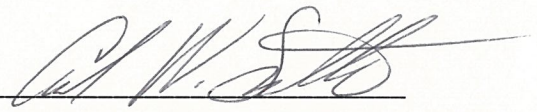




**GUIDELINES FOR  
ADJUSTMENT OF CALCULATED IMPERVIOUS SURFACE  
BASED ON APPROVED  
STORMWATER MANAGEMENT TECHNIQUES**

Approved

Director:   
Daniel W. Krueger, P.E.

City Engineer:   
Carl W. Smitha, P.E., CFM

*Effective Date*  
September 19, 2011

Office of the Director  
Department of Public Works and Engineering  
City of Houston



## TABLE OF CONTENTS

	<u>Topic</u>	<u>Page</u>
I.	Background	3
II.	Eligible Applicants	4
III.	Application Procedures	4
IV.	Maximum Allowable Adjustment	5
V.	Adjustment of Drainage Charge	5
VI.	Inspection and Maintenance	5
VII.	Transfer of Adjustment of Drainage Charge	6
VIII.	Discontinuance of Adjusted Determination	6
IX.	Misrepresentation and Penalty	6
X.	Approved Storm Water Management Techniques	7
	Bioretention	7
	Infiltration Trenches	8
	Green Roof	8
	Rain Barrels or Cisterns	9
	Porous Pavement	9
	Excess Detention	10
	Maintenance Dredging and Channel Clean-Out	10
XI.	Calculation of Adjustment	11
	Attachments	
	A.1 – Application Form	13
	A.2 – Application to Transfer Adjustment	14
	B.1 – Bioretention Worksheet	16
	B.2 – Infiltration Trench Worksheet	17
	B.3 - Green Roof Worksheet	18
	B.4 – Rain Barrel or Cistern Worksheet	19
	B.5 – Porous Pavement Worksheet	20
	B.6 – Excess Detention Worksheet	21
	B.7 – Maintenance Dredging and Channel Clean-Out	22
	C – Adjustment for Areas less than 1 Acre	23
	D – Adjustment for Areas from 1 to 50 Acres	24
	E – Infiltration Testing and Documentation	25
	F – Sample Application and Supporting Documents for Rain Barrels	26
	G – Response to Comments	30



## I. BACKGROUND

On April 6, 2011, the City of Houston City Council adopted a Municipal Drainage Utility System Ordinance (No. 2001-0254) establishing a dedicated Municipal Drainage Utility System. A Dedicated Drainage and Street Renewal Fund (Fund) to implement projects and maintenance on a pay-as-you-go basis was established in conjunction to help maintain and improve the city's drainage infrastructure and to plan upgrades to meet future needs as the city grows. One source of revenue for this Fund is a drainage charge assessed on benefitted properties citywide.

The drainage charge is based on the amount of storm water runoff from the property which is determined by the impervious surface. In general terms, the impervious surfaces are the portions of the property that shed water during a storm. Typical impervious areas include driveways, roofs, awnings, patios, sheds, swimming pools, ponds with man-made linings, parking lots and compacted aggregate.

It was contemplated during Council deliberation and adoption of the Ordinance that the City would encourage sound technical design practices that decrease the runoff from development and improve the quality of runoff to the drainage system by allowing for an adjustment to the calculated impervious surface for use of approved stormwater management techniques. The Director of Public Works and Engineering (Director) of the City of Houston (City) has issued these Guidelines pursuant to Article XIV, Chapter 47 of the City's Code of Ordinances as adopted and effective on April 6, 2011. Section 47-805 requires that:

“Calculation of impervious surface shall be adjusted by the director based on utilization of approved storm water management techniques on the benefitted property. Any approved management techniques are to be identified and described in detail by the director and information made readily available to the public.”

These guidelines will detail how the calculation of impervious surface shall be adjusted (Adjustment) for use of approved storm water management techniques. Only stormwater management techniques that exceed minimum requirements for those techniques as detailed in Chapters 9 and 13 of the Infrastructure Design Manual (IDM)<sup>1</sup>. on the benefitted property shall result in an adjustment of calculated impervious surface.

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<sup>1</sup> The current [Infrastructure Design Manual](#) was published by the City of Houston's Department of Public Works and Engineering became effective on July 1, 2011. This manual includes approved stormwater management techniques in Chapters 9 and 13.



## II. Eligible Applicants

The User of a Benefitted Property as defined in [Article IV, Chapter 47 of the Code of Ordinances](#) may apply for an Adjustment. Approved stormwater management techniques require routine inspection and maintenance in addition to the initial construction. The applicant must be in a position to perform the inspection and maintenance.

When the applicant is an occupant and not the owner, the occupant must also be receiving and paying the bill for the drainage charge in order to apply for an Adjustment. Adjustments received by the current occupant do not automatically transfer to the owner or subsequent occupants (i.e. renter). The subsequent user can submit an application for transfer of inspection and maintenance responsibilities at any time to continue the Adjustment for the approved stormwater management technique. This is necessary because responsibility for inspection and maintenance are part of the approval process.

## III. Application Procedures

The user of a benefitted property must submit an application to the City that documents the use of an approved storm water management technique in order to receive an Adjustment to the Calculated Impervious Surface (Adjustment). The application shall include:

- Completed application form (See Attachment A)
- Original signature of owner/applicant certifying that information submitted is true and correct
- Signed acknowledgement that the City may perform on-site inspection of the stormwater management technique for which an adjustment has been requested
- Worksheet for each stormwater technique implemented on the benefitted property (See Attachment B)
- Supporting drawings, photographs and/or images

Applications will not be considered complete and will not be processed unless it includes the signed Application Form, worksheet(s) and supporting documentation. Upon receipt and review, the Director may request additional information necessary for review and approval. If an approved stormwater management technique is demonstrated in the application, the Director will provide an Adjustment as detailed in Section XI. The applicant will be notified of the outcome of the application and the Adjustment applied to the benefitted property.

# Guidelines for Adjustment of Calculated Impervious Surface Based on Approved Stormwater Management Techniques

Page 5 of 34



The Application for Adjustment is provided as Attachment A-1 to this manual and can also be downloaded from the [www.ReBuildHouston.org](http://www.ReBuildHouston.org) website. Completed applications can be

submitted online at: [www.ReBuildHouston.org](http://www.ReBuildHouston.org)

mailed to the following address: City of Houston  
Public Works and Engineering Department  
P.O. Box 4244  
Houston, Texas 77210-4244

faxed to: 1-855-865-4617

Applications will be reviewed within 60 days of receiving the complete application including necessary supporting materials as may be requested to complete the review. This review will result in either an adjustment to the calculated impervious surface (approval) or no adjustment (denial). The Director will communicate the approval or denial of the application in writing. The communication will include the basis for approval or denial. The decision of the Director shall be final with no further administrative review.

#### **IV. Maximum Allowable Adjustment**

The maximum allowable Adjustment for any individual property shall not exceed the calculated impervious surface such that a negative drainage charge would result. Additionally, the amount of adjustment provided for green roofs and porous pavement shall be limited to the surface area of these techniques utilized on the site. All developments must still conform to all applicable ordinances and standard of the City of Houston.

#### **V. Adjustment of Drainage Charge**

The Adjustment will be used to calculate the drainage utility charge for the remainder of the year (July 1 to June 30) and continue for subsequent years. The lower drainage utility charge resulting from this adjustment will be applied to the first billing period after the written notification of the credit determination has been issued. No retroactive credit will be granted.

#### **VI. Inspection and Maintenance**

The feature approved for an Adjustment shall be operated and maintained in proper working condition as designed and constructed. Inspection and maintenance is detailed for each approved stormwater management technique in the IDM. Failure to inspect and maintain approved stormwater management techniques may result in discontinuance of the Adjustment as described in Section VIII of these guidelines.



