



CITY OF HOUSTON

Department of Public Works and Engineering

Interoffice

Correspondence

To: Flooding and Drainage
Committee

From: Deputy Director
Public Works & Engineering

Date: November 2, 2007

cc Flooding and Drainage
Stakeholders

Subject: REVISIONS TO GUIDELINES TEXT
CHAPTER 19

The Public Works and Engineering Department has re-visited Chapter 19-17(d) Flood Plain, to include proposed modifications to the existing guidelines related to Conveyance Analysis. These modifications were conceived with the public health, safety and general welfare in mind. The City of Houston's goal is to minimize public and private loss due to flood conditions in specific areas.

Enclosed with this letter, you will find the Revisions to Guidelines Text for Chapter 19-17(d), along with the Residential Property Owner Map to Chapter 19 Requirements.

If you have any further questions and/or concerns, please feel free to call me at 713-837-0510.

A handwritten signature in black ink, appearing to read "A. Icken".

Andrew F. Icken

AFI:ML:yc

DRAFT Revisions to Guidelines Text for §19-17(d)

These revisions will replace the portions of the guidelines (see existing text in grey boxes at end of this document).

A. Conveyance Policy. The *conveyance* capacity of a site means the ability of the site to convey water during the occurrence of the *base flood* from the upstream end to the downstream end of the site. In addition to the requirements described in this subsection, *development* in portions of the SFHA that have *conveyance* capacity must also meet the requirements for mitigation of impacts on floodplain storage volume as stated in Subsection 19-17 (c) of these Guidelines.

B. General Conveyance Zone Standards

1. The construction of fences, walls, landscaping, and/or other features that do not permit the free flow of flood waters is prohibited.
2. The permit applicant must demonstrate that floodplain storage capacity will not be diminished as a result of the proposed development, unless otherwise exempted from this requirement under §19-17(c).

C. Conveyance Zone Mapping

To facilitate the permitting process, the Office of the City Engineer has developed maps delineating areas of *conveyance* capacity. These conveyance zone maps may be viewed online at either of the following two website links:

<http://www.cohedp.swmp.org/Website/ProView/viewer.htm>
<http://www.gims.houstontx.gov/viewer1.htm>

The city engineer has defined areas that have *conveyance* capacity to include areas inside the SFHA which meet one or more of the following conditions:

1. The area is inside the regulatory floodway;
2. The area is within a 100-foot buffer zone adjacent to the regulatory floodway;
3. The area is between channel centerlines in or near areas designated as AO zones on the FIRM (overflow areas between two channels); or
4. Depth of water during the base flood (1%) event is greater than 18 inches.

Areas that have depths greater than 18 inches but are not hydraulically connected to the floodway by areas that also have depths greater than 18 inches were not mapped as part of the conveyance zone.

The conveyance zone maps show three different *conveyance* zone classifications for areas within the SFHA, as follows:

1. **Floodway or Buffer or Overflow.** These areas are either inside the floodway or the 100 foot buffer or in/near an overflow area.

2. **Depth.** These areas are hydraulically connected to the floodway and have depths greater than 18 inches.
3. **Not Analyzed.** Within these areas, the permit applicant must submit information to determine the depth of the base flood event and hydraulic connectivity of the area to the receiving channel.

In areas mapped as **Depth** or **Not Analyzed**, if the applicant's topographic survey indicates that the entire site has depths less than 18 inches or the applicant demonstrates that the site is not hydraulically connected to the floodway by areas that also have depth greater than 18 inches, no conveyance analysis will be required.

D. Requirements of a Conveyance (Engineering) Analysis

If the site of a proposed development is located totally or partially within one of the three mapped *conveyance* zones, a conveyance analysis (flow path or complete) must be prepared to demonstrate that the existing *conveyance* capacity of the site will not be adversely impacted by the proposed development. The level of analysis and documentation that must be provided to obtain a *development permit* will vary with the size and complexity of the proposed *development*. Depending on the location and nature of the project, one of the following two methods of analyses will satisfy permit requirements.

1. Flow Path Analysis. Many permit applicants for developments that are located in the *conveyance* zone may be able to demonstrate that there are existing barriers to flow that prevent conveyance across their sites. Some examples of barriers to flow are listed below:

- a. Topographic barriers, such as a ridge where the existing ground elevation rises such that the water depth is less than 6" across the entire ridge;
- b. Existing walls or privacy fencing that completely block flow across a site;
- c. Existing structures that completely block flow across a site; or,
- d. Combinations of characteristics noted in the above-listed three examples that completely block flow across a site.

Barriers to flow do not necessarily need to be located on the site. A fence on neighboring property that completely blocks flow from entering or leaving the applicant's property would be a barrier to flow. A Flow Path Analysis can be prepared that demonstrates existing barriers to flow.

