APPENDIX D:

STORM WATER DRAINAGE SYSTEM

CITY OF BEREA, KENTUCKY

STORM WATER DRAINAGE SYSTEMS

General

Specifications given hereinafter outline the minimum standards for design, materials, installation methods, and inspection procedures required by the City of Berea regulations and the construction of storm drainage facilities. Design of storm drainage facilities shall be based on Kentucky Department of Highways Manual of Instructions for Drainage Design except hereinafter modified.

Scope

The scope of these specifications is set forth the policies of the City of Berea Subdivision Regulations regarding design and construction of storm drainage facilities. Design of the facilities covered herein must be performed by and carry the seal and signature of a qualified Professional Engineer or must be Performed by and carry the seal of a Licensed Landscape Architect, licensed in the Commonwealth of Kentucky.

Design Criteria

1. **Post-development vs Pre-development Design Criteria**

   A. **Peak Discharge Consideration -** The basic standard for design of drainage systems will be to keep runoff characteristics after development as close as possible to the same level as existed prior to any development. To achieve this objective, storm water detention retention facilities will be required in most cases so that the peak discharge measured in cubic feet per second (cfs) from the developed area shall not be greater than the peak discharge from the pre-developed as identified below. The peak discharge shall be evaluated for three separate SCS typ-2 storm events. Using an approved storm water modeling procedure and approach (rational method, TR-55, etc) the 2year/1 hour storm, the 10-year/24 hour storm, and 100-year/1 hour storm shall be evaluated. The peak discharge for the pre-developed site shall be measured as an instantaneous flow rate taking into consideration both the detained storm water and any undetained storm water.

   B. **Downstream Flood Levels -** the developer shall provide storm drainage improvements that will prevent the downstream flood level from being raised in a 2-year/1 hour storm, a 10-year/24 hour storm, and the 100-year/1 hour storm considering both the instantaneous flow rate and flood elevations caused by the increased quantity of storm water from the development. Where conditions and engineering calculations indicate benefit from storm

water detention/retention facilities would not occur, they may be deleted from the development requirements in favor of channel improvements into or out of the site to improve flow if approved by the City of Berea. Calculations and analysis must be completed, submitted, and approved prior to this exception being granted.

C. **Watershed over-compensation -** There shall be no over-compensation within one watershed to allow for under-compensated storm water detention in any other watershed. Each watershed must be evaluated separately, and each watershed must meet the requirements as stipulated within the specifications.

D. **Discharge Points-** The discharge of the storm drainage facilities shall be into either a natural, well defined drainage path or into a man made drainage way. For areas proposed to drain onto adjoining properties essentially undetained, then the drainage must be sheet flow. Point discharges onto adjoining property and public right of ways are prohibited unless the discharge point is into the actual, well defined path or into a man made drainage way. Receiving channel capaCity must be confirmed as adequate to convey at least the 5-year/1 hour storm discharge.

E. **Connection to public system requirements -** Where an adequate public storm sewer system is available to the site boundary, the developer shall construct the drainage system to connect with such storm sewer system. If such a system is not available, the developer may be required to provide for the construction of necessary storm drainage facilities as may be required beyond the immediate boundaries of this subdivision in order to conduct runoff to an acceptable point of disposal.

Storm Water Collection System Design Criteria

1. **General System Design -** The preliminary storm drainage layout shall be submitted along with a preliminary arrangement of the development. This layout shall indicate the overall drainage scheme in enough detail to ensure the proposed plan is acceptable and understandable. The City of Berea shall review this preliminary plan and issue a statement indicating a general acceptance or denial of this preliminary plan. If the developer is proposing a dedicated detention or retention basin to the City of Berea for acceptance and maintenance, then this request must be made in writing and approved by the City of Berea prior to the preliminary storm water plan being generally accepted. After general acceptance by the City of Berea of the preliminary storm water drainage layout, the developers engineer may proceed with a final design of the storm drainage system. An overall drainage plan shall be prepared and furnished as part of the construction plans. This overall drainage plan shall include the pre-developed and post-developed contours and other information as may be necessary to establish that positive drainage for all the lots throughout the subdivision shall be satisfactorily accomplished. Easements for the storm drainage system shall be shown on the plats, as applicable, in the locations and widths as approved by the City. Special notes pertaining to the maintenance of detention and retention basins may be required on the plats, as applicable. Release or modification to existing drainage easements shall require the written approval for the City. Engineering reviews shall be made by City Engineering Firms to determine the adherence to the criteria as outlined in the specifications and to determine compliance with other City County specifications. After the review of the preliminary submittal, an appropriate