#### **VII. Transfer of Adjusted Determination of Impervious Surface to New User of Benefitted Property**

If the user of a benefitted property that has applied for and received an Adjustment is no longer the occupant or owner of that property, the existing Adjustment may be transferred to a subsequent user if the new user:

- Completes the application to Transfer an approved Adjustment (Appendix A-2)
- Provides a certification that the approved stormwater management technique is operating as designed and all inspections and maintenance are current
- Signs an acknowledgement that the City may perform on-site inspection of the stormwater management technique for which an adjustment has been requested

The new user will not need to resubmit drawings and calculations that were provided with the original application for Adjustment, unless the Adjustment has been discontinued as described under Section VIII of these guidelines.

#### **VIII. Discontinuance of Adjusted Determination of Impervious Surface**

Any user previously granted an Adjustment that is found to be out of compliance with the storage volume, routine investigation or required maintenance may be served a notice of non-compliance including a list of required repairs. The user will have 45 days from the receipt of notice to correct the deficiency. The required repairs or adjustments must be within the same 45-day period and the customer must contact the Department of Public Works and Engineering to be re-inspected. Failure to do so will result in a permanent discontinuation of the credit.

In the event of a discontinuation of credit, the customer may submit a new credit application after all repairs have been made and the user can display a minimum of 6 months of adequate maintenance.

#### **IX. Misrepresentation and Penalty**

As part of the application process, the applicant shall be required to sign a statement certifying that information is correct and acknowledgement that any Adjustment will be based on the information provided. A later determination that the information was inaccurate will result in the discontinuation of credit. If the misrepresentation is related to the original construction or operability of the technique, the entire cumulative value of the Adjustment will be added back to the next billing cycle as a correction.



## X. Approved Storm Water Management Techniques

Certain storm water management techniques benefit the quality of our waterways by reducing the pollutant load as well as decrease the volume or rate of runoff. The City of Houston acknowledges this by offering an adjustment for those techniques that address quantity and/or quality.

A brief description of approved techniques follows below. Refer to the City of Houston's [Infrastructure Design Manual](#) (IDM) for specific design, inspection and maintenance criteria. The IDM provides a process for submittal of other stormwater management techniques for review and approval by the City Engineer. The IDM supersedes the guidelines found in this document for all technical information related to approved stormwater management techniques.

For consideration of stormwater management techniques beyond these guidelines, the technique must be submitted to the City Engineer for approval and consideration for subsequent inclusion in the IDM. Only those techniques approved by the City Engineer will qualify for an Adjustment.

### Bioretention (Chapter 13, Page 3 of IDM)



*Bioretention* is shallow (not more than 6 inches deep) dry detention basins with specific soil and plant that addresses storm water quality while also addressing small volumes of stormwater runoff. No subsurface drainage will be allowed if this technique is being used for an Adjustment. Bioretention is used in both residential and commercial settings. Because of the depth limitations, bioretention works especially well in common residential landscapes. Bioretention requires simple routine inspection and maintenance typically involves removal of silt build-up that can be performed by most homeowners.

#### *Required Documentation:*

- *Application (Attachment A)*
- *Bioretention Worksheet (Attachment B.1)*
- *Results of infiltration test (See Attachment E)*
- *Other supporting documents*
- *Inspection and Maintenance Plans*

Infiltration Trenches (Chapter 13, Page 4 of IDM)



*Infiltration Trenches* are trenches or small basins designed to hold a specific amount of runoff volume while allowing infiltration. This technique requires an observation well to demonstrate performance and often requires either imported soil with certain characteristics. No subsurface drainage will be allowed if this technique is being used for an Adjustment. Infiltration trenches are used in both residential and commercial settings. Infiltration trenches require inspection of the observation well and maintenance typically involves mowing and removal of silt build-up.

*Required Documentation:*

- *Application (Attachment A)*
- *Infiltration Trench Worksheet (Attachment B.2)*
- *Results of infiltration test (See Attachment E)*
- *Associated engineering drawings and calculations*
- *Other supporting documents (as needed)*
- *Inspection and Maintenance Plan*

Green Roof (Chapter 13, page 8 of IDM)



*Green Roofs* are vegetated roofs. Vegetation is installed typically in a modular tray system with an under-drain system. Selected vegetation should be drought tolerant. Adjustments are based on the amount of rainfall stored in the soil system. Green roofs are used primarily in commercial settings. Green Roofs require significant inspection requirements and maintenance similar to typical lawn maintenance.

*Required Documentation:*

- *Application (Attachment A)*
- *Green Roof Worksheet (Attachment B.3)*
- *Associated engineering drawings and calculations*
- *Other supporting documents (as needed)*
- *Inspection and Maintenance Plan*



Rain Barrels or Cisterns (Chapter 13, page 12 of IDM)



*Rain Barrels or Cisterns range from around 50 gallons to several hundred gallons. They are placed near the downspout of the structure and used to collect rainwater runoff from the roof. The captured water is typically used for irrigation of plants and lawns. Rain barrels or cisterns can be used in both residential and commercial settings. To be used as an approved stormwater technique resulting in an adjustment to the calculated impervious surface area, they must be emptied after each rainfall event. Rain Barrels or Cisterns require minimal inspection and maintenance.*

*Required Documentation:*

- *Application (Attachment A)*
- *Rain Barrels or Cisterns Worksheet (Attachment B.4)*
- *Associated documentation (Example- Attachment F)*
- *Inspection and Maintenance Plan*

Porous Pavement (Chapter 13, Page 5 of IDM)



*Porous Pavement is a permeable surface course that is installed over another permeable layer of uniformly graded stones that is over undisturbed soil. The permeable layer is at least 9 inches thick serves as the reservoir volume. No subsurface drainage will be allowed if this technique is being used for an Adjustment. These areas can be used to parking pads and lots, trails and sidewalks. Porous pavement can be used in both residential and commercial settings. Porous pavement requires cleaning quarterly, semi-annual and annual inspection.*

*Required Documentation:*

- *Application (Attachment A)*
- *Porous Pavement Worksheet (Attachment B.5)*
- *Results of infiltration test (See Attachment E)*
- *Associated engineering drawings and calculations*
- *Other supporting documents (as needed)*
- *Inspection and Maintenance Plan*

Excess Detention (Chapter 9, page 16 of IDM)



*Detention* is built to mitigate the effects or impact of increased impervious cover (development) on the existing drainage system. Stormwater detention volume is based on increased impervious surfaces and correspondingly, adjustments to impervious surface area are based on the volume of detention provided. The IDM details how to size the outlet or discharge pipe. Detention requires routine inspection and maintenance typically involves removal of silt build-up in the basin and at the outfall.

*Required Documentation:*

- *Application (Attachment A)*
- *Detention Worksheet (Attachment B.6)*
- *Associated engineering documents and calculations*
- *Other supporting documents (as needed)*
- *Inspection and Maintenance Plan*

Maintenance Dredging and Channel Clean-Out (requires site specific approval of the City Engineer)



*Maintenance dredging and channel clean-out* may be approved by the City Engineer as the basis for Adjustment. Conduct of such activities by property owners/benefitted property users benefit the conveyance capacity of the public system and help preclude pollutant entry to the system. Activities within this technique must be conducted with all requisite permits and approvals for entry into the system areas which may or may not be adjacent, approvals for removal and for disposal of removed materials.

*Required Documentation:*

- *Application (Attachment A)*
- *Maintenance Dredging/Clean-Out Worksheet (Attachment B.7)*
- *Associated engineering drawings and calculations to include proposed cut sections and disposal plan*
- *Evidence of all required permits and approvals*
- *Supporting documents for work performed*
- *Other supporting documents (as needed)*





## XI. Calculation of Adjustment

The Adjustment will be based on the volume of storage provided by the approved stormwater management technique, except maintenance dredging and channel clean-out. The Adjustment under this policy will be allowed using the same ratio for required detention based on increased impervious surface detailed in the IDM, Chapter 9. Requirements of Chapter 9 and the extent of adjustment based on extent of excess detention may be reviewed and revised by the Director when and as appropriate for City standards and for the purpose of this policy respectively.

