity of the inlets, taking into account maximum allowable street flooding (8.0 foot pavement spread of flow for a "Local" street) and drainage-way capacity. All inlets located in a sump/sag condition shall use a "clogging" capacity-reduction factor (percentage of theoretical capacity) of 0.50. All inlets located on a grade/slope condition shall use a "clogging" capacity-reduction factor of 0.75. The ***maximum*** amount of water that should be bypassed on to the next downstream inlet for inlets on continuous grades is fifty percent (50%).

7. Computational procedures shall follow the methods of the FHWA *Urban Drainage Design Manual* [Hydraulic Engineering Circular#22 (HEC-22)] and/or PennDOT Design Manual Part 2 (DM-2), Chapter 10.

D. Design Standards - Detention Facilities

1. All detention facilities shall be equipped with principal outlet structures capable of providing discharge control for the 1, 10, 25 and 100-YR storm frequencies. Provision shall also be made for auxiliary structures, spillways and/or pipe that are capable of passing the post-development 100-YR storm runoff flows without endangering the detention facilities. All outlet structures for stormwater management facilities shall be designed using any generally accepted hydraulic analysis technique or method.

2. All material used in constructing earth embankments shall be clean and free of any objectionable material. Keyway anchor trenches and anti-seep pipe collars shall be used under all embankments of detention facilities. A clay core is required under all earthen embankments that are constructed on virgin material that is unsuitable for compaction.

3. Emergency spillways for earth embankments shall be designed and constructed with a minimum freeboard elevation of six inches (6") between the peak emergency spillway design-flow elevation and the top of the embankment. All spillways shall have protective lining to control design peak velocities.

4. All detention facility embankments shall have interior and exterior slopes (along each face) of not less than two (2) horizontal rise to one (1) vertical run. Soil or foundation conditions may require "flatter" slopes to be stable. All slopes must be stable. Berms, riprap, rock mulch or vegetation shall be provided as required to protect the surface of the embankment.

5. For earthen embankments, the minimum top width shall be based on the embankment height at the centerline of fill as per the following table:

Height of Embankment	Minimum Top Width
5' or less	6'
6' to 10'	8'
11' to 14'	10'
15'+	As per Chapter 105 req'mts

6. The base of the principal outlet structure must be firmly anchored to prevent its floating. As a minimum, a factor of safety of 1.25 shall be used (Downward forces = 1.25 x Upward forces).

7. For "Dry Ponds" (i.e., a basin which is intended to drain completely following a rainfall event), the use of a low-flow channel within the basin is required. The low-flow channel shall be sized for a 1-YR storm frequency.

8. All stormwater management impoundment facilities shall be designed to dewater in no less than a 24-hour time period (i.e., $\geq$ 1 day). The level of dewatering shall be taken from the top of the principal outlet structure.

9. Provide a stage/discharge and storage/elevation table for all stormwater management impoundment facilities. Provide calculations, planimeter readings or other data to document the storage/elevation tables of all stormwater management impoundment facilities.

10. All outlet structures and emergency spillways shall include an energy dissipater or stilling basin at its outlet to prevent scour. Whenever possible, all pipes shall be provided with end section or end wall.

11. All stormwater management impoundment facilities shall be located to facilitate maintenance, considering the frequency and type of equipment that will be required with suitable permanent-access provided for inspection.

12. Restriction of access (fence, walls, etc.) may be necessary depending on the location of the facility.

13. Landscaping shall be provided for stormwater management impoundment facilities that harmonize with the surrounding area.

E. 100-Year Floodplain Delineation

1. Stormwater management facilities located within or affecting the 100-Year floodplain of any watercourse shall also be subject to all applicable County, State and Federal regulations, as amended from time to time, which regulates construction and development within areas of Shenango Township subject to flooding.

2. The 100-Year floodplain must be delineated on all plans for watercourses which have a drainage watershed area of 100 acres or greater. Where, in the judgement of the municipal engineer, private property or public facilities may be adversely affected by the proposed activity, the 100-Year floodplain shall be established for any watercourse.

3. The 100-Year floodplain shall be delineated by one of the following:

   a. A hydrologic and hydraulic study as prepared by the Federal Emergency Management Agency (FEMA) or similar agency as defined in Article II of this Ordinance.

   b. A hydrologic and hydraulic report as prepared by an individual registered in Pennsylvania to perform such duties.

SECTION 304. EROSION AND SEDIMENTATION REQUIREMENTS

A. Whenever the vegetation and topography are to be disturbed, such activity must be in conformance with Chapter 102, Title 25, Rules and Regulations, Part I, Commonwealth of Pennsylvania, Department of Environmental Protection, Subpart C, protection of Natural Resources, Article II, Water Resources, Chapter 102, "Erosion Control", and in accordance with the Lawrence County Conservation District and the standards and specifications of the appropriate Township government.

B. Additional erosion and sedimentation control design standards and criteria that must be or are recommended to be applied where infiltration BMPs are proposed and include the following:

1. Areas proposed for infiltration BMPs shall be protected from sedimentation and compaction during the construction phase, so as to maintain their maximum infiltration capacity.

2. Infiltration BMPs shall not be constructed nor receive runoff until the entire contributory drainage area to the infiltration BMP has received final stabilization.

SECTION 305. GROUNDWATER RECHARGE REQUIREMENTS

A. The ability to retain and maximize the groundwater recharge capacity of an area being developed is mandatory only as it pertains to the extents of the most current requirements and standards of the PADEP. In general, groundwater recharge will mitigate the increase in runoff volume associated with the creation of impervious surfaces. This increase in runoff volume has significant impacts on downstream landowners.

B. It shall be the developer's responsibility to verify if a groundwater recharge facility is located in an area underlain by limestone. The design of all facilities over limestone formations shall include a geological evaluation to determine susceptibility to sinkhole formations.

C. Infiltration BMPs shall meet the following minimum requirements:

1. When possible, the groundwater recharge facility should be located on soils having the most permeable Hydrologic Soil Group designation.

2. A minimum of forty-eight inches (48") of soil must be maintained between the bottom of the facility and the seasonal high groundwater table and/or bedrock (limiting zones).

3. An infiltration and/or percolation rate sufficient to accept the additional stormwater load and drain completely as determined by the Owner's qualified professional.

4. Infiltration BMPs receiving only roof runoff may be placed in soils having a minimum depth of twenty-four inches (24") between the bottom of the facility and the limiting zone.

5. Infiltration BMPs shall be located a minimum of fifteen (15) feet away from the foundation wall of any building.

6. The recharge facility shall be capable of completely infiltrating the impounded water within forty-eight (48) hours.

SECTION 306. WATER QUALITY REQUIREMENTS

A. All regulated activities governed by this Ordinance shall comply with all applicable stormwater runoff "quality" concerns only as it pertains to the extents of the most current requirements and standards of the PADEP.

SECTION 307. DRIVEWAY CONSTRUCTION AND FILLING-IN OF TOWNSHIP DITCHES/SWALES BY PROPERTY OWNERS

A. Any concrete or asphalt to be installed in the Township of Shenango shall end at the edge of the property, or beginning of the Township right-of-way.

B. The section of driveway crossing the Township right-of-way to the edge of the road surface shall be finished with stone, or asphalt with a swale of "U" type drain complete with a top grate along the ditch line to allow any surface water to drain to the side into the drainage ditch or culvert, as not to allow any surface water to run on to the road surface.

C. The Township is to determine if a culvert pipe is required under any driveway.

D. The Township is to determine and approve the diameter and type of culvert pipe to be installed under a driveway. If a pipe is required, the property owner shall be responsible for purchasing the required pipe. The Township may install the culvert pipe at no cost to the property owner.

E. The Township will supply a standard drawing to be used as a reference for installing a swale over a culvert pipe and along a drainage ditch line. The standard drawing can only act as reference, due to the fact that all areas may differ in size, fall, and depth.

F. The property owner may install storm drainage piping along the road-side on the Township right-of-way to take the place of an open ditch under the following conditions:

1. A permit is obtained from the Township.
2. The Township has approved the diameter and type of pipe to be used.
3. An approved concrete precast catch basin, complete with an approved grating shall be installed at a maximum of every one-hundred fifty (150) feet, if the lot is narrow the catch basin shall be located at the corner of the property with the approval of the Township.
4. Stone must be used to cover a minimum of ¾ of the diameter of the pipe.
5. The pipe shall have a minimum fall approved by the Township.
6. The property owner/contractor must have an approved swale over the pipe, with the proper fall to allow any or all surface water to be drained into a catch basin, culvert, or drainage ditch.

G. The Township prefers an open ditch, therefore, if a property owner makes the decision to pipe in the drainage ditch, this would be done at no expense to the Township, as it will only enhance the property and not benefit the Township.

H. Before any construction begins on any old or new driveway and/or drainage ditch, the property owner/contractor must obtain a driveway permit from the Township at a cost of $25.00 (amount subject to change over time).

ARTICLE IV
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 Township.

SECTION 402. EXEMPTIONS

Any Regulated Activity that meets the following exemption criteria is exempt from the Drainage Plan preparation provisions of this Ordinance. This criterion shall apply to the total development even if development is to take place in stages or phases. The date of the Township Stormwater Ordinance adoption shall be the starting point from which to consider tracts as "parent tracts" in which future subdivisions and respective impervious area computations shall be cumulatively considered. Exemption shall not relieve the applicant from implementing such measures as are necessary to protect health, safety, and property.

A. Use of land for gardening for home consumption.

B. Land disturbances associated with existing one and two family dwellings (i.e., duplexes).

C. Construction activities creating impervious area as per the following table:

Impervious Area Exemption

Total Parcel Size	Minimum Distance (feet)*	Square Footage
0 – 0.5 acre	25	1,000
>0.5 – 1.0 acre	50	3,000
>1.0 – 2.0 acres	100	5,000
>2.0 – 5.0 acres	250	10,000
> 5.0 acres	500	15,000

* The minimum distance between the proposed impervious area and/or stormwater control/structure discharge point to the downslope property boundary. In lieu of meeting the minimum distance criteria, the applicant may provide documentation from a registered professional engineer in the Commonwealth of Pennsylvania that the increased flows from the site leaves the site in the same manner as the pre-development condition, and that there will be no adverse affects to properties along the path of flow(s), or that the increased flow(s) will reach a natural watercourse or an existing stormwater management structure before adversely affecting any property along the path of the flow(s).

D. Agriculture and Nursery operations when conducted in accordance with a conservation plan or erosion and sedimentation control plan found adequate by the Conservation District. **The agricultural activities such as growing crops, rotating crops, filling of soil and grazing animals and other such activities are specifically exempt from complying with the requirements of this Ordinance.**

E. Forest Management/Timber operations that are following the Department of Environmental Protections' management practices contained in its publication "Soil Erosion and Sedimentation Control Guidelines for Forestry" and are operating under an approved erosion and sedimentation control plan. As a minimum for "Exemption" consideration, proof of notification to the Conservation District shall be required for all proposed forest management/timber operations. Notification must be submitted 7–10 days prior to start of operations and shall include the specific project location, net acreage involved, project time-schedule and start date.

F. The Township will evaluate any other special cases (that are requested for exemption) as they occur and review stormwater management accordingly.

SECTION 403. PLAN CONTENTS

The following items, where appropriate, shall be included in the Drainage Plan:

A. General

1. A general description of project, with expected project time schedule, including anticipated start and completion dates

2. A general description of permanent stormwater management techniques, including construction specifications of the materials to be used for stormwater management.

3. Complete hydrologic, hydraulic and structural computations for all stormwater management facilities.

4. An executed signature block from a registered professional engineer certifying that the submitted stormwater management plan meets all design standards and criteria as set forth in this Ordinance.