number of sets of the final storm drainage system shall be submitted to the City of Berea. These plans shall include the original seal and signature of a professional engineer, and the engineer's calculations for runoff, catch basin spacing, pipe sizing, gutter spread, and detention volumes. The City of Berea reserves the right to reject any plan that would adversely affect adjoining or downstream properties.

A. **Curb inlets or catch basins -** Curb inlets or catch basins shall be placed at all depressions in such a manner as to prevent storm water from crossing the pavement and at other locations along the curb as necessary to limit the spreading of water onto the pavement to ½ the driving lane with a 5-year/1-hour storm. Curb inlets shall be Lexington Fayette Urban County Government Type A, Type B, and Type C or Kentucky Department of Transportation Type A, and Type B Inlets. LFUCG Type D, cast iron inlets may be used as auxiliary devices but may not be used as primary inlets. Storm water shall not be designed to cross over pavement.

B. **Piping System -** Design of storm water piping systems shall be based on the Kentucky Department of Transportation Manual of Instructions for Drainage Design (except as hereinafter modified). Storm water pipes shall be designed on the basis of a 10-year storm event and using a minimum time of concentration (TC) of eight minutes. The unit shall then be checked for backwater conditions with a return of 100-year return frequency. No structure flooding shall be induced by the structure at the 100-year return frequency. The Manning's roughness coefficient to be used in culvert design shall be 0.024 for aluminized metal pipe (AMP may not be used under roadways or within the roadway public right of way) and .012 for reinforced concrete pipe (RCP), smooth interior high-density polyethylene (HDP), ductile iron pipe (DI) and polyvinyl chloride pipe (PVC). A plan and profile of the proposed storm drainage system including pipes, drainage swales, stream relocations, etc. shall be drawn with pipe sizes, types, grades and inverts indicated. All drainage pipes must be extended to a natural, well-defined drainage path or to within 5' fo the rural property line and connected to a man made drainage way. Under no circumstances shall the storm water drainage system be designed, constructed or constructed or connected so that the flow is diverted into any public or private sanitary system. Minimum pipe size is 12" for storm sewers.

C. **Storm Manholes-** The storm drainage system shall be designed and constructed with sufficient junction boxes, manholes, and other appurtenances to provide ready access into any section for clean out and maintenance operations. Storm sewer manholes with improved inverts shall be required for pipes smaller than 60" in diameter at any change in direction or junction point and when distances between storm holes exceeds the 400'.

D. **Box Culverts -** Any drainage plan requiring the construction of box culverts shall include reinforced concrete designs from a professional structural engineer to withstand the anticipated loading.

E. **Drainage Swales -** When open channel flow in drainage swales is proposed as a method of storm water transport (natural drainage swales, man-made drainage swales,or drainage pipes), the developer shall provide drainage swales sufficient in size to contain the peak runoff from the 25-year frequencies storm. The swales shall then be checked using the 100-year frequency storm. No structure flooding shall be induced by the swales at the 100-year return frequency.

Channel lining for swales shall be based on the allowable shear stress in accordance with Kentucky Department of Transportation criteria. Riprap shall not be permitted. The remaining bottom portions of the swales containing a low flow channel shall be sloped a minimum of 2% toward the channel. Paved bottoms may be required in swales with slopes less than 2%. The side slopes fro swales shall not be steeper than 2 to 1. The side slopes for all other swales shall not be steeper than 3 to 1.

