

City of Kansas City, Missouri

**Supplement No.1 to APWA Standard Specifications and Design Criteria
Section 5600
Storm Drainage Systems and Facilities**

This is Kansas City, Missouri Supplement No. 1 to Section 5600 of the APWA Standard Specifications and Design Criteria as adopted February 15, 2006. The following additions, deletions, and/or revisions are adopted and shall become part of Section 5600 for use within Kansas City, Missouri.

5601.2 Definitions: (additions)

Bank Line: The line of intersection, above the normal depth of flow at design capacity, of the side slope of an open channel and the adjacent ground.

Controlled Area: That part of the tributary area for which a detention facility is designed to control peak discharge rates.

Dry Detention Facility: Any detention facility designed to permit no permanent impoundment of water.

Principal Spillway: A device such as an inlet, pipe, weir, etc., used to discharge water during operation of the facility under the conditions of the 100-year or less return frequency.

Return Frequency: The statistical average interval between rainfalls of equal magnitude.

Public Water: Storm water runoff ($Q_{10} \geq 8$ cfs), which crosses more than one lot, property or tract.

Private Water: Storm water runoff generated from and controlled on only one lot, property or tract wholly owned and controlled by one owner and not platted for future subdivision of ownership.

5601.6 Waivers: (addition)

C. Storm Water Drainage Studies: In the following specific situations, a waiver may be allowed provided that submitted storm water drainage studies offer adequate justification in the opinion of the City.

- a. The tributary in question flows to a regionally controlled Storm Water Management and Detention Facility.

- b. Drainage systems are adequate to convey the increased run-off to a point downstream where, at a minimum, the rate of total runoff from the site is 10 percent or less than the total runoff rate conveyed by the downstream system measured at the time of system peak.
- c. Watershed Master Studies have determined or recommended that downstream systems should be improved as a requirement of the subdivision platting process.

5602.6.A Use of Rational Method: (modification)

The maximum size for use of the Rational Method in a watershed is reduced from 200 acres to five (5) acres.

5603.3. Dam Breach Analysis: (addition)

A. General Discussion: The Dam Breach inundation analyses are applicable to a dam or any other type of impoundment structure which is intended to serve as a stormwater detention/retention facility, permitted by a City Department, as part of a development plan stormwater management program. The City as the permitting agency of such facilities is obligated to enforce a technical and regulatory program to ensure that public safety, life, and property is not endangered by the presence of dams or the impoundment facility. The terms "dam" and "impoundment structure" shall mean the embankment, spillway(s), inlet, and outlet works and all other appurtenant parts.

Failure of an impoundment structure or any of its parts and the subsequent release of large volumes of water is referred to as a "dam breach" and is the primary risk to human life and property associated with dams. Breaching may occur due to the cumulative effects of erosion or seepage, or it may occur as a result of dynamic stresses or static hydraulic pressures caused by excess water produced during a storm event.

B. Requirements: Due to the inherent dangers posed by impoundments of significant volumes of water, owners of dams and related structures are required to ensure that they are designed, constructed, and maintained so as to minimize the risk to life and property. The City requires that the owner shall submit the following documentation and technical analysis as part of application for permitting a stormwater detention facility.

1. Hydraulic and hydrologic (H&H) analyses: for a 100-year storm event hydrograph using an approved dam breach analysis computer program that will demonstrate the following:

- a. Estimate and describe all possible modes of dam failure.
- b. Calculate the outflow hydrograph at the dam, indicating the peak outflow and reservoir outflow rate versus time hydrograph function.

- c. Route the hydrograph downstream until the flows are either absorbed or completely attenuated by the downstream conveyance system or contained in the main channel.
- d. Determine downstream water surface elevations at peak flood.
- e. Plot calculated peak flood elevations at downstream cross sections, and develop a flood hazard map, and mark the prominent inundation areas.
- f. Provide at key downstream cross sections located near the high population and development densities, with the flood wave travel time, time of flood peak, peak flood elevation, flood attenuation time, flow at flood peak, and the floodplain inundation width.

A dam must be able to safely withstand the passage of a flood of 100-year magnitude event without failure. Dam structure must be designed and constructed to resist the most critical loading combination of dead loads plus live loads that may occur during its construction or design life. All dams and impoundment structures must be designed and sealed by a registered professional civil engineer. Plans pertaining to the design and construction of dam embankments must be certified by a geotechnical engineer ensuring that the structure is built and inspected in strict compliance with pertinent engineering design codes, and construction specifications.

2. Hazard Classification: Based on 100-year event H&H analyses and flood hazard map developed in Item 1, submit an impact hazard classification based on the following criteria:

IMPACT CATEGORY	POTENTIAL LOSS OF LIFE	POTENTIAL ECONOMIC LOSS
HIGH	LIKELY	EXCESSIVE
MODERATE	POSSIBLE	POSSIBLE
LOW	NOT LIKELY	MINIMAL

Based on the evaluation of the analyses submittal from Item 1 and classification from Item 2, the City will determine the best course of action to take whether to permit the construction plan to proceed or request further evaluation of alternatives and relocation of the dam.

3. Maintenance: A covenant for maintenance agreement that shall define the owner's responsibility as to the following:

- a. An inspection plan referencing an operation and maintenance plan manual specific to the dam or impoundment structure. The inspection plan is to detect deficiencies or situations that may result in a threat to life and property.

- b. An emergency action and preparedness plan specific to dam hazard classification.

4. Annual Certifications: On an annual basis, owner must submit certification of the inspection, maintenance program, and schedule that ensures all dam appurtenant structures are inspected and maintained to ensure proper functionality of all structural components and equipment. The owner will be responsible for certifying, through properly documented records, to the City that the required periodic inspections have been made, for correcting any deficiencies that maybe revealed during such inspections, and for maintaining records of all operations and maintenance activities, as well as of original construction and any subsequent modifications.