B. Map(s) of the project area showing:

1. The location of the project relative to highways, municipalities or other identifiable landmarks
2. Existing contours at intervals of two (2) feet. In areas of steep slopes (greater than 15%), five-foot contour intervals may be used
3. Streams, lakes, ponds or other bodies of water within the project area, or which will be affected by runoff from the project
4. Other physical features including existing drainage swales and areas of natural vegetation to be preserved

5. Locations of proposed underground utilities, sewers and water lines within fifty (50) feet of property lines
6. An overlay showing soil types and boundaries
7. Proposed changes to land surface and vegetative cover
8. Areas to be cut or filled
9. Proposed structures, roads, paved areas and buildings. Finish floor elevations shall be shown for all proposed structures.
10. Final proposed contours at intervals of two (2) feet. In areas of steep slopes (greater than 15%), five-foot contour intervals may be used
11. The name of the development, the name and address of the property owner(s), and the name of the individual or firm preparing the plan.
12. The date of submission
13. A graphic and written scale of no more than one (1) inch equals one hundred (100) feet.
14. A North arrow and a drawing legend which identifies all pertinent items on the drawing(s)
15. The total tract boundary and size with distances marked to the nearest foot and bearings to the nearest degree.
16. Existing and proposed land uses(s)
17. The location of all erosion and sedimentation control facilities.
18. Overland drainage paths.
19. Horizontal and vertical profiles of all storm piping and channels, including hydraulic capacity
20. A fifteen-foot wide access easement around all stormwater management facilities that provides ingress from and egress to a public right-of-way.
21. A note on the plan indicating the location and responsibility for maintenance of stormwater management facilities that would be located on-site. All off-site facilities shall meet the performance standards and design criteria specified in this Ordinance.
22. A statement, signed by the landowner, acknowledging the stormwater management system to be a permanent fixture that can be altered or removed only after approval of a revised plan by the plan administrator.

C. Supplemental information

1. The overall stormwater management concept for the project.

2. Complete stormwater runoff computations along with stormwater management techniques to be applied (both during and after construction). Include any effects upon adjacent properties or on existing municipal stormwater collection systems.

3. A soil erosion and sedimentation control plan, including all reviews and approvals, as required by the PA DEP

4. A Declaration of Adequacy and Highway Occupancy Permit from the PADOT when utilization of a PADOT storm drainage system is proposed.

D. Stormwater management facilities

1. All stormwater management controls must be shown on a map and described in detail.

2. When groundwater recharge methods such as seepage pits, beds or trenches are used, the locations of existing and proposed septic tank infiltration areas and wells must be shown.

3. Any other control devices/methods used (e.g. roof-top storage, semi-pervious paving materials, grass swales, parking-lot ponding, vegetated strips, detention/retention ponds, storm sewers, etc.) must be shown.

4. All calculations, assumptions and criteria used in the design of the stormwater management facilities must be provided.

5. Maintenance Program – A maintenance program for all stormwater management control facilities must be included. This program must include the proposed ownership of the control facilities and detail the financial responsibility for any required maintenance.

SECTION 404. PLAN SUBMISSION

A. Plan submission must include a completed "Application for Stormwater Management Review".

B. Two (2) copies of the completed plan must be submitted for review (1 copy to the Township and 1 copy to the reviewing engineer).

C. Two (2) copies of any additional required state or federal permits shall be included as part of the plan submission.

SECTION 405. PLAN APPROVAL

A. The Township shall notify the applicant within 60 days from receipt of a complete plan submission of its decision.

B. Disapproval shall contain the reasons for disapproval and a listing of the plan deficiencies.

C. Failure of the Township to render a decision within the 60-day time limit shall be deemed an approval.

D. Issuance of the Township's "Stormwater Management Permit" shall not be granted until all requisite fees are paid in full, as per Article VI of this Ordinance.

E. The Township shall not approve any subdivision or land development projects, or issue any building permit(s) until the project's stormwater management plan is found to be consistent with the criteria established in this Ordinance.

SECTION 406. MODIFICATION OF PLANS

A modification to an approved stormwater management plan which involves a change in content, methods or techniques, or which involves the relocation or redesign of control measures, or which is necessary because soil or other conditions are not as stated on the approved application (as determined by the Township engineer), shall be approved under the procedures contained in Section 405 of this Ordinance. The Township engineer shall notify the applicant when such plan modification is required.

ARTICLE V
INSPECTIONS

SECTION 501. SCHEDULE OF INSPECTIONS

A. The Township engineer or his designee shall inspect any or all phases of the site development, including all facilities required by this Ordinance in order to ensure that such facilities are completed according to approved plans.

B. Any portion(s) of the work that does not comply with the approved plan must be corrected by the permittee within 48 hours. No work may proceed on any subsequent phase of the drainage facilities, the subdivision or land development or building construction until the required corrections have been made.

C. If at any stage of the work, the Township engineer determines that the soil or other conditions are not as stated or shown in the approved application, he may refuse to approve further work and the Township may revoke existing permits until a revised plan is submitted and approved, as per Section 406 of this Ordinance.

SECTION 502. ON-SITE PLANS

A set of design plans approved by the Township shall be on file at the site throughout the duration of the construction activity.

SECTION 503. SUBMISSION OF "AS-BUILTS"

Following construction of any stormwater management facilities that are being requested for dedication to Shenango Township, the developer shall submit drawings bearing the seal of a Pennsylvania Registered Professional Engineer or Land Surveyor indicating the "As-Built" improvements called for in the approved Plan.

SECTION 504. CERTIFICATION OF COMPLETION

At the completion of the project, and as a prerequisite for the release of the construction financial security; the owner or his representative shall provide a certification of completion from an engineer, architect, surveyor or other qualified person verifying that all permanent facilities have been constructed according to the plans and specifications and approved revisions thereto.

ARTICLE VI
FEES AND EXPENSES

SECTION 601. GENERAL

Stormwater management Permit fees covering costs to the Township for plan reviews, permit issuance and inspections shall be established by resolution of the Township's governing body. No permit to begin work on the project shall be issued until the requisite fees have been paid. The Township shall periodically update the review fees to ensure that review costs are adequately reimbursed.

SECTION 602. MODIFICATION OF PLANS

If it is determined that a modification to the existing Drainage Plan is required under Section 406 of this Ordinance, a new stormwater management permit shall not be issued until the additional fees have been paid by the applicant.

SECTION 603. EXPENSES COVERED BY FEES

The fees required by this Ordinance shall at a minimum cover:

A. Administrative costs

B. The review of the Drainage Plan by the Township and the Township Engineer

C. The site inspections

D. The inspection of required controls and improvements during construction

E. The final inspection upon completion of the stormwater management facilities and drainage improvements presented in the Drainage Plan

F. Any additional work required for enforcing any permit provisions regulated by this Ordinance, to correct violations, and to assure proper completion of stipulated remedial actions (if any)

ARTICLE VII
FINANCIAL GUARANTEES AND MAINTENANCE

SECTION 701. FINANCIAL SECURITY FOR CONSTRUCTION

The developer, builder or property owner may have to provide financial security as a construction guarantee in a form to be approved by the Township, in an amount equal to One Hundred Ten (110%) percent of the full cost to install the stormwater facilities required by the approved plan. The financial security shall be released only after the Township receives a "certification of completion" as per Section 504 and, where applicable, As-Built drawings as per Section 503.

SECTION 702. FINANCIAL SECURITY FOR MAINTENANCE

Upon acceptance of any stormwater management facilities by Shenango Township, the developer, builder or property owner shall provide a financial security, in a form approved by the Township for maintenance guarantees, as follows:

A. Construction Maintenance Bond – The construction maintenance bond shall be in an amount equal to fifteen percent (15%) of the cost of the installation, and shall be used as financial security to guarantee the stability of the newly established facilities and re-vegetation for a period of one year.

B. Long-Term Maintenance Bond – The long-term maintenance bond shall be in an amount equal to a figure that shall be determined by the Township to be the established cost of maintenance of the stormwater management facility for a minimum period of ten years.

SECTION 703. MAINTENANCE BY PRIVATE ENTITY

In cases where permanent control facilities are owned by a private entity (such as a homeowner's association), such entity shall be responsible for maintenance. In this case, a legally binding agreement between the entity and Shenango Township shall be made providing for maintenance of all permanent control facilities, and allowing inspection by the Township of all such facilities deemed critical to the public welfare at any reasonable time. The Maintenance Agreement shall be subject to the review and approval of the Township Solicitor and governing body.

SECTION 704. MAINTENANCE BY INDIVIDUAL LOT OWNERS

A. When stormwater management control measures are located on an individual lot, they shall be the responsibility of that landowner to maintain. A description of the facility or system and the terms of the required maintenance shall be incorporated as part of the deed to the property.

B. If the Township determines at any time that any permanent stormwater management control facility has been eliminated, altered or improperly maintained, the owner of the property shall be advised of corrective measures required and given a reasonable period of time to take necessary action. If such action is not taken by the property owner, the Township may cause the work to be done and lien all costs against the property.

SECTION 705. FAILURE TO MAINTAIN

The failure of any person, individual lot owner or private entity to properly maintain any stormwater management facility shall be construed to be a violation of this Ordinance and is declared to be a public nuisance, subject to Article VIII, Enforcement and Penalties.

ARTICLE VIII
ENFORCEMENT AND PENALTIES

SECTION 801. RIGHT-0F-ENTRY

Upon presentation of proper credentials, duly authorized representatives of the Township may enter at reasonable times upon any property within the Township to investigate or ascertain the condition of the subject property in regard to any aspect regulated by this Ordinance.

SECTION 802. NOTIFICATION

In the event that a person fails to comply with the requirements of this Ordinance, or fails to conform to the requirements of any permit issued hereunder, the Township shall provide written notification of the violation(s) and establish a time limit for correction of these violation(s). Failure to comply within the time specified shall subject such person to the penalty provision of this Ordinance. All such penalties shall be deemed cumulative and resort by the Township from pursuing any and all other remedies. It shall be the responsibility of the owner of the real property on which any Regulated Activity is proposed to occur, is occurring, or has occurred, to comply with the terms and conditions of this Ordinance.

SECTION 803. PENALTIES

Anyone violating the provisions of this Ordinance shall be guilty of a misdemeanor, and upon conviction shall be subject to a fine of not more than $1,000.00 for each violation, recoverable with costs, or imprisonment of not more than 90 days, or both. Each day that the violation continues shall be a separate offense. In addition, the Township may institute injunctive, mandamus or any other appropriate action or proceeding at law or in equity for the enforcement of this Ordinance. Any court of competent jurisdiction shall have the right to issue restraining orders, temporary or permanent injunctions, mandamus, or other appropriate forms of remedy or relief.

SECTION 804. OCCUPANCY PERMIT

The Township shall not issue an occupancy permit unless the certification of compliance pursuant to Section 504 has been secured. The occupancy permit shall be required for each lot owner and/or developer for all subdivisions and land development in the Township.

ARTICLE IX
APPEALS

SECTION 901. APPEAL TO TOWNSHIP'S GOVERNING BODY

Any person aggrieved by any action of the Township or its agent may appeal to the Township's governing body within 30 days of that action.

SECTION 902. APPEAL TO COURT

Any person aggrieved by any decision of the Township's governing body may appeal to the County Court of Lawrence within 30 days of that decision.

REFERENCES TO STORMWATER MANAGEMENT ORDINANCE

1. Chapter 102. Erosion Control, Title 25, Rules and Regulations of the PA Department of Environmental Protection

2. Chapter 105. Water Obstructions and Encroachments, Title 25, Rules and Regulations of the PA Department of Environmental Protection.

3. Engineering Field Manual for Conservation Practices, 1975, U.S. Department of Agriculture, Soil Conservation Service.

4. Erosion and Sedimentation Control Handbook, Lawrence County Conservation Department.

5. Pennsylvania Handbook of Best Management Practices for Developing Areas, PA Department of Environmental Protection, Stormwater Planning and Management Section.

6. Soil Erosion and Sedimentation Control Manual, Department of Environmental Protection, Bureau of Soil and Water Conservation and Bureau of Water Quality Management.