At a minimum, a Flow Path Analysis must include the following elements and a statement that there is no existing conveyance due to barriers to flow:

- a. A site plan that includes existing *structures*, with location and extent of any barriers to flow indicated across the site. Show the general direction of flow in the floodplain and the *conveyance* zone boundaries on a vicinity map. Topographic barriers should be shown on the site plan by including surveyed

site topographic data. Flow paths may not necessarily align with the centerline of the channel. Also, note that near stream confluences and overflow zones, there may be flow paths in more than one direction across a site, and that these paths may need to be considered independently.

- b. For non-topographic barriers, provide evidence of the barrier to flow. Fences or buildings can be demonstrated by attaching photographs. Aerial photos from the City websites listed above or other sources such as <http://local.live.com> or <http://maps.google.com> may be used if appropriate.

2. Complete Analysis. If the potential impact of the proposed development on the conveyance capacity of the site cannot be adequately demonstrated using the Flow Path Analysis, a complete engineering analysis will be required. At a minimum, the analysis must include the following elements:

- a. Develop a site plan that includes existing topography and *structures* with *conveyance* flow paths, directions of flow and barriers to flow indicated across the site, as described for the Flow Path Analysis. Show areas of ineffective flow on the site plan, extending offsite as necessary.
- b. On the existing conditions site plan (item #1), identify points of flow constriction and limits/extents for each flow path. Depending on the nature of the site, there may be only one flow path and one constriction point, or there may be several flow paths and constriction points.
- c. Establish cross-sections at constriction points and representative locations along the length of the flow path across the site. Depending on the nature of the site, a single cross-section may intersect more than one flow path and constriction point.
- d. For each cross-section, determine appropriate roughness (“*n*”) values, based on site-specific conditions. Choose the appropriate “*n*” value from the table that follows this discussion and document roughness selection with aerial and/or site photographs.
- e. For each cross-section, calculate the *conveyance* (*K*) for existing conditions;
where $K = \frac{1.49}{n} AR^{2/3}$ and the depth of the cross-section is established from the *BFE*.
- f. Develop a site plan that includes proposed topography, *structures*, *conveyance* flow paths and directions in a manner similar to that employed for existing conditions. Show areas of ineffective flow on the proposed site plan, extending offsite as necessary.
- g. Identify proposed points of flow constriction and limits/extents of flow paths. Cross-sections for the proposed conditions should be at the same locations as the existing conditions to facilitate comparison. Identify site-specific proposed roughness values along the proposed cross-sections and document how these roughness values were determined. Calculate the *conveyance* for the proposed conditions.
- h. Cross-sections should not span the entire floodplain; rather, they should be limited to the site boundaries so that the calculations compare existing and proposed *conveyance* across the site. If the profile of the site varies significantly

in width perpendicular to the direction of flow, portions of the site may need to be compared independently of each other with *conveyance* maintained in each of the areas. Similarly, if the existing and proposed conditions vary significantly, the cross-sections used for comparison may not be in the exact same location, but should be representative of the flow in that portion of the site.

- i. Compare the proposed *conveyance* capacity with the existing *conveyance* capacity. The proposed site must maintain the existing *conveyance*. To demonstrate that *conveyance* is maintained, the proposed *conveyance* at each proposed cross-section should not be lower than the lowest conveyance value from the existing conditions analysis. Satisfaction of this requirement will be established by calculating the percent change in *conveyance* capacity with the result not being less than zero percent of the original *conveyance* capacity when rounded from the tenth percent. In addition, the site plan should describe how water will enter the site from upstream and leave the site downstream without restrictions.

E. Exceptions to the Conveyance Analysis Requirements

The permit applicant shall provide all information necessary to determine if the proposed project meets the exception requirements for a conveyance analysis. The information shall be presented on the plan sheets that contain site topography and/or those that illustrate the existing or pre-existing and proposed site plan development. A note shall be included on the plan sheet(s) describing the site conditions in relation to the particular site description listed below.

1. The site is in a mapped conveyance zone identified as **Floodway or Buffer or Overflow**. The site is located in the **Buffer** zone of the floodway, and the surveyed site topography indicates that no portion of the site within the **Buffer** zone is more than six inches below the BFE. However, any portion of the site located within the regulatory floodway is subject to regulation under Section 19-43 of these Guidelines;
2. The site is in a mapped conveyance zone identified as **Depth or Not Analyzed**. The surveyed site topography indicates that no portion of the site is at a depth of 18 inches or more below the BFE.
3. Redevelopment of a single lot or re-platting of one or more lots where the combined footprints of all proposed structures including garages, whether attached or detached, do not exceed the combined footprints of the existing, or pre-existing if demolished, structures and garages, whether attached or detached, by more than 10% compared to area of the footprint(s) existing on, or prior to, October 1, 2006, or where the proposed development will occupy not more than 25% of the area of the single lot or re-platted lots; or,
4. Development on a previously undeveloped lot of not more than 15,000 square feet where the combined footprints of the proposed structures and garages, whether attached or detached, and any other accessory structure located above grade, do not occupy more than 25% of the area of the site;

5. Paved areas at or below grade are not included within the calculation of footprints as noted in the preceding site descriptions.
6. For site descriptions 'c' and 'd', the proposed structure(s) shall consist of pier and beam construction without solid wall enclosures from natural ground to the BFE. Section 19-17(c)(1) of these Guidelines illustrates this foundation type and provides design criteria.

