City of Corpus Christi

Storm Water Management Policies

Final Draft

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INTRODUCTION

Storm Water Management

Storm water management is an essential component of community infrastructure and serves to provide both increased convenience and protection of lives and property. A properly designed system will detain and/or carry away runoff from more frequent rainfall events while allowing the movement of vehicles to homes and businesses. Such a system will also detain and/or drain storm waters from an infrequent "extreme rainfall" event so that habitable structures are not damaged and major streets are passable to public safety vehicles.

Drainage systems also impact the water quality of the natural waterways that receive the area's rainfall runoff. Creeks, rivers and bays provide wildlife habitat and support commercial and recreational fisheries, boating and nature tourism. They are fundamental to the quality of life in the region.

Providing Corpus Christi with a storm water management system that allows sustainable community growth is a continuing challenge. It involves setting minimum standards, planning for future detention basins and drainage channels, working with private development interests, coordinating with governmental agencies, and maintaining the efficiency of the existing system of culverts, pipes, open channels and other structures.

Recognizing that storm water system development should be guided by adopted policies and a comprehensive plan, the City of Corpus Christi launched a planning process aimed at setting consistent standards responsive to the needs of property developers and design engineers and compliant with federal, and state regulations.

The technological components used for mapping and modeling software are described below:

Airborne Light Detection and Ranging (LIDAR) technology gathered the data necessary to create digital elevation models (DEMs) for production of a 2-foot contour digital terrain map and hydraulic modeling. The contour map was tied to the City's adjusted GIS basemap in an Arc Info format.

The US Army Corps of Engineers Hydrologic Modeling System (HEC-HMS) is applicable in a wide range of geographic areas for solving a wide range of hydrologic problems. This includes large river basin water supply and flood hydrology and small urban or natural watershed runoff. Hydrographs produced by this program can be used directly or in conjunction with other software for studies of water availability, urban drainage, flow forecasting, future urbanization impact, reservoir spillway design, flood damage reduction, flood plain regulation, and systems operation.

The US Army Corps of Engineers River Analysis System (HEC-RAS) allows the user to perform one-dimensional hydraulic calculations for a full network of natural and constructed channels.

This ***Storm Water Master Plan*** and supporting ***Storm Water Drainage Criteria and Design Manual*** applies to all areas within City jurisdiction.

In summary, the results envisioned for the Storm Water Master Plan Project include:

- Up-to-date hydrologic and topographic information in a digital ***Geographic Information System ("G.I.S.")*** format that may be used to analyze storm water drainage and water quality issues;
- Contour maps of the City with drainage basin and sub-basin boundaries delineated in an updated master plan;
- Adopted City policies that address drainage and water quality issues; policies that will guide storm water management within the City's jurisdiction;
- The establishment of levels of protection that limit property damage and are acceptable to the community;
- Consistent criteria and design procedures for public and private development projects; and,
- Guidance for compliance with State and Federal water quality regulations.

Background

The City of Corpus Christi (City), a Texas home-rule municipal corporation, recognizes the importance of consistent, uniform and integrated management of storm water operations, design standards and capital improvements within its jurisdiction.

Although semi-arid for most of the year, the region is occasionally subjected to brief but intense rainstorms and heavy, long-duration precipitation events associated with winter and tropical storms and hurricanes. The natural topography is very flat with steep bluffs along Nueces Bay and Corpus Christi Bay. Natural drainage for much of the area within the city limits is to Oso Creek and Oso Bay. Smaller areas drain naturally to Corpus Christi Bay, Nueces Bay, Corpus Christi Ship Channel, the Nueces River, Laguna Madre and the Gulf of Mexico.

The City's existing storm water drainage system was built incrementally over more than 100 years. The system is the result of shared responsibility between the City and private property developers. Although private interests have built much of the infrastructure, the City remains responsible for the planning, operation, maintenance and rehabilitation of the storm water system.

Historical Perspective

In October of 1946, a study entitled "A Report on a Storm Sewer System" prepared by Myers & Noyes Consulting Engineers first established the hydraulic parameters and technical criteria used in the design of a large drainage system within the city. This system was comprised of 15 areas on the City's north side and along Corpus Christi Bay that required coordinated design. The 1946 report served for many years as the de-facto criteria used to design drainage structures in the city.

Subsequently a series of Master Plans were developed to guide city growth.

- "Southside Master Plan" (1961 by Blucher and Naismith);
- "West of Clarkwood Road and Flour Bluff Master Plan" (1970 by Naismith Engineering, Inc.);
- "Five Points Master Plan - West of Calallen" (1982 by Naismith Engineering, Inc.); and
- "South of Oso Creek" (1988 – Draft* by Naismith Engineering, Inc.) [Note: The City has not adopted this master plan].