7. Urban Hydrology for Small Watersheds, Technical Release No.55, Soil Conservation Service, U.S. Department of Agriculture, January 1975.

STORMWATER MANAGEMENT ORDINANCE

SHENANGO TOWNSHIP

LAWRENCE COUNTY, PENNSYLVANIA

APPENDIX

Recommended n Values to be used with Manning's Equation

Surface	Min.	Design	Max.
Asphalt Lining		0.015	
Brick in cement mortar, brick sewers	0.012	0.015	0.017
Concrete-lined channel	0.012	0.015	0.018
Cement-rubble surface	0.017		0.030
Neat cement surface	0.010	0.012	0.013
Plastic-lined channel	0.012		0.014
Shotcrete	0.016		0.017
Asbestos Cement Pipe		0.009	
Concrete Pipe	0.012	0.015	0.016
Vitrified Clay Pipe	0.010	0.013	0.017
Common-clay drainage tile	0.011	0.012	0.017
Semi-circular metal flumes, smooth	0.011		0.015
Corrugated	0.023	0.025	0.030
Channels and ditches			
Earth, straight and uniform	0.017	0.023	0.025
Rock cuts, smooth and uniform	0.025	0.030	0.035
jagged and irregular	0.035	0.040	
Dredged earth channels	0.025	0.028	0.033
Earth bottom, rubble sides	0.028	0.030	0.035
Natural Streams			
1. Clean, straight bank, full stage no rifts or deep pools	0.025		0.033
2. Same as 1, but some weeds and stones	0.030		0.040
3. Winding, some pools and shoals, clean	0.033		0.045
4. Same as 3, lower stages, more ineffective slope and sections	0.040		0.055
5. Same as 3, same weeds and stone	0.035		0.050
6. Same as 4, stony sections	0.045		0.060
7. Sluggish river reaches, rather weedy or with very deep pools	0.050		0.080
8. Very weedy reaches	0.075		0.150

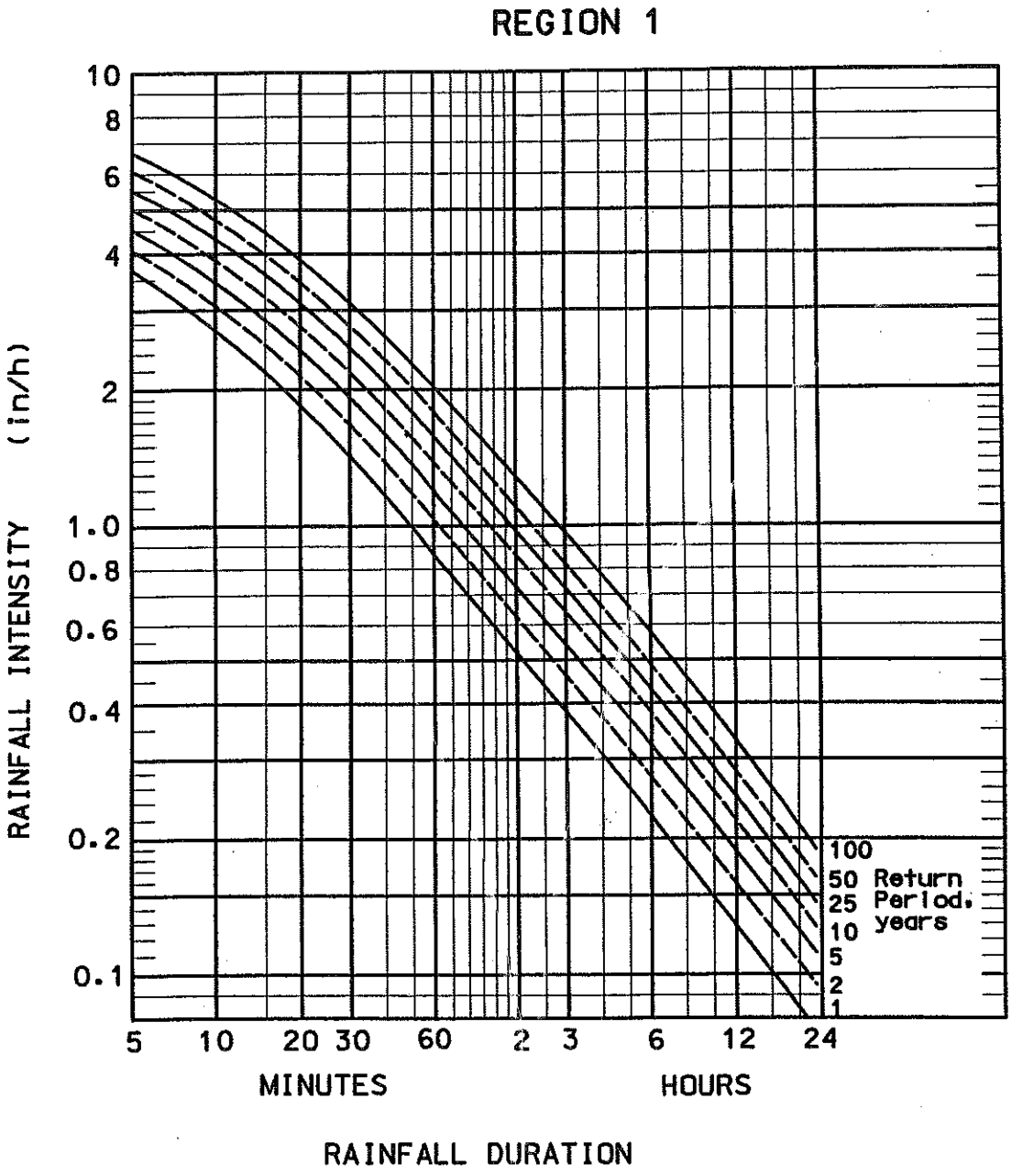


FIGURE 10.4.2(A) (ENGLISH)
STORM INTENSITY - DURATION - FREQUENCY
CURVES FOR REGION 1

TABLE 14.9 Runoff Coefficients for the Rational Formula by Hydrologic Soil Group and Slope Range

	A			B			C			D		
Land Use	**0–2%**	**2–6%**	**6%+**	**0–2%**	**2–6%**	**6%+**	**0–2%**	**2–6%**	**6%+**	**0–2%**	**2–6%**	**6%+**
Cultivated Land	0.08[a]	0.13	0.16	0.11	0.15	0.21	0.14	0.19	0.26	0.18	0.23	0.31
	0.14[b]	0.18	0.22	0.16	0.21	0.28	0.20	0.25	0.34	0.24	0.29	0.41
Pasture	0.12	0.20	0.30	0.18	0.28	0.37	0.24	0.34	0.44	0.30	0.40	0.50
	0.15	0.25	0.37	0.23	0.34	0.45	0.30	0.42	0.52	0.37	0.50	0.62
Meadow	0.10	0.16	0.25	0.14	0.22	0.30	0.20	0.28	0.36	0.24	0.30	0.40
	0.14	0.22	0.30	0.20	0.28	0.37	0.26	0.35	0.44	0.30	0.40	0.50
Forest	0.05	0.08	0.11	0.08	0.11	0.14	0.10	0.13	0.16	0.12	0.16	0.20
	0.08	0.11	0.14	0.10	0.14	0.18	0.12	0.16	0.20	0.15	0.20	0.25
Residential Lot Size ⅛ acre	0.25	0.28	0.31	0.27	0.30	0.35	0.30	0.33	0.38	0.33	0.36	0.42
	0.33	0.37	0.40	0.35	0.39	0.44	0.38	0.42	0.49	0.41	0.45	0.54
Lot Size ¼ acre	0.22	0.26	0.29	0.24	0.29	0.33	0.27	0.31	0.36	0.30	0.34	0.40
	0.30	0.34	0.37	0.33	0.37	0.42	0.36	0.40	0.47	0.38	0.42	0.52
Lot Size ⅓ acre	0.19	0.23	0.26	0.22	0.26	0.30	0.25	0.29	0.34	0.28	0.32	0.39
	0.28	0.32	0.35	0.30	0.35	0.39	0.33	0.38	0.45	0.36	0.40	0.50
Lot Size ½ acre	0.16	0.20	0.24	0.19	0.23	0.28	0.22	0.27	0.32	0.26	0.30	0.37
	0.25	0.29	0.32	0.28	0.32	0.36	0.31	0.35	0.42	0.34	0.38	0.46
Lot Size 1 acre	0.14	0.19	0.22	0.17	0.21	0.26	0.20	0.25	0.31	0.24	0.29	0.35
	0.22	0.26	0.29	0.24	0.23	0.34	0.28	0.32	0.40	0.31	0.35	0.46
Industrial	0.67	0.68	0.68	0.68	0.68	0.69	0.68	0.69	0.69	0.69	0.69	0.70
	0.85	0.85	0.86	0.85	0.86	0.86	0.86	0.86	0.87	0.86	0.86	0.88
Commercial	0.71	0.71	0.72	0.71	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72
	0.88	0.88	0.89	0.89	0.89	0.89	0.89	0.89	0.90	0.89	0.89	0.90
Streets	0.70	0.71	0.72	0.71	0.72	0.74	0.72	0.73	0.76	0.73	0.75	0.78
	0.76	0.77	0.79	0.80	0.82	0.84	0.84	0.85	0.89	0.89	0.91	0.95
Open Space	0.05	0.10	0.14	0.08	0.13	0.19	0.12	0.17	0.24	0.16	0.21	0.28
	0.11	0.16	0.20	0.14	0.19	0.26	0.18	0.23	0.32	0.22	0.27	0.39
Parking	0.85	0.86	0.87	0.85	0.86	0.87	0.85	0.86	0.87	0.85	0.86	0.87
	0.95	0.96	0.97	0.95	0.96	0.97	0.95	0.96	0.97	0.95	0.96	0.97

Source: Kibler, D.F. et al. 1982. *Recommended Hydrologic Procedures for Computing Urban Runoff in Pennsylvania* Commonwealth of Pa. Harrisburg Pa.: Dept. of Environmental Resources.

[a] Runoff coefficients for storm recurrence intervals less than 25 years

[b] Runoff coefficients for storm recurrence intervals of 25 years or more

Sheet Flow in the Northeast

Due to the irregular topography, the maximum sheet flow length that should be used for unpaved areas in the Northeast is 150 feet with a most likely length of 50-100 feet. The theoretical maximum length of 300 feet is achieved only in unique situations such as uniformly sloped paved parking lots.

The maximum roughness coefficient for sheet flow to be used for woods is 0.40.

The data does not support a higher coefficient.

Table 2-2a.—Runoff curve numbers for urban areas[1]

Cover description		Curve numbers for hydrologic soil group—			
Cover type and hydrologic condition	Average percent impervious area[2]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.)[3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only)[4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)[5]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

[1]Average runoff condition, and $I_a = 0.2S$.
[2]The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.
[3]CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.
[4]Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.
[5]Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4, based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Table 2-2b.—Runoff curve numbers for cultivated agricultural lands[1]

Cover description			Curve numbers for hydrologic soil group—			
Cover type	Treatment[2]	Hydrologic condition[3]	A	B	C	D
Fallow	Bare soil	—	77	86	91	94
	Crop residue cover (CR)	Poor	76	85	90	93
		Good	74	83	88	90
Row crops	Straight row (SR)	Poor	72	81	88	91
		Good	67	78	85	89
	SR + CR	Poor	71	80	87	90
		Good	64	75	82	85
	Contoured (C)	Poor	70	79	84	88
		Good	65	75	82	86
	C + CR	Poor	69	78	83	87
		Good	64	74	81	85
	Contoured & terraced (C&T)	Poor	66	74	80	82
		Good	62	71	78	81
	C&T + CR	Poor	65	73	79	81
		Good	61	70	77	80
Small grain	SR	Poor	65	76	84	88
		Good	63	75	83	87
	SR + CR	Poor	64	75	83	86
		Good	60	72	80	84
	C	Poor	63	74	82	85
		Good	61	73	81	84
	C + CR	Poor	62	73	81	84
		Good	60	72	80	83
	C&T	Poor	61	72	79	82
		Good	59	70	78	81
	C&T + CR	Poor	60	71	78	81
		Good	58	69	77	80
Close-seeded or broadcast legumes or rotation meadow	SR	Poor	66	77	85	89
		Good	58	72	81	85
	C	Poor	64	75	83	85
		Good	55	69	78	83
	C&T	Poor	63	73	80	83
		Good	51	67	76	80

[1]Average runoff condition, and $I_a = 0.2S$.