### Areas less than 1 acre or 43,560 square feet (equivalent adjustment provided in Attachment C):

Adjustments will be provided at a rate of 1 acre for every 0.2 acre-feet of detention provided. Attachment C provides a table that includes the amount of adjustment for gallons, cubic feet and acre-feet of storage provided on-site.

$$1 \text{ cubic foot} \left( \frac{1 \text{ acre foot}}{43560 \text{ cubic feet}} \right) \left( \frac{1 \text{ acre}}{0.2 \text{ acre feet}} \right) \left( \frac{43560 \text{ square feet}}{1 \text{ acre}} \right) = 5 \text{ square foot adjustment}$$

### Areas between 1 acre and 50 acres (equivalent adjustment provided in Attachment D):

Adjustment will be provided at a rate of 1 acre for every 0.5 acre-feet of detention provided. Attachment D provides a table that includes the amount of adjustment for gallons, cubic feet and acre-feet of storage provided on-site.

$$1 \text{ cubic foot} \left( \frac{1 \text{ acre foot}}{43560 \text{ cubic feet}} \right) \left( \frac{1 \text{ acre}}{0.5 \text{ acre feet}} \right) \left( \frac{43560 \text{ square feet}}{1 \text{ acre}} \right) = 2 \text{ square foot adjustment}$$

### Areas greater than 50 acres

Adjustment will be made based on an analysis approved by the City Engineer.

### Maintenance Dredging and Channel Clean-Out

Under specific circumstances, a Benefitted User may be approved for an adjustment to impervious surface based on the performance of maintenance dredging or channel clean-out of public channels within the City's storm drainage system. Adjustments under this provision require approval of the City Engineer for the work to be performed and will be based on the actual expenditures of the benefitted user on the public system.

### Conversions

1 cubic foot = 7.481 gallons

1 acre-foot = 43,560 cubic feet = 325,851 gallons



## **Attachment A**

### **A.1 – Application for Adjustment to Calculated Impervious Surface**

### **A.2 – Application for Transfer of Adjustment**



## APPLICATION FORM ADJUSTMENT TO CALCULATED IMPERVIOUS SURFACE BASED ON APPROVED STORMWATER MANAGEMENT TECHNIQUES



### APPLICANT INFORMATION

Name: Last _____	First _____	Date _____
Property Address _____		
City _____	State _____	ZIP _____
Drainage Account No. _____		
Utility Billing Address _____	Apartment/Unit # _____	
City _____	State _____	ZIP _____
Phone (____) _____	E-mail Address _____	
Utility Account No. _____		

### STORMWATER MANAGEMENT TECHNIQUE(S) IN USE ON THE BENEFITTED PROPERTY (Include Attachment B Worksheet(s) and associated drawings and calculations)

<input type="checkbox"/> Bioretention _____ <input type="checkbox"/> Infiltration Trench _____ <input type="checkbox"/> Green Roof _____	<input type="checkbox"/> Gallons <input type="checkbox"/> Cubic Feet <input type="checkbox"/> Acre-Feet  <input type="checkbox"/> Gallons <input type="checkbox"/> Cubic Feet <input type="checkbox"/> Acre-Feet  <input type="checkbox"/> Gallons <input type="checkbox"/> Cubic Feet <input type="checkbox"/> Acre-Feet	<input type="checkbox"/> Rain Barrels or Cisterns _____ <input type="checkbox"/> Porous Pavement _____ <input type="checkbox"/> Excess Detention _____	<input type="checkbox"/> Gallons <input type="checkbox"/> Cubic Feet <input type="checkbox"/> Acre-Feet  <input type="checkbox"/> Gallons <input type="checkbox"/> Cubic Feet <input type="checkbox"/> Acre-Feet  <input type="checkbox"/> Gallons <input type="checkbox"/> Cubic Feet <input type="checkbox"/> Acre-Feet
<b>TOTAL</b> _____ <input type="checkbox"/> Gallons <input type="checkbox"/> Cubic Feet <input type="checkbox"/> Acre-Feet			

Maintenance Dredging & Channel Clean-Out

### DISCLAIMER AND SIGNATURE

*I certify that the attached information is accurate to the best of my knowledge and that I have the authority to make such a request for this property. I agree to provide the City of Houston with corrected information should there be any changes made to the information provided herein. I further agree to provide the City of Houston with reasonable access to the property identified for adjustment in this application.*

Signature \_\_\_\_\_ Name (printed) \_\_\_\_\_ Date \_\_\_\_\_

### CITY OF HOUSTON USE (DO NOT WRITE IN SHADED AREA)

Date Submitted	Approved	<input type="checkbox"/> YES	<input type="checkbox"/> NO	Total Volume Approved _____	Total SF equiv. _____
Approved By:		Signature:			
Title:		Date:			
Date Response Letter Sent to Applicant Address:					
Date Adjustment Submitted to Billing:					



# TRANSFER APPLICATION FORM

## TRANSFER OF ADJUSTMENT TO CALCULATED IMPERVIOUS SURFACE BASED ON APPROVED STORMWATER MANAGEMENT TECHNIQUES



### TRANSFER APPLICANT INFORMATION

Name: Last _____	First _____	Date _____
Property Address _____		
City _____	State _____	ZIP _____
Drainage Account No. _____		
Previous User: (person with adjustment) _____	Date of Purchase or change of User: _____	
Utility Billing Address _____	Apartment/Unit # _____	
City _____	State _____	ZIP _____
Phone _____	E-mail Address _____	
Utility Account No. _____		

### STORMWATER MANAGEMENT TECHNIQUE(S) IN USE ON THE BENEFITTED PROPERTY

*(Include Attachment B Worksheet(s) and photographs or other documentation of technique properly maintained and in-use)*

<input type="checkbox"/> Bioretention _____ <input type="checkbox"/> Infiltration Trench _____ <input type="checkbox"/> Green Roof _____	<input type="checkbox"/> Gallons <input type="checkbox"/> Cubic Feet <input type="checkbox"/> Acre-Feet <input type="checkbox"/> Gallons <input type="checkbox"/> Cubic Feet <input type="checkbox"/> Acre-Feet <input type="checkbox"/> Gallons <input type="checkbox"/> Cubic Feet <input type="checkbox"/> Acre-Feet	<input type="checkbox"/> Rain Barrels or Cisterns _____ <input type="checkbox"/> Porous Pavement _____ <input type="checkbox"/> Excess Detention _____ <input type="checkbox"/> Gallons <input type="checkbox"/> Cubic Feet <input type="checkbox"/> Acre-Feet
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**TOTAL** \_\_\_\_\_  Gallons  Cubic Feet  Acre-Feet

Maintenance Dredging & Channel Clean-Out

### DISCLAIMER AND SIGNATURE

*I certify that the attached information is accurate to the best of my knowledge and that I have the authority to make such a request for this property. I agree to provide the City of Houston with corrected information should there be any changes made to the information provided herein. I further agree to provide the City of Houston with reasonable access to the property identified for adjustment in this application.*

Signature \_\_\_\_\_

Name (printed) \_\_\_\_\_

Date \_\_\_\_\_

### CITY OF HOUSTON USE (DO NOT WRITE IN SHADED AREA)

Date Submitted	Approved	<input type="checkbox"/> YES	<input type="checkbox"/> NO	Total Volume Approved _____	Total SF equiv. _____
Approved By:			Signature:		
Title:			Date:		
Date Response Letter Sent to Applicant Address:					
Date Adjustment Submitted to Billing:					



## **Attachment B**

### **STORM WATER MANAGEMENT TECHNIQUES WORKSHEETS**

- B.1 Bioretention Worksheet
- B.2 Infiltration Trenches Worksheet
- B.3 Green Roof Worksheet
- B.4 Rain Barrels or Cisterns Worksheet
- B.5 Porous Pavement Worksheet
- B.6 Excess Detention Worksheet
- B.7 Maintenance Dredging/Clean-Out Worksheet



# WORKSHEET B-1 BIORETENTION WORKSHEET SITES 0 TO 50 ACRES



### SITE INFORMATION

Drainage Account No.