These master plans have historically been inconsistent with each other and do not cover the City's entire jurisdictional area. The City has previously relied on these master plans pending adoption of a more comprehensive ***Storm Water Master Plan***.

Regulatory Perspective

The 1972 amendment to the Federal Water Pollution Control Act ***(Clean Water Act - CWA)*** prohibits discharge of any pollutant into the waters of the United States from a point source unless the discharge is authorized by a ***National Pollutant Discharge Elimination System (NPDES)*** permit.

The Congress of the United States further amended the Clean Water Act in 1987 and required the United States ***Environmental Protection Agency (EPA)*** to establish NPDES requirements for storm water discharges. On November 16, 1990, the EPA published (55 Federal Register 47990) initial permit applications for 11 categories of storm water discharges associated with industrial activity and from drainage systems located in municipalities with a population of 100,000 or more.

In 1995, the City of Corpus Christi, along with its co-permittees (TxDOT, the Port of Corpus Christi Authority, Del Mar College and Texas A&M University-Corpus Christi), was issued a ***Municipal Separate Storm Sewer Systems*** (***MS4***) NPDES permit.

In 1998, the State of Texas assumed the authority to administer the NPDES permitting program in Texas. The ***Texas Natural Resource Conservation Commission's (TNRCC) Texas Pollutant Discharge Elimination System (TPDES)*** program now has federal regulatory authority over discharges of pollutants to Texas surface waters.

Texas House Bill 2912 included a provision to change the TNRCC's name to the Texas Commission on Environmental Quality by January 1, 2004. On September 1, 2002, the TNRCC formally changed its name and began doing business as the Texas Commission on Environmental Quality, or the TCEQ.

The agency name change does NOT affect any provisions, permits, registrations, or any other paperwork or transactions between the public and the TNRCC prior to September 1, 2002. As of May 2002, the City was awaiting TNRCC renewal of its MS4 permit (TXS000601) which expired on June 1, 2000, but remains in effect.

Level of Protection

Fundamental to this Storm Water Master Plan is the establishment of ***Level of Protection (LOP)*** standards. These LOP's are the community's benchmark for measuring the performance and associated risk in the design and upgrade of specific components of the storm water system. A LOP is that depth and/or spread of storm water that a community decides is acceptable given a storm event of a certain frequency, duration and intensity. In setting LOP's, a community must balance capital improvement costs against property protection and convenience benefits.

Different LOP standards apply to various categories of drainage components including streets and right-of-ways (which play an important part in storm water management). LOP standards are set out in detail in the "Flood Protection" and "Drainage" sections of this document. In all cases the recommended LOP is aimed at keeping storm water below habitable residential and business structures. The following table summarizes LOP standards adopted by the City.

Level of Protection Summary for Corpus Christi

COMPONENT CATEGORY	L.O.P. STANDARD Design Storm Event Frequency (Years)			
	5	25	50	100
Rural Roads				
Storm water contained within adjacent ditch	●			
Storm water below adjacent habitable structures				●
Local Streets				
Ponding contained below top-of-curb	●			
Storm water below adjacent habitable structures				●
Residential and Commercial Collector Streets				
Minimum of one traffic lane open in each direction	●			
Storm water below adjacent habitable structures				●
Arterial Streets				
Ponding limited to outside lanes		●		
Storm water below adjacent habitable structures				●
Major Highways and Freeways				
Main lanes open			●	
Storm water below adjacent habitable structures				●
Inlets				
On-grade – See ponding & spread of water limits above	●			
Sump/Sag – See ponding & spread of water limits above	●			
Minor Drainage System Components				
Underground Storm Sewers (HGL below gutters and rims)	●			
Minor Channels (1 foot freeboard above water surface)*	●			
Minor Channel Crossings – Culverts (1 foot freeboard)*	●			
Minor Channel Crossings – Bridges (1 foot freeboard)*	●			
Collector Drainage System Components				
Underground Storm Sewers (HGL below gutters and rims)		●		
Collector Channels (1 foot freeboard above water surface)		●		
Collector Channel Crossings – Culverts (1 foot freeboard)		●		
Collector Channel Crossings – Bridges (1 foot freeboard)		●		
Major Drainage System Components				
Enclosed pipe & box systems (HGL below gutters & rims)				●
Major Channels (2 foot freeboard above water surface)				●
Major Channel Crossings – Culverts (2 foot freeboard)				●
Major Channel Crossings – Bridges (2 foot freeboard)				●
Pump Stations				●
Seawalls and Associated Outlet Control Structures				●
Extreme Event Overflow (Structure Flood Prevention)				●
● = Conveys Design Storm Event				

* Note: New "Minor Channels" are prohibited. These LOP's are for existing minor channels, where replacement with an underground storm sewer is not feasible.