F. **Headwalls -** Head walls are required for any pipe within the proposed storm drainage system. Headwalls are also required for any existing pipe within the proposed subdivision. Headwalls pipes and of a configuration to prevent erosion and to reduce the veloCity. Minimum 3' high chain link fencing shall be required along the perimeter of the headwall if the distance from the pipe invert to the top of the head wall exceeds 3.5'. The fence shall consist of galvanized number 9-gauge wire with 2 ½ " diameter core posts. All headwalls designed shall have prior approval of the City of Berea.

G. **Existing Structures -** The storm drainage system shall take into account adjoining subdivision and drainage areas to ensure that the effects of existing structures and or drainage ways have been considered. If existing structures are to be utilized within the storm drainage system, then each existing structure shall meet the design requirements as set forth in the specifications. Additionally, the existing structure shall meet the materials and construction requirements as set forth in the specifications.

H. **Sinkholes -** Sinkholes, either active or inactive, shall not be used for the storage or transfer of storm water. Sinkholes shall not be considered as a viable part of the storm drainage system. No structure shall be allowed beneath the sinkholes over topping elevation.

I. **Springs -** Springs, either constantly flowing or wet weather flowing, shall be considered within the storm drainage system Spring boxes and piping shall be required to divert the ground water from the spring to the public system. This shall include existing springs and any spring discovered during construction. Under no circumstances shall a spring be designed, constructed, or connected so that the flow is diverted into any public or private sanitary sewer system.

J. **Private Systems** - A private storm drainage system shall be defined as a system installed by an individual (i.e. person or company) to fulfill drainage requirements not associated with systems, nor accepted by the City of Berea. The system shall follow the same drainage criteria as outlined in the specifications.

2. Detention and Retention Basin Design Criteria

A. **Detention Basins -** A detention basin shall be defined as a normally dry, storm water storage area with a principal spillway and an emergency spill way. Grass bottoms in detention basins shall be designed with minimum slopes of 2%. Basins with slopes less than 2% shall include low flow concrete channels designed with minimum slopes of 0.5% from the basin inlets to the outlets. The concrete channels shall have a minimum 6" depth with side slopes not to exceed 2

to 1 and shall be constructed in accordance with standards outlined by the Kentucky Department of Highways. The bottoms and sides of detention basins shall be sodded. In certain instances, other techniques (underground vault storage) may be considered for private systems on a case-by-case basis, after it has been proven with engineering calculation that traditional detention designs are not feasible. Detention basins shall be excavated and the principle spillways constructed prior to the construction of the water facilities, streets, and other storm drainage facilities. If basins are to be used as sediment basins, then the basin must be maintained on a regular and ongoing basis and all accumulated sediment must be removed prior to final vegetation. Additionally, final plats shall stipulate that only the City of Berea may make changes or modifications to the drainage and detention facilities. If the detention basin is used as a sediment basin, accumulated silt shall be removed prior to final revegetation.

B. **Retention Basins -** A retention basin shall be defined as a storm water storage area that permanently stores a predetermined pool of water. Retention basins shall be designed with drainage areas of sufficient size to ensure that the standing water will not stagnate or present health hazards. For the design of retention basins the static ground water level must be taken into consideration for any and all utilities and the existence or possibilities of nearby basements. The minimum depth for retention basin shall be 3' as measured from the invert of the principle spillway to the invert of the emergency spillway. The storm water piping system used to feed the retention basin shall have the inflow inverts above the normal lake level as dictated by the invert elevation of the principal spillway. Trash racks and rock silt check dams shall be designed at each inflow source to the retention basin to prevent silt and or trash from entering into the permanent pool.

C. **Construction in Flood Plain -** Detention and retention basins shall not be constructed within the 100-year flood plain as defined by the flood insurance rate maps for theCity of Berea unless a permit for such construction is obtained from the Division of Water in Frankfort, Kentucky. In the absence of any such map, the engineer will be required to complete sufficient studies so as to determine the 100-year flood plain.

D. **Principle Spillway -** Each detention or retention basin is required to have a principal spillway of a size dictated by the overall storm water detention/retention plan. The minimum size for principal spillways shall be 4" in diameter for either pipe or orifice. More than one principle spillway for each detention or retention basin may be required to ensure compliance with the method as outlined in the specifications. Gabion baskets will not be used as spillways.