Property Address

TOTAL VOLUME REQUESTED FOR THIS TECHNIQUE \_\_\_\_\_  Gallons  Cubic Feet  Acre-Feet

### REQUIRED INFORMATION/ATTACHMENTS

- |   |   |
|---|---|
| <input type="checkbox"/> Site Map including property boundaries, structures & bioretention  | <input type="checkbox"/> Infiltration Test Results (see Attachment E) |
| <input type="checkbox"/> List of plants   |   |
| <input type="checkbox"/> Calculated storage volume in bioretention area (average area at ground level with area at 6" depth and multiply by maximum 6" depth) |   |
| <input type="checkbox"/> By checking this box, the applicant confirms that no subsurface drainage system is installed.  |   |

### INSPECTION PLAN (INITIAL EACH ITEM BELOW)

- \_\_\_\_ Quarterly inspect the for the presence of plants (vegetation) included in design computations
- \_\_\_\_ Quarterly inspect to ensure that sedimentation has not reduced the design volume
- \_\_\_\_ Twice a year after rain events, verify that the bioretention area drains within 48 hours

### MAINTENANCE PLAN (INITIAL EACH ITEM BELOW)

- \_\_\_\_ Correct any deficiencies noted during inspections required above

### INSPECTION AND MAINTENANCE AGREEMENT (INITIAL EACH ITEM BELOW)

- \_\_\_\_ The Applicant's facility is a private facility and will not transfer to City or Public ownership by execution of this agreement
- \_\_\_\_ The Applicant acknowledges that the City is under no obligation to maintain or repair the Applicant's facility.
- \_\_\_\_ The Applicant agrees to provide the City of Houston with reasonable access to the property identified for adjustment in this application.
- \_\_\_\_ The Applicant shall provide for adequate long term maintenance and continuation of the approved stormwater technique detailed in this worksheet and the attached information.
- \_\_\_\_ If requested, the Applicant shall submit an annual report detailing the inspections and any associated maintenance performed for the preceding July 1 to June 30 period.
- \_\_\_\_ This agreement is not transferable.

### CERTIFICATION

***I certify that I, the applicant, have the financial resources and will perform inspection and maintenance of this stormwater management facility in accordance with the above Inspection and Maintenance Plans and execute the Inspection and Maintenance Agreement. I also acknowledge that the City of Houston will be provided reasonable access to perform on-site inspection of this facility. I acknowledge that failure to deliver the requirements under these Plans and Agreement may result in a discontinuation of Adjustment applied to Calculated Impervious Surface.***

Signature	Name (printed)	Date
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## WORKSHEET B-2 INFILTRATION TRENCH WORKSHEET SITES 0 TO 50 ACRES



### SITE INFORMATION

Drainage Account No. \_\_\_\_\_

Property Address \_\_\_\_\_

TOTAL VOLUME REQUESTED FOR THIS TECHNIQUE \_\_\_\_\_  Gallons  Cubic Feet  Acre-Feet

### REQUIRED INFORMATION/ATTACHMENTS

- |  |   |
|--|---|
| <input type="checkbox"/> Site Map including property boundaries, structures & infiltration trench                      | <input type="checkbox"/> Infiltration Test Results (see Attachment E) |
| <input type="checkbox"/> Calculated storage volume in infiltration trench  | <input type="checkbox"/> Cross-Section sketch with depths             |
| <input type="checkbox"/> By checking this box, the applicant confirms that no subsurface drainage system is installed. |   |

### INSPECTION PLAN (INITIAL EACH ITEM BELOW)

\_\_\_ Inspect the observation well for water level and drainage times after rain events.

### MAINTENANCE PLAN (INITIAL EACH ITEM BELOW)

\_\_\_ Conduct landscaping, mowing and desilting of the facility.

### INSPECTION AND MAINTENANCE AGREEMENT (INITIAL EACH ITEM BELOW)

\_\_\_ The Applicant's facility is a private facility and will not transfer to City or Public ownership by execution of this agreement

\_\_\_ The Applicant acknowledges that the City is under no obligation to maintain or repair the Applicant's facility.

\_\_\_ The Applicant agrees to provide the City of Houston with reasonable access to the property identified for adjustment in this application.

\_\_\_ The Applicant shall provide for adequate long term maintenance and continuation of the approved stormwater technique detailed in this worksheet and the attached information.

\_\_\_ If requested, the Applicant shall submit an annual report detailing the inspections and any associated maintenance performed for the preceding July 1 to June 30 period.

\_\_\_ This agreement is not transferable.

### CERTIFICATION

***I certify that I, the applicant, have the financial resources and will perform inspection and maintenance of this stormwater management facility in accordance with the above Inspection and Maintenance Plans and execute the Inspection and Maintenance Agreement. I also acknowledge that the City of Houston will be provided reasonable access to perform on-site inspection of this facility. I acknowledge that failure to deliver the requirements under these Plans and Agreement may result in a discontinuation of Adjustment applied to Calculated Impervious Surface.***

Signature \_\_\_\_\_

Name (printed) \_\_\_\_\_

Date \_\_\_\_\_



# WORKSHEET B-3 GREEN ROOF



### SITE INFORMATION

Drainage Account No.

Property Address

TOTAL VOLUME REQUESTED FOR THIS TECHNIQUE \_\_\_\_\_  Gallons  Cubic Feet  Acre-Feet

### REQUIRED INFORMATION/ATTACHMENTS

- |  |  |
|--|--|
| <input type="checkbox"/> Site Map including property boundaries, structures & Green Roof | <input type="checkbox"/> Porosity test results if not using a modular system |
| <input type="checkbox"/> Calculated storage volume                                       | <input type="checkbox"/> Plant selection list                                |

### INSPECTION PLAN (INITIAL EACH ITEM BELOW)

- \_\_\_\_ Maintenance inspections should be performed in accordance with the membrane manufacturer's instructions and at least four times per year.
- \_\_\_\_ Routine inspections for leaks at joints at adjoining walls, roof penetrations for vents, electrical and air conditioning conduits
- \_\_\_\_ Ceilings located directly below the green roof should be visually inspected for signs of staining or leaking
- \_\_\_\_ Vegetation should be visually inspect to identify weeds, accumulated trash or debris, dead or dying vegetation, disease or other infestation problems

### MAINTENANCE PLAN (INITIAL EACH ITEM BELOW)

- \_\_\_\_ Vegetation maintenance and replacement to maintain a minimum 80% coverage/survival rate
- \_\_\_\_ Weed and dead vegetation should be removed on a regular basis. If a certain plant or grass species continues to die, that plant or grass should be replaced with a more tolerant species.
- \_\_\_\_ Certified professionals should be used to apply chemical applications for the control of disease or insects at trouble spot locations
- \_\_\_\_ Trimming and pruning to keep the vegetation aesthetically groomed.

### INSPECTION AND MAINTENANCE AGREEMENT (INITIAL EACH ITEM BELOW)

- \_\_\_\_ The Applicant's facility is a private facility and will not transfer to City or Public ownership by execution of this agreement
- \_\_\_\_ The Applicant acknowledges that the City is under no obligation to maintain or repair the Applicant's facility.
- \_\_\_\_ The Applicant grants the City or its agent the right of entry at reasonable times to inspect the Applicant's facility.
- \_\_\_\_ The Applicant shall provide for adequate long term maintenance and continuation of the approved stormwater technique detailed in this worksheet and the attached information.
- \_\_\_\_ If requested, the Applicant shall submit an annual report detailing the inspections and any associated maintenance performed for the preceding July 1 to June 30 period.
- \_\_\_\_ This agreement is not transferable.