F. Bridges and Channel Construction. Bridges and channel work must meet the No Adverse Impact requirements of Section 19-43 of these Guidelines. Because there are not likely to be multiple bridges or channels at one location, cumulative impacts are of less concern with bridges and channel construction. As such, a full conveyance analysis is not required for a bridge or channel. The permit applicant is required to provide a site plan identifying flow paths as described in Item D.2., Flow Path Analysis, discussed previously.

G. Development in the Floodway. No new development of structures on vacant land within the floodway is permitted. Except as noted in Item 'F', Bridges and Channel Construction, all allowable development within the regulatory floodway must meet the requirements of Section 19-43 of these Guidelines in addition to the requirements of this subsection.

This text is taken from current Guidelines for §19-17(d) and is proposed to be replaced by above text.

Conveyance Policy. *Development* in portions of the SFHA that have *conveyance* capacity must meet permitting requirements above and beyond the requirements of Subsection 19-17 (c); however, all of the *fill* mitigation requirements of that subsection apply to areas of *conveyance* capacity as well.

The city engineer has defined areas within 100 feet of the boundary of the regulatory *floodway* and areas where the depth from the *BFE* to natural ground is 18 inches, or greater, to have *conveyance* capacity. The Office of the City Engineer is developing maps delineating areas of *conveyance* capacity to facilitate the permitting process; but ultimately, the *development permit* applicant is responsible for demonstrating that the proposed *development* location does not possess *conveyance* capacity to avoid having to satisfy the requirements of this subsection.

The proposed *development* must not change the existing *conveyance* capacity of the project site. *Conveyance* capacity of a site is understood to mean the ability of the site to convey water at the *BFE* from the upstream end to the downstream end of the site with a given total change in water surface elevation (total head loss). The level of analysis and documentation that must be provided to obtain a *development permit* will vary with the size and complexity of the proposed *development*. At a minimum, the analysis must include the following elements:

- Develop a site plan that includes existing topography and *structures* with *conveyance* flow paths and directions indicated across the site. *Conveyance* flow paths may not necessarily align with the centerline of the modeled stream. Show areas of ineffective flow on the site plan, extending offsite as necessary.
- On the existing conditions site plans, identify points of flow constriction for each flow path. Depending on the nature of the site, there may be only one flow path and one constriction point, or there may be several flow paths and constriction points.
- Establish cross-sections at constriction points. Depending on the nature of the site, a single cross-section may intersect more than one flow path and constriction point.
- For each cross-section, determine appropriate roughness ("n") values, based on site-specific conditions. Choose the appropriate "n" value from the table that follows this discussion and document roughness selection with aerial and/or site photographs.
- For each cross-section, calculate the *conveyance* (K) for existing conditions: where $K = 1.49 AR^{2.3} / n$, and the depth of the cross-section is established from the *BFE*.
- Develop a site plan that includes proposed topography, *structures*, *conveyance* flow paths and directions in a manner similar to that employed for existing conditions. Show areas of ineffective flow on the proposed site plan, extending offsite as necessary.
- Identify proposed points of flow constriction and construct cross-sections for the proposed conditions. Identify site-specific proposed roughness values along the proposed cross-sections and document how these roughness values were determined. Calculate the *conveyance* for the proposed conditions.
- Cross-sections should not span the entire floodplain; rather, they should be limited to the site boundaries so that the calculations compare existing and proposed *conveyance* across the site. If the profile of the site varies significantly in width perpendicular to the direction of flow, portions of the site may need to be compared independently of each other with *conveyance* maintained in each of the areas. Similarly, if the existing and proposed conditions vary significantly, the cross-sections used for comparison may not be in the exact same location, but should be representative of the flow in that portion of the site.

- Compare the proposed *conveyance* capacity with the existing *conveyance* capacity. The proposed site must maintain the existing *conveyance*. To demonstrate that *conveyance* is maintained, the proposed *conveyance* should not vary more than 0.5% from the existing *conveyance*.
- *Conveyance* calculations must be included in the documentation. These calculations may be performed using a model such as HEC-RAS, in which case model outputs showing *conveyance* must be provided at each cross-section and model inputs must be provided.

Residential Property Owner Map to Chapter 19 Requirements



WHAT YOU NEED
 1. Street address
 2. Value of proposed improvements
 3. Market value of structure before improvements