E. **Emergency Spillway -** Each detention or retention basin must have an emergency spillway of sufficient size to discharge the 100-year/24 hour storm event discharge through the emergency spillway. Gabion baskets will not be used as spillways.

F. **Embankment Requirements -** If an earthen berm is used to construct a detention or retention basin, the minimum top width shall be 4', and the maximum slope of the embankment shall be three horizontal for each foot vertical rise. The embankment shall be constructed to a minimum 1' above the crest of the 100-year/24 hour storm event discharge through the emergency spillway.

G. **Materials -** All materials, construction methods, and methods of measurement shall conform to the latest edition of the Kentucky Department of Highways Bridge and Highways Specification Manual. Appropriate Kentucky Department of Transportation or Lexington Fayette Urban County Government standard drawings shall be included with all plans.

H. **Erosion and Sediment Control Plan -** A complete and comprehensive erosion control plan (ECP) shall be prepared for each and every development submitted to the City of Berea. This erosion control plan shall be based on the criteria listed in the latest edition of the Manual of Best Management Practices for Construction Activities, prepared by the Kentucky Division of Conservation and the Division of Water, Natural Resources and Environmental Protection. Erosion and sedimentation controls must be in place prior to the start of construction. The City of Berea reserves the right to inspect erosion and sediment controls and to order and require corrective action if the erosion and sediment controls do not meet approval. Plats and/or plans shall stipulate maintenance responsibilities for the erosion and sediment controls. This plan will contain at the very minimum:

A. A discussing of the land-disturbing project including the purposes, location and size of area to be disturbed.
B. A discussion of the topography, land cover condition, soils, percent of impervious area and drainage patterns both before and after development.
C. An identification of land use and cover conditions on adjacent property
D. The beginning and completion dates of construction activities
E. A discussion of construction sequencing, including clearing, grading, and revegetation activities as well as winter shut downs.
F. A listing of erosion and sediment control BMP's, along with location, installation schedule and the logic for each
G. A listing of storm water pollution control and groundwater protection BMP's to minimize pollution during construction (other than erosion) that might result from construction activities
H. Current topography from field surveys or aerial photography showing pre-construction topography, drainage ways, property lines, utilities, limits of construction, and trees to be preserved
I. Finished grades, building locations, paved areas, construction entrances, access or haul roads, stock pile areas, and equipment storage areas
J. All planned BMP's overlaid on the other features
K. Areas that are not to be disturbed
L. All hydrologic, hydraulic, structural and geotechnical calculations
M. An operation and maintenance (O & M) plan which provides a schedule for inspection, maintenance and repair of BMP's during construction activities. A maintenance schedule shall also be provided to ensure that permanent measures such as vegetation are properly established after construction is complete
N. The name, address, and telephone number of the parties responsible for implementing the plan as well as the name for the construction supervisor who will be on-site at all times during construction

Approvals - This section provides information related to the various approvals required prior to start of

construction and prior to acceptance of the completed project.

1. **Planning Commission Approval -** An appropriate number of construction plans including storm drainage plans shall be submitted to the Planning Commission staff office for review and approval. The Planning Commission's review will be to verify that the project complies with the requirements of subdivision regulations and general specifications. After the review an appropriate number of sets of plans shall be submitted for written approval. At least one set shall contain the original seal and signature of a registered professional engineer on each sheet. Construction shall not begin until the Planning Commission has issued a written approval of the plans. Upon completion of the construction the developer shall make a written request to the City of Berea for acceptance of the public facilities.

2. **Changes -** The developers and/or property owner may make minor changes to the approved construction plans if written notification of the change is given to the Codes Administrator if changes meet the requirements of the City's subdivision regulations and general specifications, and if the changes do not violate any City, county, state or federal regulation. Any changes from the approved plans that are not in compliance with the regulations must be approved by the Planning Commission prior to making the proposed changes.

3. **NPDES Notice of Intent -** When applicable to the size of the development, a copy of an approved NPDES-Notice of Intent Permit must be filed with the City of Berea before approval for construction is granted.