5. Emergency Action Plans: For all dams in a high impact hazard category the following specific emergency action plan requirements shall apply:

- a. A dam must be constructed with an emergency spillway drawdown structure capable of emptying the reservoir in a period of four hours within two-thirds of the maximum height achievable during a 100-year storm event.
- b. In anticipation of possible dam failure, the dam must be equipped with an early warning system capable of alerting downstream residents if necessary. The warning lead time will be based on the dam breach analysis results and should allow enough time for complete evacuation of areas likely to be impacted.
- c. A notice must be mailed to all affected residences notifying them that they are located downstream from a potential dam breach area and telling them the evacuation procedures. The emergency action plan shall be submitted as a component of the maintenance and operating procedures as a condition of the permitting process. It is the owner's responsibility that the provisions of the emergency action plan are implemented in the event of an emergency situation.

For all dams in moderate impact hazard category the following specific emergency action plan requirements shall apply:

- a. A dam must be constructed with an emergency spillway drawdown structure capable of emptying the reservoir in a period of six hours within two-thirds of the maximum height achievable during a 100-year storm event.
- b. A notice must be mailed to all affected residences notifying them that they are located downstream from a potential dam breach area and list the potential risks and hazards.

For all dams in low impact hazard category the following specific emergency action plan requirements shall apply:

- a. A notice must be mailed to all affected residences notifying them that they are located downstream from a potential dam breach area and list the potential risks and hazards.

C. Applicability: These standards apply to the construction and operation of dams less than 35 (thirty-five) feet in height that are not regulated by federal government. All dam impoundments which are 35 feet or more in height must be submitted to Missouri Department of Natural Resources (MDNR) for certification. The height of a dam is measured from the natural bed of the stream or watercourse at the downstream toe of the embankment, or the height from the lowest elevation of the outside limit of the embankment, to the top of dam crest.

D. Acceptable Dam Breach Analysis Models: The National Weather Service (NWS) Dam-Break Flood Forecasting Model (DAMBRK) and the updated version FLDWAV, the U. S. Army Corps of Engineers Hydrologic Engineering Center Flood Hydrograph Package (HEC-1), and the NWS Simplified Dam-Break Flood Forecasting Model (SMPDBK).

5604.8 Connection of private storm systems to the public system: (addition)

Roof drains, parking lot drains, detention storage drains, etc. will only be allowed a connection to the existing City system after it is shown that the connection will not have a detrimental effect on the capacity or structural integrity of the existing City system.

5607.9 Energy Management: (addition)

Drop structures shall be provided to minimize the velocity to 15 feet per second or less in systems located in or next to residential areas.

5608.5.F Public Safety Considerations in Structural Design and Operation of Stormwater Detention Facilities: (addition)

- (1) The side slopes of all wet bottom basins and dry bottom basins shall be in accordance with KCMO Adopted APWA standards. If the side slopes exceed a maximum of 3 feet horizontal to 1 foot vertical (3:1) the design engineer shall justify the need for steeper slopes, and shall provide a design to address the following:
 - a. Erosion control during construction and until ground is stabilized.
 - b. Safety measures not limited to the following:

- i. guardrail around basins 4 feet to 6 feet in depth with adequate gates for access.
 - ii. security fence around basins greater than 6 feet in depth with adequate gates for access.
 - iii. safety ledges, access ladders, or level steps (gradient terraces) with permanent pools of water, deeper than 4 feet in depth.
 - iv. adequate egress provisions (e.g. ladders, steps, gradient terraces, etc.) along perimeter between inflow-outflow structures for people to escape from the basin.
 - v. posted and maintained signage of safety hazard and hazard area visible on all sides of the facility, also designating area as a no-play or trespass area.
 - vi. liftable trash grating at exit pipes to prevent people from being sucked in.
 - vii. structural walls shall include sealed structural design, soil analysis information, and design/construction details for review and permitting.
 - viii. if adjacent to roads adequate protection from vehicle entry.
 - ix. if adjacent to habitable structures, a top of slope setback equal to 20 feet or generally 10% of the basin width in the perpendicular dimension to the structure, which ever is greater.
- c. Adequate access both in width and longitudinally for maintenance equipment and workers using ordinary tractor/mower equipment.
 - d. All storm water detention facilities shall incorporate sound engineering and public safety. Enforcement of the design guidelines is subject to approval by the City reviewing agency, which shall reserve the right to deny any design that would have a potential for endangering public safety.

RESOLUTION

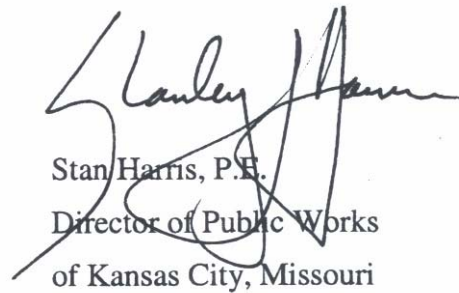
Be it resolved by the Director of Public Works of Kansas City, Missouri that Section 5600 – Storm Drainage Systems and Facilities as approved and adopted February 15, 2006 by the Kansas City Metropolitan Chapter of the American Public Works Association, is hereby modified by the following supplement and adopted as the official design criteria for the City of Kansas City, Missouri.

Supplement No.1 to
Section 5600: Storm Drainage Systems and Facilities

A copy of said criteria are attached hereto and incorporated herein by reference.

Effective date for implementation of these standards is October 9, 2006.

Approved and adopted as Official Document No. CS070031
this 18th day of July, 2006.



Stan Harris, P.E.
Director of Public Works
of Kansas City, Missouri