### CERTIFICATION

*I certify that I, the applicant, have the financial resources and will perform inspection and maintenance of this stormwater management facility in accordance with the above Inspection and Maintenance Plans and execute the Inspection and Maintenance Agreement. I also acknowledge that the City of Houston will be provided reasonable access to perform on-site inspection of this facility. I acknowledge that failure to deliver the requirements under these Plans and Agreement may result in a discontinuation of Adjustment applied to Calculated Impervious Surface.*

Signature

Name (printed)

Date



## WORKSHEET B-4 RAIN BARREL OR CISTERN SITES 0 TO 50 ACRES



### SITE INFORMATION

Drainage Account No. \_\_\_\_\_

Property Address \_\_\_\_\_

TOTAL VOLUME REQUESTED FOR THIS TECHNIQUE \_\_\_\_\_  Gallons  Cubic Feet  Acre-Feet

### REQUIRED INFORMATION/ATTACHMENTS

Site Map including property boundaries, structures with roof lines, location of downspouts & rain barrel or cistern location

Volume and number of rain barrels or cisterns

Number of Rain Barrel(s): _____	Size: _____ Gallons	Volume: _____ Gallons
Number of Rain Barrel(s): _____	Size: _____ Gallons	Volume: _____ Gallons
Number of Rain Barrel(s): _____	Size: _____ Gallons	Volume: _____ Gallons
Total Number of Rain Barrel(s): _____		Total Volume: _____ Gallons

### INSPECTION PLAN (INITIAL EACH ITEM BELOW)

\_\_\_ Inspect rain barrel or cistern annually

### MAINTENANCE PLAN (INITIAL EACH ITEM BELOW)

\_\_\_ Empty rain barrel after each rainfall event

### INSPECTION AND MAINTENANCE AGREEMENT (INITIAL EACH ITEM BELOW)

\_\_\_ The Applicant's facility is a private facility and will not transfer to City or Public ownership by execution of this agreement

\_\_\_ The Applicant acknowledges that the City is under no obligation to maintain or repair the Applicant's facility.

\_\_\_ The Applicant grants the City or its agent the right of entry at reasonable times to inspect the Applicant's facility.

\_\_\_ The Applicant shall provide for adequate long term maintenance and continuation of the approved stormwater technique detailed in this worksheet and the attached information.

\_\_\_ If requested, the Applicant shall submit an annual report detailing the inspections and any associated maintenance performed for the preceding July 1 to June 30 period.

\_\_\_ This agreement is not transferable.

### CERTIFICATION

***I certify that I, the applicant, have the financial resources and will perform inspection and maintenance of this stormwater management facility in accordance with the above Inspection and Maintenance Plans and execute the Inspection and Maintenance Agreement. I also acknowledge that the City of Houston will be provided reasonable access to perform on-site inspection of this facility. I acknowledge that failure to deliver the requirements under these Plans and Agreement may result in a discontinuation of Adjustment applied to Calculated Impervious Surface.***

Signature _____	Name (printed) _____	Date _____
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# WORKSHEET B-5 POROUS PAVEMENT SITES 0 TO 50 ACRES



### SITE INFORMATION

Drainage Account No.

Property Address

TOTAL VOLUME REQUESTED FOR THIS TECHNIQUE \_\_\_\_\_  Gallons  Cubic Feet  Acre-Feet

### REQUIRED INFORMATION/ATTACHMENTS

- Site Map including property boundaries, structures and porous pavement
- Infiltration Test results of underlying soil
- Cross-section and subsurface drainage system (if any)
- Volume of storage in porous pavement section
- By checking this box, the applicant confirms that no subsurface drainage system is installed.

### INSPECTION PLAN (INITIAL EACH ITEM BELOW)

- \_\_\_\_\_ Inspect porous pavement monthly for the first three months post construction
- \_\_\_\_\_ Semi-annual inspection to ensure pavement surface is free of sediment
- \_\_\_\_\_ Annually inspect pavement surface and subsurface drainage system (if any) for deterioration, spalling or malfunctioning

### MAINTENANCE PLAN (INITIAL EACH ITEM BELOW)

- \_\_\_\_\_ Quarterly vacuum sweep hard porous pavement by high pressure hosing to keep voids free from sediment
- \_\_\_\_\_ Repair any deterioration, spalling or malfunctioning noted during inspection

### INSPECTION AND MAINTENANCE AGREEMENT (INITIAL EACH ITEM BELOW)

- \_\_\_\_\_ The Applicant's facility is a private facility and will not transfer to City or Public ownership by execution of this agreement
- \_\_\_\_\_ The Applicant acknowledges that the City is under no obligation to maintain or repair the Applicant's facility.
- \_\_\_\_\_ The Applicant grants the City or its agent the right of entry at reasonable times to inspect the Applicant's facility.
- \_\_\_\_\_ The Applicant shall provide for adequate long term maintenance and continuation of the approved stormwater technique detailed in this worksheet and the attached information.
- \_\_\_\_\_ If requested, the Applicant shall submit an annual report detailing the inspections and any associated maintenance performed for the preceding July 1 to June 30 period.
- \_\_\_\_\_ This agreement is not transferable.

### CERTIFICATION

***I certify that I, the applicant, have the financial resources and will perform inspection and maintenance of this stormwater management facility in accordance with the above Inspection and Maintenance Plans and execute the Inspection and Maintenance Agreement. I also acknowledge that the City of Houston will be provided reasonable access to perform on-site inspection of this facility. I acknowledge that failure to deliver the requirements under these Plans and Agreement may result in a discontinuation of Adjustment applied to Calculated Impervious Surface.***

Signature

Name (printed)

Date



**WORKSHEET B-6  
EXCESS DETENTION  
SITES 0 TO 50 ACRES**



**SITE INFORMATION**

Drainage Account No.

Property Address

TOTAL VOLUME REQUESTED FOR THIS TECHNIQUE \_\_\_\_\_  Gallons  Cubic Feet  Acre-Feet

**REQUIRED INFORMATION/ATTACHMENTS**

- |  |   |
|--|---|
| <input type="checkbox"/> Site Map including property boundaries, structures and detention facility | <input type="checkbox"/> Topographic map of detention facility with outfall shown |
| <input type="checkbox"/> Volume of detention or mitigation required for development                | <input type="checkbox"/> Inspection and Maintenance Plan                          |
| <input type="checkbox"/> Volume of detention available in the facility                             | <input type="checkbox"/> Documentation of COH or HCFCD maintenance, if applicable |

**INSPECTION AND MAINTENANCE AGREEMENT (INITIAL EACH ITEM BELOW)**

- \_\_\_\_\_ The Applicant's facility is a private facility and will not transfer to City or Public ownership by execution of this agreement
- \_\_\_\_\_ The Applicant acknowledges that the City is under no obligation to maintain or repair the Applicant's facility.
- \_\_\_\_\_ The Applicant grants the City or its agent the right of entry at reasonable times to inspect the Applicant's facility.
- \_\_\_\_\_ The Applicant shall provide for adequate long term maintenance and continuation of the approved stormwater technique detailed in this worksheet and the attached information.
- \_\_\_\_\_ If requested, the Applicant shall submit an annual report detailing the inspections and any associated maintenance performed for the preceding July 1 to June 30 period.
- \_\_\_\_\_ This agreement is not transferable.

**CERTIFICATION**

*I certify that I, the applicant, have the financial resources and will perform inspection and maintenance of this stormwater management facility in accordance with the above Inspection and Maintenance Plans and execute the Inspection and Maintenance Agreement. I also acknowledge that the City of Houston will be provided reasonable access to perform on-site inspection of this facility. I acknowledge that failure to deliver the requirements under these Plans and Agreement may result in a discontinuation of Adjustment applied to Calculated Impervious Surface.*

Signature	Name (printed)	Date
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## WORKSHEET B-7 MAINTENANCE DREDGING & CHANNEL CLEAN-OUT



### SITE INFORMATION

Drainage Account No.

Property Address

### REQUIRED INFORMATION/ATTACHMENTS

<input type="checkbox"/> Site Map including property boundaries, structures and areas where activities will occur on public property	<input type="checkbox"/> Evidence of necessary permits and/or approvals to perform work
<input type="checkbox"/> Engineering drawings showing proposed cut section	<input type="checkbox"/> Annually submit supporting documents of work performed
<input type="checkbox"/> Engineering calculations detailing volume planned to be removed	<input type="checkbox"/> Other supporting documents required by City Engineer

### INSPECTION AND MAINTENANCE AGREEMENT (INITIAL EACH ITEM BELOW)

- \_\_\_\_\_ The Applicant's facility is a private facility and will not transfer to City or Public ownership by execution of this agreement
- \_\_\_\_\_ The Applicant acknowledges that the City is under no obligation to maintain or repair the Applicant's facility.
- \_\_\_\_\_ The Applicant agrees to provide the City of Houston with reasonable access to the property identified for adjustment in this application.
- \_\_\_\_\_ The Applicant shall provide for adequate long term maintenance and continuation of the approved stormwater technique detailed in this worksheet and the attached information.
- \_\_\_\_\_ The Applicant shall submit an annual report detailing the inspections and any associated maintenance performed for the preceding July 1 to June 30 period.
- \_\_\_\_\_ The Applicant shall submit documents supporting evidence of work performed for the preceding July 1 to June 30 period.
- \_\_\_\_\_ This agreement is not transferable.