See Appendix "G"

APPENDIX E

GRADING AND FILL ORDINANCE

GRADING AND FILL ORDINANCE

PURPOSE

Grading, filling, excavating and other earthwork activities frequently cause damage to existing land features and create problems and conflicts with future public works construction and other related construction activities such as subdivisions, and commercial developments. These earthwork activities frequently result in uncompacted fills and significantly altered contours, which adversely affect all of the citizens of Berea.

The intent of this document is to safeguard the public, protect the natural resources and environment within the boundaries of our City and to prevent conflicts with future developments and constructions. This will be accomplished by regulating clearing, earthwork, excavation, filling and other land disturbing activities, reducing soil erosion, and providing procedures for submission, review and approval of fill site plans and erosion control plans prior to soil disturbance. A standardized permitting process will be developed and detailed.

At all times the permittee is expected to use and exercise reasonable, rational and logical judgment in the filling process so as not to jeopardize the safety of the public, the quality of his site or the integrity of the environment.

DEFINITIONS

Earth Material - Soil, topsoil, clay, sand, or gravel. Rocks, stones, bricks concrete slabs no more than twelve (12) inches in size in any direction may be defined as Earth material. Material of this size may NOT be placed within the top twenty-four(24) inches of a fill area.

Erosion - The process by which the ground surface is worn away by the action of wind or water.

Excavation - Removal of material from a site via any method.

Filling - The process of depositing fill material on a site to replace or supplement the existing material.

Fill Material - Acceptable earth material that is not organic in nature. Fill material shall be capable of being compacted to the standards as noted elsewhere in this document. Furniture, automobiles and other mechanical devices, wood chips, cinders, ashes, trees, tree stumps and other vegetative material are NOT acceptable fill material.

Grading - Any stripping, excavation, filling, stockpiling of soil or any combination thereof used to alter or change existing contours

PERMIT REQUIRED, EXCEPTIONS AND COMPACTION

A permit is required for the following fill activities:

1. A permit shall be required for any activity that involves fill materials as defined in this document and is being brought into a property from an off-site location.

A permit is not required for the following fill activities:

1. When the total amount of fill to be brought onto, a property is less than one hundred (100) cubic yards.

2. When the fill material is to be brought onto a site is for a public improvement project or a utility improvement project, which has been authorized by the City of Berea, the Commonwealth of Kentucky or the United States Government.

3. The construction of a single or two family dwelling unit for which a building permit has bas been issued.

Compaction of the fill material shall be required in the following situations:

1. Compaction shall be required on each and every site NOT zoned Agricultural. Sites in Agricultural zoned areas will be considered on a case-by-case basis. Fill material shall be compacted in no greater than one (1) foot layers to a minimum density of 95% of maximum density as defined by the current ASTM or KDT standard. The compaction process and final configuration shall be monitored and certified by a Licensed Professional Geotechnical Engineer licensed in the Commonwealth of Kentucky.

REQUIREMENTS FOR FILL PERMIT

A fill permit application shall include the following:

1. The name, address, contact phone number and signature of the property owner as well as the name, address, contact phone number and signature of the person doing the filling operation. The person doing the fill operation must have and maintain a 24-hour contact number.

2. The name, address, parcel number and related deed information of the property where the fill operation will take place.

3. The name, address and phone number of the Licensed Geotechnical Engineering who will be doing the compaction monitoring, fill testing and ultimate site compaction certification.

4. The nature and purpose of the proposed fill operation.

5. The type of fill material to be brought and placed on the site as well as the type of material to be brought and placed on the site.

6. A detailed description and schedule of the filling process to include the proposed method of compaction and a beginning and ending date.

7. The proposed transportation route for the fill material.

8. A drawing/plan of the site which shall contain:

   A. North arrow.

   B. The dimensions of the lot and acreage.

   C. Dimensions of the area to be filled and proposed phasing and method of stabilization for each phase.

   D. Adjoining property addresses and names of owners.

   E. The location of all roads bordering or on the property.

   F. The location of all utilities on the property.

   G. The location of all easements on the property.

   H. Any and all natural features.

   I. Existing 2' contours of the property shown with dashed lines. Contours must extend a minimum of 50' past subject property lines.