[2]*Crop residue cover* applies only if residue is on at least 5% of the surface throughout the year.

[3]Hydrologic condition is based on combination of factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes in rotations, (d) percent of residue cover on the land surface (good ≥ 20%), and (e) degree of surface roughness.

Poor: Factors impair infiltration and tend to increase runoff.

Good: Factors encourage average and better than average infiltration and tend to decrease runoff.

Table 2-2c.—Runoff curve numbers for other agricultural lands[1]

Cover description		Curve numbers for hydrologic soil group—			
Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range—continuous forage for grazing.[2]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element.[3]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	[4]30	48	65	73
Woods—grass combination (orchard or tree farm).[5]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods.[6]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	[4]30	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

[1]Average runoff condition, and $I_a = 0.2S$.

[2]*Poor:* <50% ground cover or heavily grazed with no mulch.
Fair: 50 to 75% ground cover and not heavily grazed.
Good: >75% ground cover and lightly or only occasionally grazed.

[3]*Poor:* <50% ground cover.
Fair: 50 to 75% ground cover.
Good: >75% ground cover.

[4]Actual curve number is less than 30; use CN = 30 for runoff computations.

[5]CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.

[6]*Poor:* Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

Sheet flow

Sheet flow is flow over plane surfaces. It usually occurs in the headwater of streams. With sheet flow, the friction value (Manning's n) is an effective roughness coefficient that includes the effect of raindrop impact; drag over the plane surface; obstacles such as litter, crop ridges, and rocks; and erosion and transportation of sediment. These n values are for very shallow flow depths of about 0.1 foot or so. Table 3-1 gives Manning's n values for sheet flow for various surface conditions.

For sheet flow of less than 300 feet, use Manning's kinematic solution (Overton and Meadows 1976) to compute T_t:

$$T_t = \frac{0.007\ (nL)^{0.8}}{(P_2)^{0.5}\ s^{0.4}} \qquad \text{[Eq. 3-3]}$$

Table 3-1.—Roughness coefficients (Manning's n) for sheet flow

Surface description	n[1]
Smooth surfaces (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated soils:	
Residue cover ≤20%	0.06
Residue cover >20%	0.17
Grass:	
Short grass prairie	0.15
Dense grasses[2]	0.24
Bermudagrass	0.41
Range (natural)	0.13
Woods:[3]	
Light underbrush	0.40
Dense underbrush	0.80

[1]The n values are a composite of information compiled by Engman (1986).
[2]Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.
[3]When selecting n, consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.

where

T_t = travel time (hr),
n = Manning's roughness coefficient (table 3-1),
L = flow length (ft),
P_2 = 2-year, 24-hour rainfall (in), and
s = slope of hydraulic grade line (land slope, ft/ft).

This simplified form of the Manning's kinematic solution is based on the following: (1) shallow steady uniform flow, (2) constant intensity of rainfall excess (that part of a rain available for runoff), (3) rainfall duration of 24 hours, and (4) minor effect of infiltration on travel time. Rainfall depth can be obtained from appendix B.

Shallow concentrated flow

After a maximum of 300 feet, sheet flow usually becomes shallow concentrated flow. The average velocity for this flow can be determined from figure 3-1, in which average velocity is a function of watercourse slope and type of channel. For slopes less than 0.005 ft/ft, use equations given in appendix F for figure 3-1. Tillage can affect the direction of shallow concentrated flow. Flow may not always be directly down the watershed slope if tillage runs across the slope.

After determining average velocity in figure 3-1, use equation 3-1 to estimate travel time for the shallow concentrated flow segment.

Open channels

Open channels are assumed to begin where surveyed cross section information has been obtained, where channels are visible on aerial photographs, or where blue lines (indicating streams) appear on United States Geological Survey (USGS) quadrangle sheets. Manning's equation or water surface profile information can be used to estimate average flow velocity. Average flow velocity is usually determined for bank-full elevation.

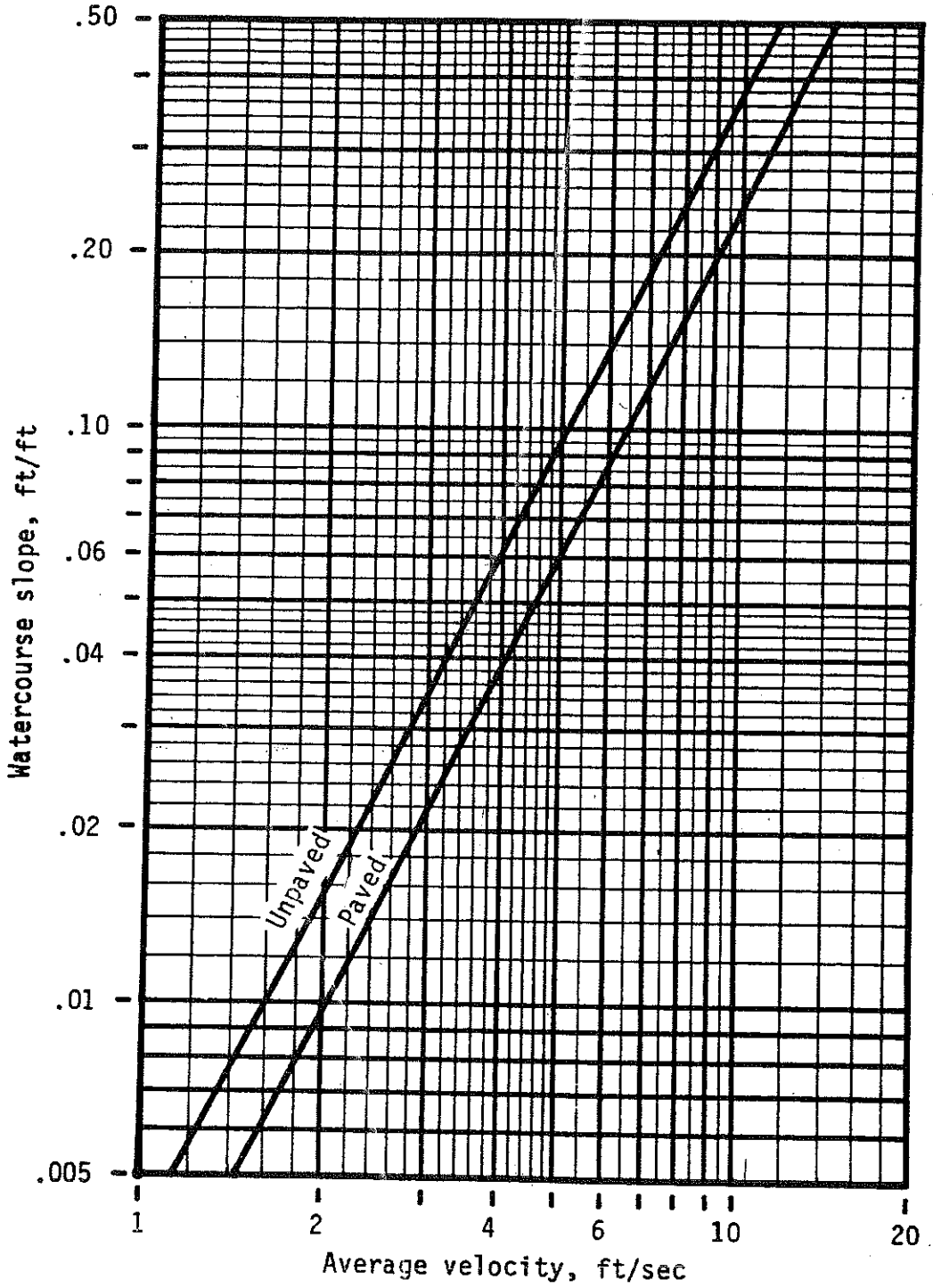


Figure 3-1.—Average velocities for estimating travel time for shallow concentrated flow.

Various On-Site Stormwater Control Methods

AREA	REDUCING RUNOFF	DELAYING RUNOFF
Large Flat Roof	1. Cistern and/or pond storage 2. Rooftop gardens 3. Pool storage or fountain 4. Infiltration system	1. Ponding on roof by constricted downspouts
Building Roofs	1. Cistern and/or pond storage 2. Pool storage or fountain 3. Infiltration system	1. Outlet to lawn area
Parking Lots	1. Porous pavement a. Gravel parking lots (porous). b. Porous or punctured 2. Concrete vaults and cisterns 3. Vegetated ponding areas 4. Gravel trenches. 5. Infiltration systems with W.Q. pretreatment BMP. 6. Bioretention Facilities	1. Grassy strips on parking lots. 2. Grassed waterways draining parking lot. 3. Ponding and detention a. Rippled pavement b. Depressions c. Basins 4. Bioretention Facilities 5. Constructed Treatment Wetland
Residential	1. Cisterns for individual homes or groups of homes. 2. Gravel driveways (porous) 3. Contoured landscape plantings. 4. Groundwater recharge: a. Perforated pipe b. Gravel (sand) trenches c. Dry Wells d. Infiltration Ponds 5. Vegetated depressions 6. Bioretention Facilities	1. Reservoir of detention basin. 2. Maintaining vegetation density on lawns and mowing with mowers set at a higher height. 3. Gravel driveways. 4. Grassy gutters or channels. 5. Increased length of travel of runoff by means of gutters, diversions, etc. 6. Bioretention Facilities 7. Constructed Treatment Wetland
General	1. Gravel alleys 2. Porous sidewalks 3. Mulched planters	1. Gravel alleys

Source: (1) Urban Hydrology for Small Watershed. Technical Release No. 55, January 1995.
(2) Pennsylvania Handbook of Best Management Practices for Developing Areas, Spring 1998.

Advantages and Disadvantages Of Various On-Site Stormwater Control Methods

MEASURE	ADVANTAGES	DISADVANTAGES
A. Rooftop Gardens	1. Aesthetically pleasing. 2. Runoff reduction. 3. Reduce noise levels. 4. Wildlife enhancement.	1. Higher structural loadings on roof and building. 2. Expensive to install and maintain.
B. Increased Roof Roughness: a. Rippled roof b. Gravel on roof	1. Runoff delay and some reduction (detention in ripples or gravel).	1. Somewhat higher structural loading.
C. Ponding on Roof by Constricted Downspouts	1. Runoff delay. 2. Cooling effect for building.	1. Higher structural loadings. 2. Clogging of constricted down spouts 3. Freezing during winter (expansion) & increased structural loading 4. Waves and wave loading. 5. Leakage of roof water into building.
D. Porous pavement (parking lots and alleys): a. Gravel parking lot b. Holes in impervious pavements (1/4 in. diameter filled with sand. c. Interconnected paving blocks	1. Runoff reduction (a and b). 2. Potential groundwater recharge. 3. Gravel pavements may be cheaper than asphalt or concrete (a).	1. Clogging of holes or gravel (a and b). 2. Compaction of earth below pavement or gravel decreases permeability of soil (a and b). 3. Ground-water pollution from salt in winter (a and b). 4. Frost heaving for impervious pavement with holes (b). 5. Difficult to maintain. 6. Grass or weeds could grow in porous pavement (a, b, and c) 7. Will require vacuuming of surface.
E. Converted septic tank for storage and ground water recharge.	1. Low installation costs. 2. Runoff reduction 3. Water may be used for: a. Fire protection. b. Watering lawns and gardens.	1. Requires periodic maintenance (silt removal). 2. Sometimes requires a pump.
F. Cisterns and Covered Ponds.	1. Additional Storage may be provided for: a. Fire Protection b. Watering lawns c. Industrial processes 2. Reduce runoff while only occupying small area. 3. Land and space above cistern may be used for other purposes.	1. Expensive to install. 2. Cost required may be restrictive if the cistern must accept water from large drainage areas. 3. Requires slight maintenance. 4. Restricted access.