As adopted, these LOP standards apply to all new drainage facilities, roadways and crossing structures within the City's jurisdiction. Where feasible, these standards also apply to improvements to the existing drainage system.

Organization and Structure

The Storm Water Master Plan reflects the direction that the City expects to take with regard to storm water management within its jurisdiction. This vision is supported by ***Storm Water Management Policies*** which establish the regulatory framework for implementing the Storm Water Master Plan and its supporting Storm Water Drainage Criteria & Design Manual.

The Storm Water Management Policies document addresses a number of important issues related to **Flood Protection, Drainage, City/Developer Participation, Maintenance, Water Quality,** and **Quality of Life.**

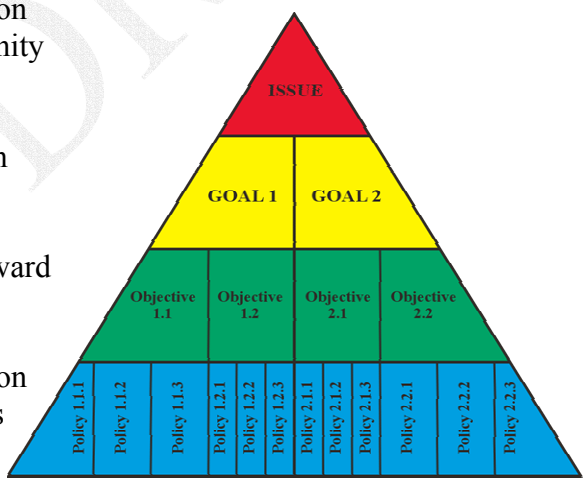
Each successive level of an ***"Issue Pyramid"*** supports the next. The four levels are described as follows:

Issue: A broad area of consideration that determines the community standard.

Goal: The community's aspiration on a particular issue.

Objective: A performance measure toward the achievement of a goal.

Policy: A plan or course of action intended to guide decisions and actions.



"ISSUE PYRAMID"

Criteria:

More detailed requirements on the analysis and design of storm water system components, and operating procedures, are defined as ***Criteria*** and are provided in the City's "*Storm Water Drainage Criteria and Design Manual*". These more detailed requirements will be consistent with and support the policies herein. Therefore, criteria are defined as technical or procedural standards that implement policies.

Note: The policy statements shown in the following pages were authored prior to their adoption and prior to the creation of supporting documents such as the "Storm Water Master Plan" and the "Storm Water Drainage Criteria and Design Manual", the grammatical tense of the policy statements and references to their supporting documents, are based upon the assumption that these will all exist and will all be adopted by the City Council.

ISSUE: FLOOD PROTECTION

GOAL FP-1: PROTECT COMMUNITY LIFE & PROPERTY

Background: The City has a flood protection and drainage system in place to help protect life and property from flood events. The system includes the bayfront seawall & levees, pump stations in the Central Business District, and various open and closed storm water conveyance conduits throughout the rest of the City's jurisdiction. Policies and criteria consistent with State of Texas drainage law governing the design, construction, operation and maintenance of the City's drainage system make up the regulatory framework for providing flood protection.

Objective FP-1.1: Minimize Potential Flood Damage to Homes and Businesses

Policy FP-1.1.1 Existing Developed Areas.
Where feasible, drainage system improvements and flood damage reduction measures should be implemented to address and reduce existing flooding problems.

Policy FP-1.1.2 New Construction.
New construction in ***Special Flood Hazard Areas*** (as defined by the Federal Emergency Management Agency - ***"FEMA"***) must have a minimum first floor elevation of 15 inches above the ***Base Flood Elevation - "BFE"*** (per the current, applicable FEMA - ***Flood Insurance Rate Map - "FIRM")*** or 18 inches above the lowest adjacent top-of-curb, whichever is higher.

In those locations outside of any Special Flood Hazard Areas, new construction must have a minimum first floor elevation of 18 inches above the lowest adjacent top-of-curb or crown of road if uncurbed.

Policy FP-1.1.3 Extreme Event Overflow.
New drainage systems must include provisions in the design that prevent the flooding of structures, by detaining and/or conveying the overland flow caused by a 100-year design storm without exceeding the lowest finished floor elevation of adjacent habitable structures or critical facilities.

Overland flow paths may include streets, swales and open areas. Drainage systems must be designed to avoid the creation of "depressed" or "bowl" areas that allow water levels to rise above the finished floor elevation of existing or proposed structures.

Where feasible, the extreme event overflow will be included in the design of in-fill and redevelopment projects. The Director of Engineering Services is authorized to determine the site-specific 100-year overland flow requirements for those project sites surrounded by existing development.

The City will develop ordinances that preclude property owners from blocking extreme event overflow corridors with obstructions such as, but not limited to, buildings, sheds, and fill materials and landscape alterations.