### CERTIFICATION

***I certify that I, the applicant, have the financial resources and will perform inspection and maintenance of this stormwater management facility in accordance with the above Inspection and Maintenance Plans and execute the Inspection and Maintenance Agreement. I also acknowledge that the City of Houston will be provided reasonable access to perform on-site inspection of this facility. I acknowledge that failure to deliver the requirements under these Plans and Agreement may result in a discontinuation of Adjustment applied to Calculated Impervious Surface.***

Signature \_\_\_\_\_ Name (printed) \_\_\_\_\_ Date \_\_\_\_\_



## Attachment C

### Adjustment Based on Storage Volume

#### Sites less than 1 acre

Storage Volume Provided			Impervious Area Adjustment	Equivalent Annual Charge		Equivalent Monthly Charge	
Gallons	Cubic Feet	Acre-Feet	Square Feet	SFR Open Ditch	Curb & Gutter	SFR Open Ditch	Curb & Gutter
0	0	0.00	0	\$ -	\$ -	\$ -	\$ -
10	1	0.00	7	\$ 0.17	\$ 0.21	\$ 0.01	\$ 0.02
20	3	0.00	13	\$ 0.35	\$ 0.43	\$ 0.03	\$ 0.04
30	4	0.00	20	\$ 0.52	\$ 0.64	\$ 0.04	\$ 0.05
40	5	0.00	27	\$ 0.70	\$ 0.86	\$ 0.06	\$ 0.07
50	7	0.00	33	\$ 0.87	\$ 1.07	\$ 0.07	\$ 0.09
55	7	0.00	37	\$ 0.96	\$ 1.18	\$ 0.08	\$ 0.10
60	8	0.00	40	\$ 1.04	\$ 1.28	\$ 0.09	\$ 0.11
70	9	0.00	47	\$ 1.22	\$ 1.50	\$ 0.10	\$ 0.12
80	11	0.00	53	\$ 1.39	\$ 1.71	\$ 0.12	\$ 0.14
90	12	0.00	60	\$ 1.56	\$ 1.93	\$ 0.13	\$ 0.16
100	13	0.00	67	\$ 1.74	\$ 2.14	\$ 0.14	\$ 0.18
150	20	0.00	100	\$ 2.61	\$ 3.21	\$ 0.22	\$ 0.27
200	27	0.00	134	\$ 3.48	\$ 4.28	\$ 0.29	\$ 0.36
500	67	0.00	334	\$ 8.69	\$ 10.69	\$ 0.72	\$ 0.89
1000	134	0.00	668	\$ 17.38	\$ 21.39	\$ 1.45	\$ 1.78
2000	267	0.01	1337	\$ 34.76	\$ 42.78	\$ 2.90	\$ 3.56
5000	668	0.02	3342	\$ 86.89	\$ 106.94	\$ 7.24	\$ 8.91
10000	1337	0.03	6684	\$ 173.78	\$ 213.89	\$ 14.48	\$ 17.82
15000	2005	0.05	10026	\$ 260.68	\$ 320.83	\$ 21.72	\$ 26.74
20000	2674	0.06	13368	\$ 347.57	\$ 427.78	\$ 28.96	\$ 35.65
25000	3342	0.08	16710	\$ 434.46	\$ 534.72	\$ 36.21	\$ 44.56
30000	4010	0.09	20052	\$ 521.35	\$ 641.67	\$ 43.45	\$ 53.47
35000	4679	0.11	23394	\$ 608.25	\$ 748.61	\$ 50.69	\$ 62.38
40000	5347	0.12	26736	\$ 695.14	\$ 855.56	\$ 57.93	\$ 71.30
45000	6016	0.14	30078	\$ 782.03	\$ 962.50	\$ 65.17	\$ 80.21
50000	6684	0.15	33420	\$ 868.92	\$ 1,069.44	\$ 72.41	\$ 89.12
55000	7352	0.17	36762	\$ 955.82	\$ 1,176.39	\$ 79.65	\$ 98.03
60000	8021	0.18	40104	\$ 1,042.71	\$ 1,283.33	\$ 86.89	\$ 106.94
65170	8712	0.20	43560	\$ 1,132.56	\$ 1,393.91	\$ 94.38	\$ 116.16

Equivalent Annual and Monthly Charge based on rates of \$0.032 per square foot of impervious cover (\$0.026 for Single Family Residential properties served by Open Ditch systems).



## Attachment D

### Adjustment Based on Storage Volume

#### Sites from 1 to 50 Acres

Storage Volume Provided		Impervious Area Adjustment		Equivalent Annual Charge		Equivalent Monthly Charge	
Acre-Feet	Cubic Feet	Acres	Square Feet	Open Ditch	Curb & Gutter	Open Ditch	Curb & Gutter
0.00	0	0.00	0	\$0.00	\$0.00	\$0.00	\$0.00
0.05	2,178	0.10	4,356	\$113.26	\$139.39	\$9.44	\$11.62
0.10	4,356	0.20	8,712	\$226.51	\$278.78	\$18.88	\$23.23
0.15	6,534	0.30	13,068	\$339.77	\$418.17	\$28.31	\$34.85
0.20	8,712	0.40	17,424	\$453.02	\$557.57	\$37.75	\$46.46
0.25	10,890	0.50	21,780	\$566.28	\$696.96	\$47.19	\$58.08
0.50	21,780	1.00	43,560	\$1,132.56	\$1,393.91	\$94.38	\$116.16
1.00	43,560	2.00	87,120	\$2,265.11	\$2,787.83	\$188.76	\$232.32
2.50	108,900	5.00	217,799	\$5,662.78	\$6,969.57	\$471.90	\$580.80
5.00	217,799	10.00	435,598	\$11,325.55	\$13,939.14	\$943.80	\$1,161.59
7.50	326,699	15.00	653,397	\$16,988.33	\$20,908.71	\$1,415.69	\$1,742.39
10.00	435,598	20.00	871,196	\$22,651.10	\$27,878.28	\$1,887.59	\$2,323.19
12.50	544,498	25.00	1,088,995	\$28,313.88	\$34,847.85	\$2,359.49	\$2,903.99
15.00	653,397	30.00	1,306,794	\$33,976.65	\$41,817.42	\$2,831.39	\$3,484.78
17.50	762,297	35.00	1,524,593	\$39,639.43	\$48,786.99	\$3,303.29	\$4,065.58
20.00	871,196	40.00	1,742,392	\$45,302.20	\$55,756.56	\$3,775.18	\$4,646.38
22.50	980,096	45.00	1,960,192	\$50,964.98	\$62,726.13	\$4,247.08	\$5,227.18
25.00	1,088,995	50.00	2,177,991	\$56,627.76	\$69,695.70	\$4,718.98	\$5,807.97

Equivalent Annual and Monthly Charge based on rates of \$0.032 per square foot of impervious cover (\$0.026 for Single Family Residential properties served by Open Ditch systems).





## **Attachment E**

### **INFILTRATION TESTING AND DOCUMENTATION**

#### **ONLY APPLICABLE TO SITES LESS THAN ONE ACRE**

A simple infiltration test will determine if there is adequate soil infiltration. Follow each of these steps, documenting with photographs to be included in the submittal documentation.

- 1) Dig a 24" round and 24" deep hole and fill it to the top with water
- 2) Allow the water to completely drain out
- 3) Note the time and refill the hole with water, marking the top of the water level from the lowest spot
- 4) Exactly one hour (60 minutes) later, measure from the spot marked in 3) to the top of the water.

If the water has dropped 2 inches or more in that hour, the soils are good enough to handle a stormwater facility that soaks in or infiltrates water.