Advantages And Disadvantages Of Various On-Site Stormwater Control Methods

MEASURE	ADVANTAGES	DISADVANTAGES
G. Infiltration System	1. Maintain hydrologic balance ground & surface waters. 2. Reduce runoff while occupying small area. 3. Land and space above system may be used for other purposes.	1. Installation cost. 2. Cost may be restrictive if must accept water from large drainage areas. 3. Proper maintenance and use at pretreatment water quality (filtering) BMP required. 4. Repair or replacement cost could be expensive. 5. Potential for ground water contamination. 6. Winter de-icing chemicals could destroy soil structure, especially pervious clays, and reduce or prevent infiltration.
H. Bioretention Facilities	1. Can be used to recharge groundwater by infiltration runoff. 2. Reduce peak runoff rates. 3. Provides water quality benefits. 4. Aesthetically pleasing. 5. Attenuation air pollutants and noise. 6. Provide wildlife habitat.	1. Potential for groundwater pollution. 2. Require maintenance. 3. Cost may be restrictive if must accept water from large drainage areas. 4. Maintenance of system and vegetation.
I. Grassed channels and vegetated strips.	1. Runoff delay. 2. Some runoff reduction (infiltration recharge). 3. Aesthetically pleasing: a. Flowers b. Trees	1. Sacrifice some land area for vegetated strips. 2. Grassed areas must be mowed or cut periodically (maintenance costs).
J. Ponding and detention measures on impervious pavement:	1. Runoff delay 2. Peak discharge reduction	1. Somewhat restricted movement of vehicles. 2. Interferes with normal use during storms.
K. Constructed Treatment Wetlands	1. Provide water quality treatment. 2. Control large drainage areas. 3. Aquatic and wetland life habitat. 4. Provides runoff delay.	1. Require large areas. 2. Regular supply of inflow required for biological health of system. 3. Possible mosquito breeding areas. 4. Maintenance problems. 5. Cattails and other wetland vegetation are unsightly. 6. Generally not suited to smaller drainage areas, unless continuous flow of water is available.
L. Surface Pond Storage	1. Controls large drainage areas with low release. 2. Aesthetically pleasing. 3. Possible recreation benefits: a. Boating b. Ice Skating c. Fishing d. Swimming 4. Aquatic life habitat 5. Increases land value of adjoining property.	1. Requires large areas. 2. Possible pollution from stormwater and siltation. 3. Possible mosquito breeding areas. 4. May have adverse alga blooms as a result of nutrient runoff. 5. Possible drowning. 6. Maintenance problems

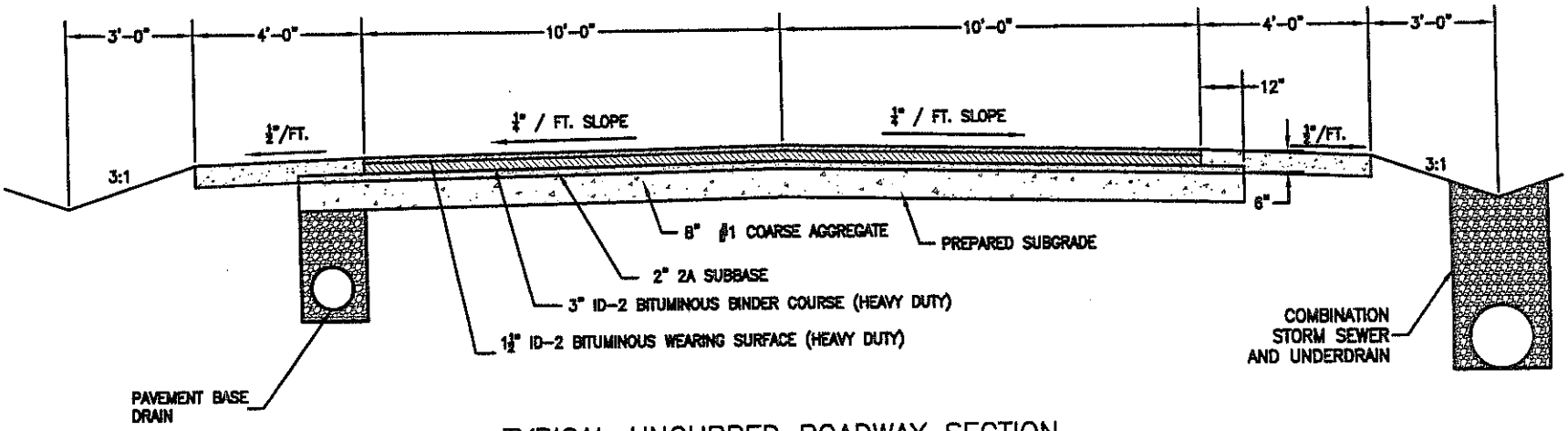
Suitability Of Runoff Control Measures

MEASURE	RECOMMENDATIONS
Cisterns and Covered Ponds:	Recommended in industrial parks where water could be utilized for fire protection; expensive to install with limited benefit; low additional water storage maintenance costs (usually requires periodic sediment removal).
Rooftop Gardens:	Recommended for consideration on new buildings properly designed for earth, plant and water loads.
Surface Pond Storage:	Recommended where pond sites exist, on more porous soils (A and B) can benefit groundwater recharge; relatively inexpensive to install and maintain; helps entrap sediment to improve water quality of receiving stream. Water Quality benefits can be further achieved by incorporating delayed discharge, wet storage or wetlands as part of the design on appropriate sites.
Ponding on Roof, Constricted Downspouts:	Possible on new large public and commercial buildings with flat roofs; existing buildings require structural evaluation and possibly modification; usually expensive if modifications required; low maintenance costs unless leaks occur.
Increased Roof Roughness:	Possible for industrial, commercial and public buildings; relative effectiveness minimal on a watershed wide basis; moderate installation costs; little maintenance costs.
Porous Pavement:	Highly recommended where possible, especially in A and B soils and large parking facilities; promotes groundwater recharge; moderate in expense compared to typical paving; low maintenance costs. Not recommended for travel lanes or truck parking areas. Can be installed on low infiltration soils if under paving gravel storage beds with controlled outlets are provided.
Grassed Channels and Vegetated Strips:	Recommended wherever possible throughout the watershed to slow velocity and reduce erosion; minimal slopes recommended; could entrap sediment to improve water quality; low installation and maintenance costs; promotes minimal infiltration on most soils.
Ponding and Detention on Pavement:	Recommended in entire watershed; very inexpensive with low maintenance costs; freezing should be considered. Shallow depth required to prevent damage to vehicles parked or driven on the area during storm event.
Reservoir or Detention Basin:	Recommended in entire watershed.
Groundwater Recharge:	Required throughout the watershed except for industrial sites with potential to pollute groundwater. Recommend site investigation to determine suitability of selected area and for determining the design infiltration rate.
Dense High Mower Height Grass and Routing Flow Over Lawns:	Recommended in the entire watershed; delays runoff, increases infiltration, entraps sediment, reduces velocities, reduces erosion potential; relatively inexpensive installation and maintenance costs.
Bioretention Facilities:	Recommended in the entire watershed; delays runoff, increases infiltration, relatively inexpensive installation and maintenance costs.
Constructed Treatment Wetlands:	Recommended in entire watersheds where soil and hydrologic conditions are suitable. Proper maintenance and availability of continuous flow required to minimize mosquito problems.

Recommended culvert sizes for waters of the Commonwealth crossings.

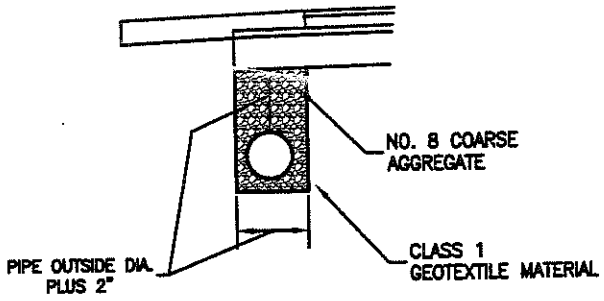
Maximum Drainage Area Above Culvert (Acres)	CMP	CMPA	RCP / SLLP
2	12	13 x 17	12
3	15	15 x 21	12
4	15	15 x 21	12
5	15	15 x 21	15
6	18	18 x 24	15
8	18	18 x 24	18
12	24	20 x 28	18
16	24	20 x 28	24
22	30	24 x 35	24
29	30	24 x 35	30
40	36	29 x 42	30
50	36	29 x 42	36
64	42	33 x 49	36
82	42	33 x 49	42
94	48	38 x 57	42
120	N/A	43 x 64	48

CMP = Corrugated Metal Pipe
CMPA = Corrugated Metal Pipe Arch
RCP = Reinforced Concrete Pipe
SLLP = Smooth Lined PlasticPipe



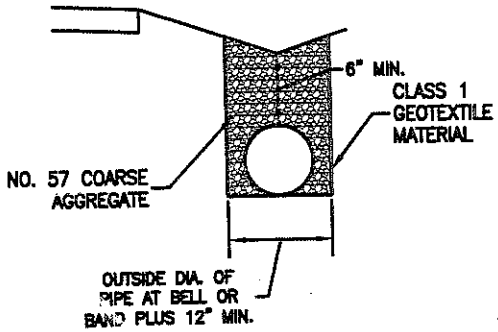
TYPICAL UNCURBED ROADWAY SECTION

NOT TO SCALE



6" PAVEMENT BASE DRAIN DETAIL

NOT TO SCALE

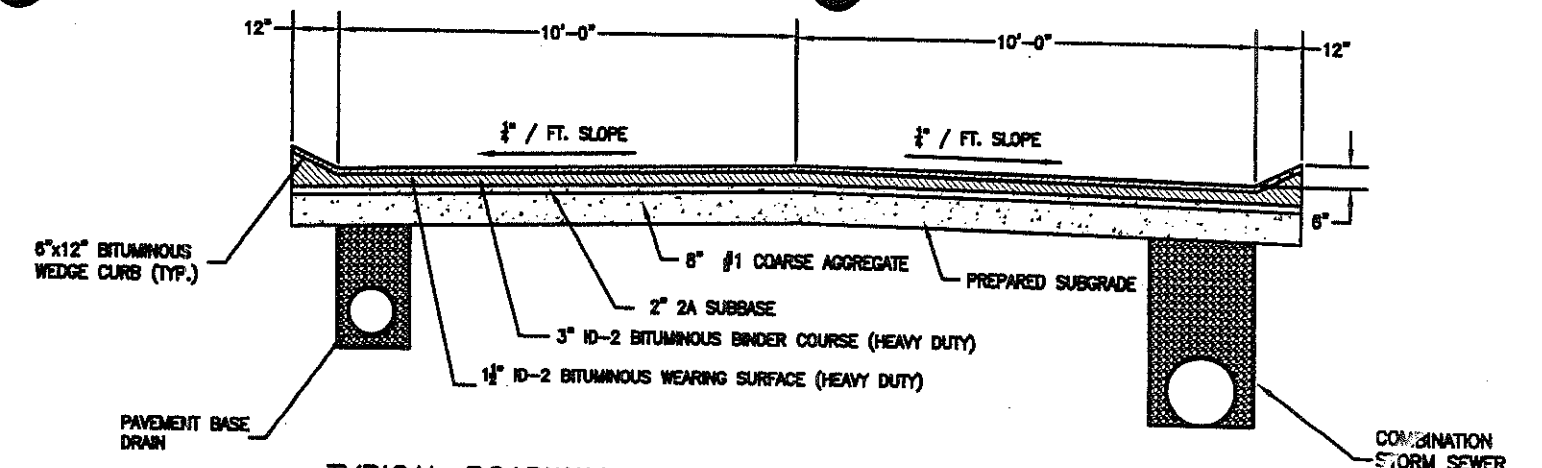


COMBINATION STORM SEWER AND UNDERDRAIN

NOT TO SCALE

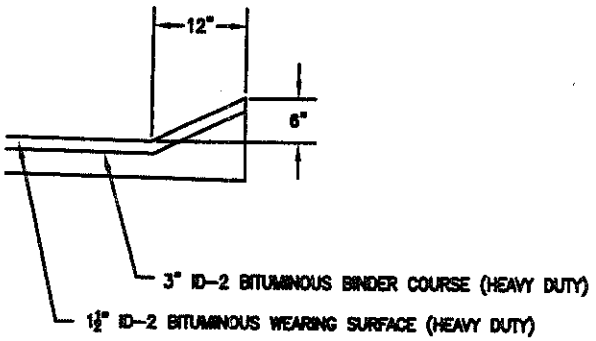
NOTE:
1. ALL MATERIALS TO MEET PENN DOT 408 SPECIFICATIONS
2. ALL CONSTRUCTION METHODS TO BE PER PENN DOT 408 SPECIFICATIONS
3. SUBGRADE TO BE COMPACTED TO 98% PROCTOR
4. SUBGRADE TO BE CONSTRUCTED TO MEET ROAD TEMPLATE
5. WEARING COARSE SRL DESIGNATION TO BE APPROVED BY TOWNSHIP