   J. Proposed 2' contours of the property shown with solid lines. Contours must extend a minimum of 50' past subject property lines.

   K. The location, size and use of any structures on the property.

   L. Calculated fill volumes based on existing and proposed contours. Cross sections may be required.

   M. Drainage calculations.

   N. A detailed soil erosion control and" water quality protection plan which includes but is not limited to:

      i. Silt fence

ii. Seeding/straw/mulch erosion controls.

iii. Temporary and final/permanent seeding schedule

iv. Check dams

v. Silt control ponds

vi. Any and all other necessary Best Management Processes

Any requested fill permit with a site within proximity to a stream, creek or any other waterway may be subject to additional and extensive requirements due to possible State Government and Federal Government requirements. It is the permittees responsibility to determine and gain any additional approvals that may be required.

APPROVALS, TIME FRAME AND APPEAL PROCESS

Within 30 days from the date the requested fill permit was logged in to the Codes Administration office, the Codes Administrator or the City Engineer will determine if the requested permit may be approved by City of Berea Staff, or approved by the Berea Planning Commission and/or if a public hearing will be necessary. The following guidelines will govern the approval process:

A. If the intended fill area contains less than 250 cubic yards of fill material or if the intended fill area is less than 10,000 square feet, the fill permit may be approved by City of Berea Staff. However, it is still within the discretion of the staff to take this request to the planning commission. This actual decision will be made within 60 days from the date the request is logged in to the Codes Administration Office. Decisions made by City of Berea Staff may be appealed to the Planning Commission.

B. If the intended fill area contains more than 250 cubic yards of fill material or if the intended fill area is greater than 10,000 square feet, the fill permit must be approved by Berea Planning Commission. The Planning Commission will decide on a case-by-case basis whether to require a public hearing. If no public hearing is required, the final decision will be rendered within 60 days from the date the request was logged in to the Codes Administration Office. Approvals that require a public hearing may require up to 120 days after the date the request was logged into the Codes Administration Office, however, additional time may be required due to the legal requirements to conduct a public hearing. Decisions made by the Berea Planning Commission may be appealed to the Madison County Circuit Court.

Any requested fill permit with a site within proximity to a stream, creek or any other waterway may be subject to additional and extensive time due to possible State Government and Federal Government requirements. It is the permittees responsibility to determine what additional approvals may be required.

PUBLIC NOTICE REQUIREMENTS

In every case regardless of the approval process, it will -be the permittees responsibility to notify the public of their intention to fill on the proposed site via:

A. A sign posted on the site that is legible from the closest street stating the owners name, the site address, a contact number as well as a proposed schedule for the filling process.

B. A legal notice in the local newspaper at least 30 days prior to the start of the filling process. A copy of the notice must be submitted before final approval of the permit.

C. Certified letters sent to each adjoining property owner and any property owners within a 500-foot radius of any street or road contiguous to the fill site. Copies of the mail receipts must be submitted before final approval of the permit.

AS-BUILT DRAWINGS AND SITE CERTIFICATION

Upon completion of the fill process and within 30 days of the intended competition date as stated in the original fill application the permittee must submit:

A. Certified as built drawings, stamped and signed by the Geotechnical Engineering as designated in the original fill application. The as built drawings shall contain but are not limited final contours, any and all drainage structures with invert and flow line elevations, any other relocated or added public utility facilities, roadways and/or entrances, structures of any type or size.

B. A site certification letter signed and stamped by the Licensed Geotechnical Engineering who did the compaction monitoring and fill testing The Certification Letter will contain statements by the Geotechnical Engineer that he monitored the fill site and fill process, tested the material on an ongoing basis, and that the final compaction meets required standards. Copies of all test results and dates of his site visits and/or his project diary must also be submitted.

The Codes Administrator or the City Engineer shall respond within 30 days of the receipt of the above documents with a decision or a recommendation for a decision to the Planning Commission.