Note: Sites larger than one acre must provide an infiltration test performed by a professional.



## Attachment F

### SAMPLE APPLICATION (RAIN BARRELS)



## APPLICATION FORM

### ADJUSTMENT TO CALCULATED IMPERVIOUS SURFACE BASED ON APPROVED STORMWATER MANAGEMENT TECHNIQUES



#### APPLICANT INFORMATION

Name: Last <u>DOE</u>		First <u>JOHN</u>	Date <u>9/19/2011</u>
Property Address <u>12345 STREET NAME</u>			
City <u>HOUSTON</u>	State <u>TX</u>	ZIP <u>XXXXX</u>	
Drainage Account No. <u>XXXXXXXXXXXX</u>			
Utility Billing Address <u>12345 STREET NAME</u>		Apartment/Unit # <u>N/A</u>	
City <u>HOUSTON</u>	State <u>TX</u>	ZIP <u>XXXXX</u>	
Phone <u>(XXX) XXX-XXXX</u>	E-mail Address <u>XXX@XXX.COM</u>		
Utility Account No. <u>XXXXXXXXXXXX</u>			

#### STORMWATER MANAGEMENT TECHNIQUE(S) IN USE ON THE BENEFITTED PROPERTY

*(Include Attachment B Worksheet(s) and associated drawings and calculations)*

<input type="checkbox"/> Bioretention	<input type="checkbox"/> Gallons <input type="checkbox"/> Cubic Feet <input type="checkbox"/> Acre-Feet	<input checked="" type="checkbox"/> Rain Barrels or Cisterns	<input checked="" type="checkbox"/> Gallons <input type="checkbox"/> Cubic Feet <input type="checkbox"/> Acre-Feet
<input type="checkbox"/> Infiltration Trench	<input type="checkbox"/> Gallons <input type="checkbox"/> Cubic Feet <input type="checkbox"/> Acre-Feet	<input type="checkbox"/> Porous Pavement	<input type="checkbox"/> Gallons <input type="checkbox"/> Cubic Feet <input type="checkbox"/> Acre-Feet
<input type="checkbox"/> Green Roof	<input type="checkbox"/> Gallons <input type="checkbox"/> Cubic Feet <input type="checkbox"/> Acre-Feet	<input type="checkbox"/> Excess Detention	<input type="checkbox"/> Gallons <input type="checkbox"/> Cubic Feet <input type="checkbox"/> Acre-Feet
<b>TOTAL</b>		<input type="checkbox"/> Gallons <input type="checkbox"/> Cubic Feet <input type="checkbox"/> Acre-Feet	
<input type="checkbox"/> Maintenance Dredging & Channel Clean-Out			

#### DISCLAIMER AND SIGNATURE

*I certify that the attached information is accurate to the best of my knowledge and that I have the authority to make such a request for this property. I agree to provide the City of Houston with corrected information should there be any changes made to the information provided herein. I further agree to provide the City of Houston with reasonable access to the property identified for adjustment in this application.*

Signature <u>John Doe</u>	Name (printed) <u>JOHN DOE</u>	Date <u>9/19/2011</u>
---------------------------	--------------------------------	-----------------------

#### CITY OF HOUSTON USE (DO NOT WRITE IN SHADED AREA)

Date Submitted	Approved	<input type="checkbox"/> YES	<input type="checkbox"/> NO	Total Volume Approved _____	Total SF equiv. _____
Approved By:			Signature:		
Title:			Date:		
Date Response Letter Sent to Applicant Address:					
Date Adjustment Submitted to Billing:					



# WORKSHEET B-1 BIORETENTION WORKSHEET SITES 0 TO 50 ACRES



### SITE INFORMATION

Drainage Account No. XXXXXXXXXXXX

Property Address 12345 STREET NAME

TOTAL VOLUME REQUESTED FOR THIS TECHNIQUE 110  Gallons  Cubic Feet  Acre-Feet

### REQUIRED INFORMATION/ATTACHMENTS

Site Map including property boundaries, structures with roof lines, location of downspouts & rain barrel or cistern location

Volume and number of rain barrels or cisterns

Number of Rain Barrel(s): 2 Size: 55 Gallons Volume: 110 Gallons

Number of Rain Barrel(s): \_\_\_\_\_ Size: \_\_\_\_\_ Gallons Volume: \_\_\_\_\_ Gallons

Number of Rain Barrel(s): \_\_\_\_\_ Size: \_\_\_\_\_ Gallons Volume: \_\_\_\_\_ Gallons

Total Number of Rain Barrel(s): \_\_\_\_\_ Total Volume: \_\_\_\_\_ Gallons

### INSPECTION PLAN (INITIAL EACH ITEM BELOW)

JD Inspect rain barrel or cistern annually

### MAINTENANCE PLAN (INITIAL EACH ITEM BELOW)

JD Empty rain barrel after each rainfall event

### INSPECTION AND MAINTENANCE AGREEMENT (INITIAL EACH ITEM BELOW)

JD The Applicant's facility is a private facility and will not transfer to City or Public ownership by execution of this agreement

JD The Applicant acknowledges that the City is under no obligation to maintain or repair the Applicant's facility.

JD The Applicant grants the City or its agent the right of entry at reasonable times to inspect the Applicant's facility.

JD The Applicant shall provide for adequate long term maintenance and continuation of the approved stormwater technique detailed in this worksheet and the attached information.

JD If requested, the Applicant shall submit an annual report detailing the inspections and any associated maintenance performed for the preceding July 1 to June 30 period.

JD This agreement is not transferable.

### CERTIFICATION

***I certify that I, the applicant, have the financial resources and will perform inspection and maintenance of this stormwater management facility in accordance with the above Inspection and Maintenance Plans and execute the Inspection and Maintenance Agreement. I also acknowledge that the City of Houston will be provided reasonable access to perform on-site inspection of this facility. I acknowledge that failure to deliver the requirements under these Plans and Agreement may result in a discontinuation of Adjustment applied to Calculated Impervious Surface.***

Signature John Doe

Name (printed) JOHN DOE

Date 9/19/2011



# EXAMPLE ADDITIONAL INFORMATION RAIN BARREL APPLICATION



Scale: 1 square = 2 feet

Draw a bird's eye view of your property including the property boundaries, structures with roof lines, location of downspouts, and location of stormwater management technique. Draw arrows showing the



## Attachment G

### Response to Public Comments

#### General Comments

**Comment** 7/26/2011 – Public Comment

It is interesting to me that some of the best engineering minds in Houston have attempted to “dumb down” the subject of approved management techniques of storm water improvements. In doing so, one is proposing stuff that has nothing to do with drainage as “approved techniques” and another engineer is opposing certain techniques on the basis of a an extremely simplified engineering criteria, total discharge.

Excess detention pond capacity may be the only real storm water management technique on the proposed list. That issue is being debated as an all or nothing issue, when it should be evaluated on the relationship of the “rainfall event time” and the “discharge event time”. Councilman Costello touched on this, but only by reference. I guess an honest discussion of “routing a storm hydrograph thru a detention pond” does not make for very interesting public debate.

Economic analysis is another way of evaluating the subject. Assuming the only benefit to the land owner is reducing his Drainage Charge, the maximum value of any technique is the present value of 3.2 cents/square foot over 20 years. At 5% interest that present value is about 40 cents per square foot. In other words a land owner could build something worth \$0.40/square foot now and break even. The trick is to suggest or approve new techniques that cost less than 40 cents but would be of value to the City over the life of the City’s new drainage and paving improvements...say 70 years. Try dumbing this down.

**Response** The current approach using a relationship between impervious surface and storage volume is consistent with adopted City criteria and policy for requiring mitigation for new and increased impervious surface. No change is recommended.

**Comment** 8/2/2011 – Public Comment  
Who would have thought it was this easy?

**Response** No change is recommended.

**Comment** 8/29/2011 – Public Comment

The Houston Parks Board supports the ReBuild Houston program and is interested in working with the City and the community to encourage the use of bioretention, infiltration, porous pavement and excess stormwater detention on private property. Particularly for larger sites, low impact development techniques provide an opportunity to increase greenspace while reducing stormwater runoff volume. These methods are also highly effective in managing the ‘first flush’ of runoff from frequent two-year rainfall events, and can significantly reduce the amount of pollutants draining into our bayous.