SHENANGO TOWNSHIP
LAWRENCE COUNTY, PA.



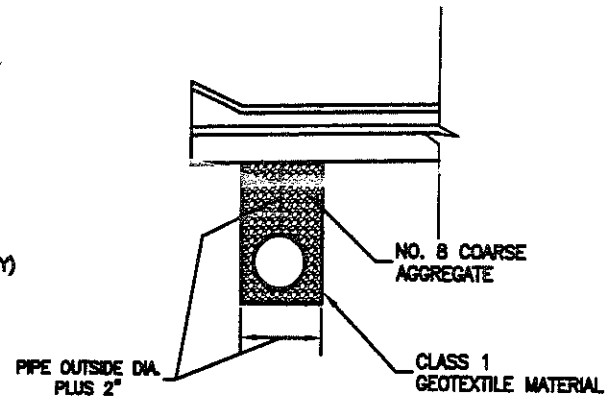
TYPICAL ROADWAY SECTION WITH BITUMINOUS WEDGE CURB

NOT TO SCALE



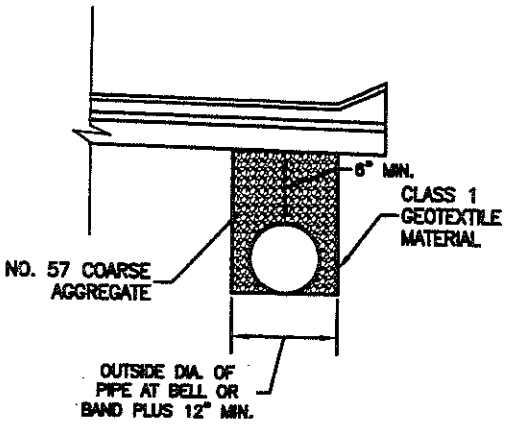
BITUMINOUS WEDGE CURB DETAIL

NOT TO SCALE



6" PAVEMENT BASE DRAIN DETAIL

NOT TO SCALE



COMBINATION STORM SEWER AND UNDERDRAIN

NOT TO SCALE

SHENANGO TOWNSHIP
LAWRENCE COUNTY, PA.

NOTE:
1. ALL MATERIALS TO MEET PENN DOT 408 SPECIFICATIONS
2. ALL CONSTRUCTION METHODS TO BE PER PENN DOT 408 SPECIFICATIONS
3. SUBGRADE TO BE COMPACTED TO 98% PROCTOR
4. SUBGRADE TO BE CONSTRUCTED TO MEET ROAD TEMPLATE
5. WEARING COARSE SRL DESIGNATION TO BE APPROVED BY TOWNSHIP

APPLICATION
FOR STORMWATER MANAGEMENT PLAN REVIEW

Applicant's Name: _____

Applicant's Address: _____

_____

_____

Applicant's phone no.: ( ) _____-_____ Fax No.: ( ) _____-_____

Engineer's Name: _____

Engineer's Address: _____

_____

_____

Engineer's Phone no.: ( ) _____-_____ Fax No.: ( ) _____-_____

Project location: _____

_____

Project description: _____

_____

Fee: A review fee will be charged at the actual expense to the Township as levied by the engineering firm completing the review.

NOTE: APPLICANT AGREES THAT ALL FEES ARE TO BE PAID IN FULL PRIOR TO THE ISSUANCE OF THE STORMWATER PERMIT.

Applicant's Signature:_____ Date:_____

Print Name:_____

*Two sets of plan and design calculations are to be submitted with the application.

FOR TOWNSHIP USE:

Application received by: _____ Date: _____

Application forwarded to: _____
(Name of Engineer) (Date)

Application returned to Township on: _____
(Date)

Fee Paid on: _____
(Date)

Permit No.: _____ Issued on:_____ By:_____

STORMWATER MANAGEMENT PERMIT

PERMIT NUMBER:_____ ISSUED:_____

This permit is issued pursuant to the requirements of the Shenango Township, Lawrence County, Pennsylvania, "Stormwater Management" Ordinance, being Ordinance #_____, passed on _____, 2001.

By the issuance of this permit, the applicant has provided the necessary documents which have been reviewed by Representatives of the Township for which the review fee has been paid.

The applicant further agrees to pay all additional expenses as covered under Section 603 of the Ordinance. Upon full payment of the requisite fees, completion of the stormwater plan as provided and approval of each inspection, a final approval will be indicated on the permit. THIS PERMIT IS NOT VALID UNTIL FINAL INSPECTION AND COMPLIANCE IS COMPLETED.

FOR TOWNSHIP USE:

Review of plan: _____
(By) (Date)

Site inspection:_____
(By) (Date)

Inspection of controls & improvements:_____
(By) (Date)

COMMENTS:_____

_____

_____

_____

FINAL INSPECTION AND APPROVAL:

Date:_____ Inspected by:_____

FEES PAID:_____ Amount:_____

: _____
(Received by) (Date)

: _____
(Received by) (Date)

: _____
(Received by) (Date)

Undetained Area – An area of a site that cannot be routed to a stormwater management facility because of its location. Generally small areas around access drives or below stormwater management facilities.

Watercourse – A stream of water; river; brook; creek; or a channel or ditch for water, whether natural or manmade.

Waters of the Commonwealth – Any and all rivers, streams, creeks, rivulets, ditches, watercourses, storm sewers, lakes, dammed water, wetlands, ponds, springs, and all other bodies or channels of conveyance of surface and underground water, orparts thereof, whether natural or artificial, within or on the boundaries of this Commonwealth.

Water Table – Upper surface of a layer of saturated material in the soil.

Wetland – Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions, including swamps, marshes, bogs, fens and similar areas.

ARTICLE III
STORMWATER MANAGEMENT REQUIREMENTS

SECTION 301. GENERAL REQUIREMENTS

A. All regulated activities in the Township which do not fall under the exemption criteria listed in Section 402 shall submit a drainage plan consistent with this Ordinance to the Township for review. This criteria shall apply to the total proposed development(s) even if the development(s) are to take place in stages or phases. Impervious cover shall include, but not be limited to, any roof, parking or driveway areas and any new streets and sidewalks. Any areas designed to initially be gravel or crushed stone shall be assumed to be impervious for the purposes of comparison to the waiver criteria.

B. Stormwater drainage systems shall be provided in order to permit unimpeded flow along natural watercourses, except as modified by stormwater management facilities or open channels consistent with this Ordinance.

1. Design Storms: The 1, 10, 25 and 100-year design storm frequencies shall be used (as a minimum) for analyzing all peak discharge-rates and volumes of stormwater runoff for all sites.

C. The existing points of concentrated drainage that discharge onto adjacent property shall not be altered without permission of the altered property owner(s) and shall be subject to any applicable discharge criteria specified in this Ordinance.

Undetained Area – An area of a site that cannot be routed to a stormwater management facility because of its location. Generally small areas around access drives or below stormwater management facilities.

Watercourse – A stream of water; river; brook; creek; or a channel or ditch for water, whether natural or manmade.

Waters of the Commonwealth – Any and all rivers, streams, creeks, rivulets, ditches, watercourses, storm sewers, lakes, dammed water, wetlands, ponds, springs, and all other bodies or channels of conveyance of surface and underground water, orparts thereof, whether natural or artificial, within or on the boundaries of this Commonwealth.

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C. The existing points of concentrated drainage that discharge onto adjacent property shall not be altered without permission of the altered property owner(s) and shall be subject to any applicable discharge criteria specified in this Ordinance.

D. All stormwater management plans shall be designed and certified by individuals registered in the Commonwealth of Pennsylvania and qualified to perform such duties.

E. Stormwater runoff from a project site shall flow directly into a natural watercourse or into an existing storm sewer system, or onto adjacent properties in a manner similar to the runoff characteristics of the Pre-development flow. If diffused flow is proposed to be concentrated and discharged onto adjacent property, the Developer must document that adequate downstream conveyance facilities exist to safely transport the concentrated discharge, or otherwise prove that no erosion, sedimentation, flooding or other harm will result from the concentrated discharge. In some cases this may require cooperation between land owners.

F. Where a development site is traversed by watercourses, drainage easements shall be provided conforming to the line of such watercourses. The terms of the easement shall prohibit excavation, the placing of fill or structures, and any alterations that may adversely affect the flow of stormwater within any portion of the easement. Also, maintenance, including mowing of vegetation within the easement shall be required, except as approved by the appropriate governing authority.

G. Stormwater runoff shall not be transferred from one drainage area to another unless: i) the drainage areas are subareas of a common drainage area which join together within the perimeter of the property; or ii) the effect of the transfer does not alter the peak discharge onto adjacent lands; or iii) the necessary drainage easement(s) from the affected landowners are provided.

H. All stormwater runoff flowing over the project site shall be considered in the design of the stormwater management facilities.

I. Maintenance of natural drainageways – All natural streams, channels, swales, drainage systems and/or areas of surface water concentration shall be maintained in their existing condition unless the Township approves an alteration. Clearing or restoring of natural waterways is not considered an alteration. All encroachment activities shall comply with the requirements of Chapter 105 (Water Obstructions and Encroachments) of Title 25, Rules and Regulations of the Pennsylvania Department of Environmental Protection (PADEP).

J. Stormwater management facilities regulated by this Ordinance that would be located on State highway rights-of-way shall be subject to approval by the Pennsylvania Department of Transportation (PennDOT).

K. For any stormwater management facility requiring a permit to be issued by the PADEP, said permit along with supporting report and plans used to secure the permit shall also be submitted. Where there is a question whether wetlands may be involved, it is the responsibility of the Developer or his agent to show that the land in question cannot be classified as wetlands, otherwise approval to work in the area must be obtained from the PADEP.

L. Roof drains and foundation drains shall NOT be allowed to discharge overland onto neighboring down-slope properties. All roof drains must be connected directly to storm sewers or stormwater channels/swales/ditches as applicable. Roof drains and foundation drains shall NOT be connected to sanitary sewers. When it is more advantageous to NOT connect directly to storm sewers or open channels (to promote infiltration/percolation of stormwater), then the Township shall permit it on a case-by-case basis.

M. Minimization of impervious surfaces and infiltration of runoff through seepage beds, infiltration trenches, etc., are encouraged, where soil conditions permit, to reduce the size or eliminate the need for detention facilities.

N. All sites shall be graded to provide drainage away from and around structures to prevent potential flooding damage.

O. Methods of stormwater runoff detention and control – The following is a listing of detention and control methods which may be utilized in stormwater management systems, if appropriate. The choice of control techniques is not limited to the ones appearing on this list.

1. Detention/Retention basins
2. Roof-top storage
3. Parking lot and private street ponding
4. Seepage pits, seepage trenches or other infiltration structures
5. Porous pavement and concrete lattice block surfaces
6. Grassed channels and vegetated strips
7. Dry wells, cisterns and underground reservoirs
8. Routed flow over pervious areas (grass filter strips)
9. Low-impact design techniques that decrease impervious area coverage
10. Natural area conservation

The use of other control methods that meet the criteria in this section will be permitted when approved by the Township engineer. Various combinations of methods should be tailored to suit the particular requirements of the type of development and the topographic features of the project area.

SECTION 302. GENERAL STANDARDS

A. General - In order to implement the provisions of the stormwater management plan, the Township is hereby divided into one (1) stormwater management district.

B. Off-Site Areas - Off-site areas that drain through a proposed development site are not subject to release rate criteria when determining allowable peak runoff rates. However, on-site drainage facilities shall be designed to safely convey off-site flows through the development site.

C. Site Areas - Where the site area to be impacted by a proposed development activity differs significantly from the total site area, only the proposed impact area shall be subject to the release rate criteria.

D. Runoff - Post development runoff from the site shall not be concentrated or have increased runoff discharged onto adjacent property without the written consent of the adjacent landowners in the form of a drainage easement.

E. The design of all stormwater management facilities shall incorporate sound engineering principles and practices. The Township shall reserve the right to disapprove any design that would result in the occupancy or continuation of an adverse hydrologic or hydraulic condition within the Township.

F. "No-Harm Option" – For any proposed development site located in the Township, the developer has the option of using a less restrictive runoff control (including no detention) if the developer can prove that "no harm" would be caused by discharging at a higher runoff rate than that specified by the Plan. The "no-harm" Option is used when a developer can prove that the post-development hydrographs can match pre-development hydrographs, or if it can be proved that the post-development conditions will not cause increases in peaks at all points downstream. Proof of "no-harm" shall include a "downstream hydraulic capacity analysis" to determine if adequate hydraulic capacity exists. The developer shall submit to the Township (as part of the Drainage Plan submission per Article IV) this evaluation of the impacts due to increased downstream stormwater flows in the watershed.

- The evaluation shall continue downstream until the increase in flow diminishes due to additional flow from tributaries and/or stream attenuation.
- A financial distress shall not constitute grounds for granting a no-harm exemption.
- Capacity improvements may be provided as necessary to implement the "no-harm" option, which proposes specific capacity improvements to provide that a less stringent discharge control would not create any harm downstream.

SECTION 303. DESIGN CRITERIA

A. Drainage Area Management Standards

1. Design Storms: The 1, 10, 25 and 100-year design storm frequencies shall be used (as a minimum) for analyzing all peak-discharges and volumes of stormwater runoff for all sites.

2. Peak Flow Rates: The calculated peak rates of runoff for stormwater originating on the project site must meet the following conditions, for all drainage areas flowing from the project site:

MANAGEMENT PLAN FOR SUBDIVISIONS
SHENANGO TOWNSHIP, LAWRENCE COUNTY

1. PLANNING MODULES

This is the first step in the subdivision process.

On-Lot Septic Systems

The Township's Sewage Enforcement Officer should be notified to complete all testing of soils and complete all paperwork for the planning modules. Once completed, the modules, along with the plot plan should be submitted to the Township for review and approval by the Board of Supervisors, Zoning Officer and Planning Commission. The Township will then submit the modules to DER for the review. (DER review is a 60 - 120 day process).

Sanitary Sewer Facilities

The developer must request in writing for the required number of credits for the subdivision (1 credit = 400 gallons/day). Upon approval of the credits, the developer must submit the planning modules to the following parties for review and approval in the order stated (1) New Castle Sanitation Authority (2) Lawrence County Planning Commission (3) Shenango Township Planning Commission (4) Shenango Township Board of Supervisors. Shenango Township will then submit the approved modules to DER for their review (Review process with DER is a 60 - 120 day time period).

No fee is required for submission of the planning modules.

2. SUBDIVISION PLANS

Plans are initially submitted to the Lawrence County Planning Commission for their review. The County will notify the Township of their review, whether it be favorable or unfavorable. Upon a favorable review from the County, the plans must then be submitted to the Township for their review. The Township shall submit the plans to the engineering firm, and if favorable the plan will be acted upon at the next regularly scheduled meeting (meetings are held each second Thursday of the month) of the Board of Supervisors. The plan will then be submitted to the Shenango Township Planning Commission for their approval. Note: There is a thirty day time period between the County's approval and the Township's approval. If the situation warrants, the Township may schedule a special meeting to approve the plan.

Fee Required: $200.00

3. STORM WATER MANAGEMENT PLAN

Ordinance No. 2-1988 establishes the storm water management regulations in

Shenango Township. The goal of this ordinance is to limit storm water run-off from subdivision and other land development to pre-development flows. Prior the commencement of any land disturbance activity, the developer or his agent shall submit a storm water management plan to Shenango Township for approval. The plan shall meet the requirements set forth in Ordinance No. 2-1988 and shall also meet all requirements of Title 25 Rules and Regulations - Chapter 102 of the Pennsylvania Department of Environmental Resources.

Section 402, Plan Requirements shall be followed in strict accordance when designing the storm water management plan. All plans shall be submitted to the Office of the Township Secretary, along with the requisite fee. Four (4) copies of the completed plan and calculations must be submitted.

Shenango Township shall forward a copy of the plan to the Lawrence County Conservation District for review and comment. The comments of the Conservation District along with the plan shall be submitted to the township's engineering firm for their review and comments. The firm shall then notify the Township of their recommendations as to whether the plan be approved or disapproved. Shenango Township shall notify the applicant within 45 days fo the receipt of the completed plan submission of its decision. A disapproval shall contain the reasons for disapproval and a listing of the plan deficiencies. Failure of Shenango Township or their designee to render a decision within 45 days time limit shall be deemed an approval.

Schedule of Inspections. The developer must submit a certification by a Pennsylvania Registered Professional Engineer; which certificate shall certify that all elements of the approved plan have been constructed as designed and approved. Shenango Township shall inspect all phases of the development of the site. It is the responsibility of the developer to notify Shenango Township 48 hours in advance of the commencement of each identified phase of development. Any portion of the work which does not comply with the approved plan must be corrected by the developer. No work may proceed on any subsequent phase of the storm water management plan, the subdivision or land development or building construction until the required corrections have been made. If at any stage of the work, Shenango Township determines taht the soil or other conditions are not as stated or shown in the approved application or plan, it may refuse to approve further work and Shenango Township or their designee may revoke existing permits and approvals until a revised plan is submitted and approved.

As Builts. Following construction, the developer shall submit drawings bearing the seal of Pennsylvania Registered Professional Engineer indication the "As-Built" improvements called for in the approved plan.

Construction Guarantees. The developer shall provide financial security as a construction guarantee in the amount equal to One Hundred Ten (110%) Percent of the full cost to install the facilities required by the approved plan. The financial security shall be released only after receipt by the Township of certification and "As-Builts" as required.

Upon acceptance of any storm water facilities by Shenango Township, the developer shall provide a financial security for maintenance guarantees as follows:

1. Construction Maintenance Bond. The construction maintenance bond shall be in an amount equal to fifteen percent of the cost of the installation, and shall be used as financial security to guarantee the stability of the newly established basin and revegetation for a period of one year.

2. Long Term Maintenance Bond. The long term maintenance bond shall be in an amount equal to a figure which shall be determined by the Township to be the established cost of maintenance of the storm water management facility for a period of ten years.

Requisite Fee Required: $500.00

4. STREET IMPROVEMENTS

The Township shall have no obligation to take over and make public any street unless said street shown on the approved plan has been constructed and conforms to the Township Standards and Specifications.

The developer shall submit two copies of the profile. Said profile shall be a vertical secion of the street with details of vertical alignment as follows:

(1) Profiles and elevations along the existing ground surface over the center line, rights-of-way lines or building setback lines, both right and left of the center line.

(2) Profile of the proposed curb grade showing percentage of grade on tangents and details of vertical curves including elevation at intersection of tangents projected and length of vertical curve; also elevation at intersection of curb lines projected, station and top of curb elevation at all points of curve and tangent of horizontal curves.

All plans and specifications for street improvements shall be submitted to the Township's engineering firm for review and approval. The Township will then notify the developer when the plan has been approved.

Construction Guarantees. The developer shall provide financial security as a construction guarantee in the amount equal to One Hundred Ten (110%) Percent of the full cost to install the facilities required by the approved plan. The developer shall carry out the construction and installation of the street improvements in accordance with the approved drawings and specifications. All improvements shall be constructed in strict adherence to the Standards and Specifications of the Township.

Inspection of Work and Material. The Township Engineer shall be notified twenty-four (24) hours in advance to the commencement of any construction operation. All construction and material inspections will be made by representatives of the Township. Each phase of the construction process shall be inspected, this will include all subgrading, construction of base and paving activities.

Release of Completion Guarantees. After satisfactory completion of work as determined by the Township, Engineer, 80% of the completion guarantees will be released in accordance with the amount of work completed upon Township receipt of a certified itemized required for release of improvement con-

struction guarantees. Upon total completion of work and satisfactory final inspection by the Township Engineer, the remaining percentage of the completion guarantees will be released.

Upon final completion and acceptance of the street, the appropriate paperwork shall be forwarded to the developer for execution. The Township shall accept the street by resolution.

The developer shall guarantee for a period of two (2) years from the date of the resolution accepting dedication of the street to maintain the stability of all materials and work and to promptly make good and replace all poor or inferior materials and work and to remedy defects in materials and workmanship, all shrinkage, settlement or other faults of any kind whatsoever arising therefrom at his own expense, and to the satisfaction fo the Township Engineer, whenever notified in writing to do so by the Township Engineer, and in order to secure the guarantee as herein required, the Township shall be assured by means of a proper guarantee in the form of a bond, with surety satisfactory to the Township, or the deposit of funds or securities in escrow in an amount equal to ten percent (10%) of the completion guarantee posted by the owner with the Township.

Requisite Fee Required: $300.00

5. SANITARY SEWER IMPROVEMENTS

All public sanitary sewers shall be designed and constructed in accordance with the rules, regulations and standards of the Township of Shenango. No public sanitary sewer lines shall be extended until the planning modules have been approved by the Department of Environmental Resources (DER). Owner's engineer shall confer with the Township Engineer prior to designing public sanitary sewers to establish the procedure to be followed.

Plans and specifications shall be submitted to the Township for approval.

Construction Guarantees. The developer shall provide financial security as a construction guarantee in the amount equal to One Hundred Ten (110%) Percent of the full cost to install the facilities required by the approved plan. The developer shall carry out the construction and installation of the sewer facilities in accordance with the approved drawings and specifications.

Inspection of Work and Material. The Township Engineer shall be notified forty-eight (48) hours in advance to the commencement of any construction operation. All construction and materials inspections will be made by the Township Engineer. The Township Engineer shall certify to the Township the date the line has been approved for acceptance by the Township.

Release of Completion Guarantees. After satisfactory completion of work as determined by the Township Engineer, 80% of the completion guarantees will be released in accordance with the amount of work completed upon Township receipt of a certified itemized required for release of improvement construction guarantees. Upon total completion of work and satisfactory final inspection by the Township Engineer, the remaining percentage of the completion guarantees will be released.