Although the proposed guidelines would fulfill the requirement to provide an adjustment on drainage fees based on the creation of storage volume, it seems unlikely that they are sufficient to encourage wide-spread use of these stormwater management tools.



For a typical resident, installation of a rain barrel might be an attractive option, yet the credit for a typical 55 gallon container is only \$1.18. The incentive for the user of a larger site seems higher – providing one acre-foot of storage equals a credit of \$2,787. However the cost to build and properly maintain the detention facilities needed to store over 43,000 cubic feet of water during a rain event is likely to cost far more.

Creating a program that effectively incentivizes responsible stormwater management, rewards solutions that increase neighborhood attractiveness, livability and property values, and reduces flooding while enhancing water quality may require additional research and input. Therefore, we believe the City should evaluate successful programs in other large metropolitan areas, perhaps in conjunction with the Mayor's Office of Sustainability, to identify current best practices.

The solutions that are developed as part of this process could have a significant impact on how our communities look and function. We encourage the City to evaluate a broad range of alternatives, and stand ready to support the Public Works Department, City Council and the Rebuild Oversight Committee in any way we can.

**Response** The approved stormwater management techniques were selected from existing approved stormwater management techniques in the infrastructure design manual and based on the existing relationship between impervious surface and required mitigation volume. It was not the intent of these adjustments to create incentives beyond the equivalent mitigation requirements, nor to investigate alternatives that are not approved in the Infrastructure Design Manual. There is an existing process to incorporate new or additional techniques into the IDM that the Houston Parks Board is encouraged to use.

**Comment** 9/15/2011 – Public Comment  
The drainage fee adjustment allowed for installation of such techniques and will likely result in a low level of participation in seeking such adjustments. For example, the adjustment allowed for installation of a 55-gallon rainfall collection system would only obtain a \$1.18 annual adjustment. The cost of such a system for the equipment alone ranges from \$30 to \$130, thus the payback period for a property owner at this low rate of adjustment would not be a sufficient incentive for wide adoption of such techniques.

**Response** The approved stormwater management techniques were selected from existing approved stormwater management techniques in the infrastructure design manual and based on the existing relationship between impervious surface and required mitigation volume. It was not the intent of these adjustments to create financial incentives beyond the equivalent mitigation requirements. However, a full financial analysis would also need to address reduced potable water use by both choice of landscaping and/or use of collected rainwater instead of treated drinking water in addition to other costs. No change is recommended.

**Comment** 9/15/2011 – Public Comment  
The current draft guidelines allows for up to 100% adjustment to the drainage fee assessed for a property. This fails to recognize that the property would need off property drainage facilities during some severe rainfall events when the rainfall exceeds the capacity of the approved techniques to capture. It also fails to repay the administrative costs to review adjustment applications and verify compliance. We suggest that the maximum allowable adjustment be about 75% of the drainage fee so



that drainage facilities used during severe storm events are borne by the property owner and the cost to administer the program are captured.

**Response** The adjustment is based on storage volume and limited to the full amount of the drainage charge for the design frequencies contemplated in the IDM with minimal administrative burden. No change is recommended.

#### Section I – Background

**Comment** 8/10/2011 – Public Comment

Why is a swimming pool considered an impervious surface when it acts like a retention pond?

**Response** Retention and detention ponds capture runoff from other areas on the site. The area around pools are typically sloped away from the pool. Therefore pools only “collect” the rainwater that falls directly on them and do not collect water from the parcel at large as detention and retention ponds do. Swimming pools have been added to the list of Typical Impervious surfaces (see next two comments).

**Comment** 8/15/2011 – City of Houston Internal Comment

Suggested addition of “swimming pool” to list of Typical Impervious Areas

**Response** Text updated to add swimming pools to the list of typical impervious areas

**Comment** 8/15/2011 – City of Houston Internal Comment

Are amenity lakes, detention pond and retention ponds considered an impervious area?

**Response** These features with a man-made lining are considered impervious. These features that use natural or *in-situ* soils without modification are not considered impervious under Article IV, Chapter 47 of the Code of Ordinances. Text was added within the list of Typical Impervious Areas.

#### Section VI – Inspection and Maintenance

**Comment** 8/15/2011 – City of Houston Internal Comment

How does the City ensure that each approved stormwater management technique in the IDM is properly maintained?

**Response** The applicant acknowledges in the application that they will perform inspection and maintenance, including submitting an annual report documenting such activities. It is the City’s intent to request submission of a random sampling of applicants receiving an adjustment of approximately 10% of the properties with adjustments. No change is recommended.

#### Section VII – Inspection and Maintenance

**Comment** 8/15/2011 – City of Houston Internal Comment

Who would certify that the facility is operating as designed and all inspections and maintenance are current?

**Response** The applicant is required to certify that the approved stormwater management technique is operating as designed. The applicant should obtain plans and/or supporting documents and calculations from the previous owner/applicant and ensure that current system is in accordance with those previously





submitted material. If those documents do not exist, an applicant may create these documents and apply for a new credit with all of the necessary supporting documents. No change is recommended.

#### Section X – Approved Stormwater Management Techniques

**Comment** 7/29/2011 – Public Comment

May a benefitted property claim and obtain credit for existing facilities which are identical to the proposed management techniques, or must one add new managment techniques to obtain credit?

**Response** Applicants may apply for any constructed facility that provides storage in excess of the volume required through normal City review and permitting processes. No change is recommended.

**Comment** 8/15/2011 – City of Houston Internal Comment

Bioretention – According to the IDM, if the in-situ or new soils will not empty the area within 48-hours, a subsurface drainage system may be used. Where will the confirmation that no subsurface system is being used reside?

**Response** The bioretention worksheet has been updated to include a statement that the applicant does not have a subsurface drainage system installed.

**Comment** 8/15/2011 – City of Houston Internal Comment

Bioretention – Is the plan reviewed annually? Would the facility be inspected annually?

**Response** The bioretention worksheet details inspection requirements. No change is recommended.

**Comment** 8/15/2011 – City of Houston Internal Comment

Infiltration – According to the IDM, if the in-situ or new soils infiltrate less than 0.5” per hour, a subsurface drainage system must be used. Where will the confirmation that no subsurface system is being used reside?

**Response** The infiltration worksheet has been updated to include a statement that the applicant does not have a subsurface drainage system installed.

**Comment** 8/15/2011 – City of Houston Internal Comment

Infiltration – Is the plan reviewed annually? Would the facility be inspected annually?

**Response** The infiltration worksheet details inspection requirements. No change is recommended.

**Comment** 8/15/2011 – City of Houston Internal Comment

Green Roof – Is the plan reviewed annually? Would the facility be inspected annually?

**Response** The green roof worksheet details inspection requirements . No change is recommended.

**Comment** 8/15/2011 – City of Houston Internal Comment

Porous Pavement – According to the IDM, if the in-situ or new soils infiltrate less than 0.5” per hour, a subsurface drainage system must be used. Where will the confirmation that no subsurface system is being used reside?

**Response** The porous pavement worksheet has been updated to include a statement that the applicant does not have a subsurface drainage system installed.



**Comment** 8/15/2011 – City of Houston Internal Comment  
Porous pavement – Is the plan reviewed annually? Would the facility be inspected annually?

**Response** The porous pavement worksheet details inspection requirements. No change is recommended.

**Comment** 8/15/2011 – City of Houston Internal Comment  
Porous pavement – How will the City ensure that required cleaning and inspection is happening?

**Response** The porous pavement worksheet details inspection requirements . No change is recommended.

#### Appendix E – Infiltration Testing and Documentation

**Comment** 8/15/2011 – City of Houston Internal Comment  
Non-residential properties should not be allowed to perform the “do-it-yourself” infiltration test. This should be limited to single family residential properties.

**Response** The appendix has been updated to reflect that only single family residential parcels of less than one-acre can use the simplified infiltration test.