Maintenance Bond. The developer shall post for a period of one (1) year from the date of acceptance, a bond in the amount equal to ten (10%) percent of the completion guarantee previously posted by the developer with the Township. This shall guarantee that the developer will maintain the stability of all materials and workmanship and to promptly make good and replace all poor or inferior materials and work and to remedy defects in materials and workmanship, settlement or other faults of any kind whatsoever arising therefrom at this own expense, and to the satisfaction of the Township Engineer, whenever notified to do so by the Township Engineer.

"As-Built Drawings". Following construction the developer shall submit drawings bearing the seal of Pennsylvania Registered Professional Engineer indication the "As-Built" improvements called for in the approved plan.

Requisite Fee Required: $300.00

SALE OF LOTS, ISSUANCE OF BUILDING PERMITS, ERECTION OF BUILDINGS

No lot in a subdivision or land development may be sold, no permit to erect, alter or repair any building in a subdivision or land development may be issued, and no building may be erected in a subdivision or land development until the following have been satisfied:

1. The improvements required by the Board of Supervisors in connection therewith have either been constructed or the Board of Supervisors have been assured of proper completion guaranteed by the deposit of funds or securities in escrow, sufficient to cover the cost of the required improvements, as estimated by the Township Engineer.

2. The subdivision or land development plan has been approved by the Board of Supervisors and recorded in the Lawrence County Recorder of Deed Office. (A full size copy of the subdivision or land development must be submitted to the Township)

A certification will be given to the Zoning Officer by the Board of Supervisors when all requirements have been met. This will then authorize the Zoning Officer to issue Building Permits for the subdivision or land development.

Shenango Township Board of Supervisors

_____
Richard L. Schweinsberg, Chairman

_____
Joseph J. Budai, Vice-Chairman

_____
Andrew Piccuta, Supervisor

ROADWAY CONSTRUCTION SPECIFICATIONS

I. DESIGN AND CONSTRUCTION

1. Scope

The purpose of these specifications is to provide a pavement structure standard for the construction of roadways within Shenango Township. As referenced, the Commonwealth of Pennsylvania Department of Transportation Specifications Publication 408, including latest revisions, will be made part of these specifications.

2. Subgrade

This work is the preparation of the roadbed in accordance with Section 210 of PennDOT Publication 408 and the Township Typical Roadway Section.

Grade roadbed to the established subgrade elevation and cross slope. Compact to the specific density requirements determined by the dry weight density of the subgrade material.

At the discretion of the Township Engineer, remove and replace any unstable material as determined by acceptance testing based on nonmovement of material.

Correct all surface irregularities exceeding ½-inch by removing and adding material as required before placement of subbase.

3. Storm Sewers

This work is the construction of storm sewers in accordance with Section 601 and 604 of PennDOT Publication 408, Roadway Construction Standards (RC-30) and the Township Typical Roadway Section.

All pipes will be smooth interior corrugated polyethylene (PE) culvert pipe, type S (or approved equal) and a minimum of 15 inches in diameter.

Parallel storm sewers must be combination storm sewer and underdrain. All other pipes within the roadway area will be backfilled and compacted with 2A aggregate to subgrade.

Any roof and foundation drain laterals that are proposed to be tapped into the storm sewer system must be connected at the time of the storm sewer installation with approved fittings. No drainage from dwellings will be permitted to discharge onto the road surface without approval from the Township Engineer.

4. 6" Pavement Base Drain

This work is the construction of pavement base drains in accordance with Section 610 of PennDOT Publication 408, Roadway Construction Standards (RC-30) and the Township Typical Roadway Section.

Place pavement base drains along all gutter line locations except where parallel combination storm sewer and underdrain are located. All connections, fittings, and outlet locations must be approved and inspected by the Township Engineer.

5. Endwalls, Inlets, and Manholes

This work is the construction of endwalls, inlets, and manholes in accordance with Section 605 of PennDOT Publication 408 and Roadway Construction Standards (RC-31, RC-34, and RC-39). Inlet tops will be steel frames and bicycle safe grates.

Neatly trim all pipe connections flush with structure and seal on both sides of structure with hydraulic cement. Seal and fasten all metal frames. Pour a trowel finished invert.

6. Subbase

This work is the construction of compacted aggregate on the prepared subgrade in accordance with Section 350 of PennDOT Publication 408 and the Township Typical Roadway Section.

The subbase will consist of 8 inches of #1 coarse aggregate and 2 inches of 2A aggregate placed and compacted to the established subbase elevation and cross slope. At the discretion of the Township engineer, remove and replace any unstable material as determined by acceptance testing based on nonmovement of material.

7. Bituminous Pavement

This is work is the construction of plant-mixed bituminous concrete courses on the prepared subbase in accordance with Sections 420 and 421 of PennDOT Publication 408 and the Township Typical Roadway Section.

The initial roadway pavement construction will consist of 3" of ID-2 bituminous binder course, heavy duty and 1" of ID-2 bituminous wearing course, heavy duty until seventy-five (75) percent of the building construction is completed and three (3) years of time has elapsed. Inlets and manholes will be set to match the initial finish grade. The developer will be responsible for all repairs determined necessary by the Township and Township Engineer during this initial construction period. After this initial period, the Township and Township Engineer will inspect and determine any necessary repairs prior to placing a final 1" of ID-2 bituminous wearing course, heavy duty. Inlets and manholes will be adjusted to match the final finish grade. All materials shall be placed and compacted as per Sections 420 and 421 of PennDOT Publication 408. The skid resistance level designation (SRL) of the wearing course will be determined by the Township Engineer based on roadway grade and anticipated average daily traffic (ADT).

8. Curb Alternatives

A. Bituminous Concrete Curb

This work is the construction of bituminous concrete curb in accordance with Section 636 of PennDOT Publication 408 and the Township Typical Roadway Section.

The bituminous curb will consist of ID-2 bituminous binder course, heavy duty and 2.0 inches of ID-2 bituminous wearing course, heavy duty (initial and final construction) placed and compacted integrally with the bituminous pavement.

Immediately after completion of curing, backup curb with acceptable backfill material placed and compacted to the required cross section.

B. Plain Cement Concrete Curb

This work is the construction of plain cement concrete curb (or approved equal) in accordance with Section 630 of PennDOT Publication 408 and Roadway Construction Standards (RC-64).

9. Guiderail

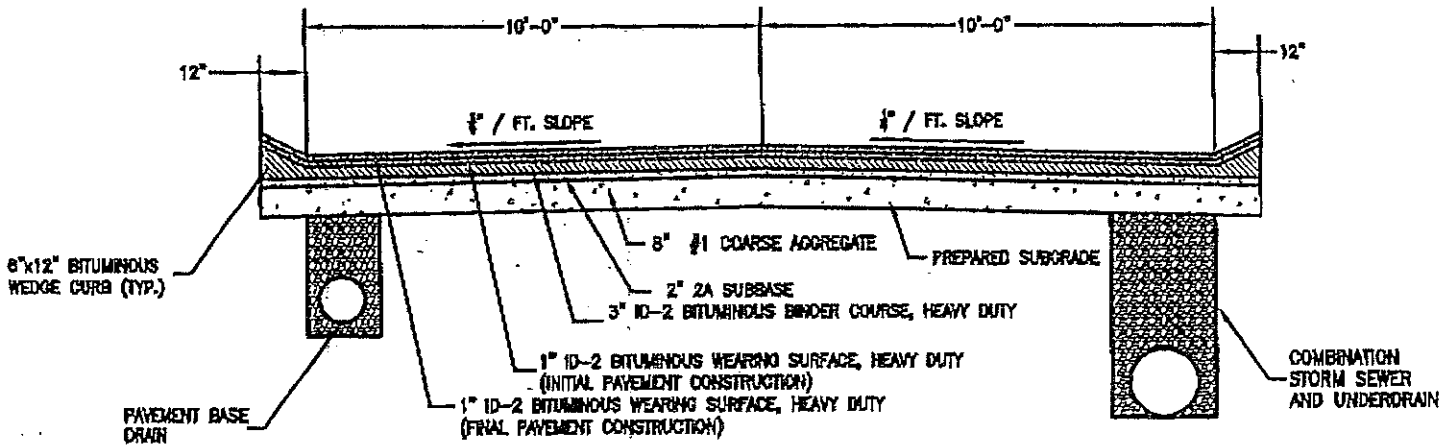
Any guiderail determined necessary will be constructed in accordance with Section 620 of PennDOT Publication 408 and applicable Roadway Construction Standards.

II. BOND REQUIREMENTS

1. Performance: 100% of approved construction estimate.

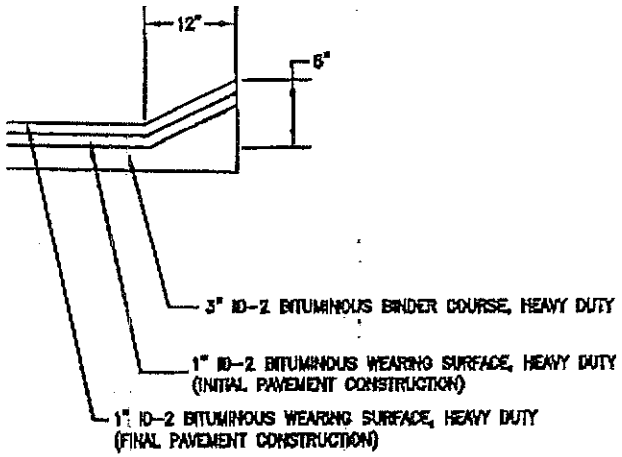
2. Labor and Materials: 100% of approved construction estimate.

3. Maintenance: _____% of approved construction estimate. Developer will pay for any repairs, which may develop during a period of _____ years from the date of Township acceptance or date that the roadway is ordained. All repair methods must be approved by the Township Engineer.



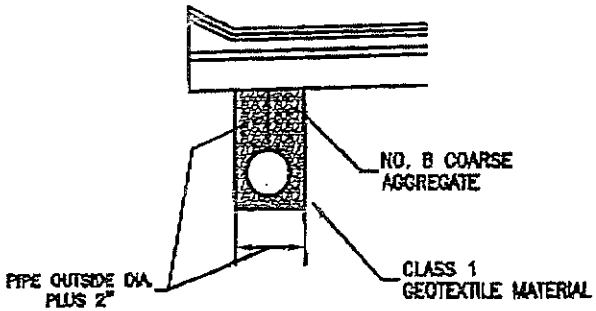
TYPICAL ROADWAY SECTION WITH BITUMINOUS WEDGE CURB

NOT TO SCALE



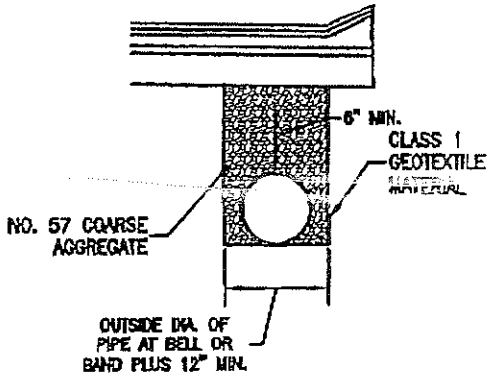
BITUMINOUS WEDGE CURB DETAIL

NOT TO SCALE



6" PAVEMENT BASE DRAIN DETAIL

NOT TO SCALE



COMBINATION STORM SEWER AND UNDERDRAIN

NOT TO SCALE

SHENANGO TOWNSHIP
LAWRENCE COUNTY, PA.

NOTE:
1. ALL MATERIALS TO MEET PENN DOT 408 SPECIFICATIONS
2. ALL CONSTRUCTION METHODS TO BE PER PENN DOT 408 SPECIFICATIONS
3. SUBGRADE TO BE COMPACTED TO 98% PROCTOR
4. SUBGRADE TO BE CONSTRUCTED TO MEET ROAD TEMPLATE
5. WEARING COARSE SRL DESIGNATION TO BE APPROVED BY TOWNSHIP