Policy FP-1.1.4 Comply with FEMA Requirements.
As a participant in the ***National Flood Insurance Program - "NFIP"***, the City has adopted a flood plain management ordinance that is consistent with the FEMA model ordinance. Chapter 13 of the City Code of Ordinances, Article V, Flood Hazard Prevention Code regulates development in Special Flood Hazard Areas as delineated by FIRM maps.

Policy FP-1.1.5 Floodway Development Restrictions.
Development in delineated ***floodways*** is restricted. Limited development may be allowed when a hydraulic analysis performed by a Licensed Professional Engineer (State of Texas) demonstrates that the proposed development will not increase Base Flood Elevation and floodway elevations upstream. Floodways development must not adversely impact properties upstream and downstream of development.

Objective FP-1.2: Minimize "Adverse Water Quantity Impacts" to Adjacent Property Owners

According to Section 11.086 of the Texas Administrative Code, property owners are not permitted to adversely affect drainage conditions of neighboring properties.

Policy FP-1.2.1 Adverse Water Quantity Impacts.
Adverse water quantity impacts must be as defined in the Storm Water Drainage Criteria and Design Manual and must include factors such as:

a) Increases in peak discharges;
b) Increases in flood stage, exceeding outfall channel design capacity;
c) Increases in design flood velocity; and,
d) Diversions to adjacent property.

The City's Storm Water Master Plan anticipates the effects of future development. The estimated hydrological impact of future development is based upon land use projections adopted by the City's ***Area Development Plans***. If a proposed development represents a more intensive land use than assumed by the City's Storm Water Master Plan, then the project ***proponent*** shall be responsible for identifying, quantifying and mitigating the additional impacts to the drainage basin. Proponent mitigation may include an application for credit if another section of the proposed development represents a less intensive land use than assumed by the City's Storm Water Master Plan.

Policy FP-1.2.2 Combined Impacts:
The City will serve as custodian of the latest version of Storm Water Master Plan computations and/or analyses. This information will be available to those who are analyzing or designing storm water facilities under the City's jurisdiction.

A project ***proponent*** shall submit to the City staff for review and approval, a drainage report detailing the hydrologic and hydraulic analysis used to support the project. Once approved, the City will use the approved computations and/or analyses as the most current version of the Storm Water Master Plan and will make said computations, analyses and current plan available for public use.

Policy FP-1.2.3 Regional Detention:
Regional storm water detention is one option commonly used to prevent or reduce flooding. These regional facilities are public improvements used to store storm water runoff from multiple properties within a watershed to reduce the peak discharge flow rate downstream of the facility. The City will determine when and where to construct regional storm water detention facilities. Design of these facilities must be in accordance with the Storm Water Drainage Criteria and Design Manual. The City is responsible for maintenance of regional detention facilities.

Policy FP-1.2.4 Local Detention:
Local on-site detention facilities are private improvements and are an acceptable option for mitigating impacts associated with development. They are used to store storm water runoff from a single property and reduce the peak discharge flow rate from the site. Design of these facilities must be in accordance with the Storm Water Drainage Criteria and Design Manual. Maintenance of local detention basins is the responsibility of the property owner.

On-site local detention facilities will earn landscaping and/or park dedication credits that can be used towards fulfilling parcel development requirements.

Policy FP-1.2.5 Master Plan Channels & Right-of-Way.
Master plan drainage corridors and channels will be designed to convey runoff quantity estimates derived from the anticipated ultimate development of the serviced watershed. Public and private interests planning new drainage improvement projects shall abide by and use Storm Water Master Plan guidance and information.

ISSUE: DRAINAGE

GOAL D-1: CONVEY STORM WATER RUNOFF EFFICIENTLY

Background: The City of Corpus Christi has a drainage system in place to convey storm water. This system consists of:

a) Rural Roads with Drainage Swales and Local Streets with Curb & Gutter;
b) Inlets;
c) Minor Underground Storm Sewers;
d) Minor Channels;
e) Minor Channel Crossing Structures;
f) Collector Underground Storm Sewers;
g) Collector Channels;
h) Collector Channel Crossing Structures;
i) Major Enclosed Storm Drain Pipe and Box Systems;
j) Major Channels;
k) Major Channel Crossing Structures;
l) Pump Stations; and,
m) Seawalls and Associated Outlet Control Structures.

The purpose of the storm water drainage system is to convey storm water away from developed areas to natural drainage outfalls.

Public streets and right-of-ways are an integral part of the drainage system, because they can temporarily hold, then convey storm water during severe rainfall events.

Objective D-1.1: Define Design Storms and Levels of Protection
Policies under this objective address both existing and new storm water drainage system components. Level of Protection standards are summarized in the table on page 4.

Existing System Component Upgrades. The policy for reconstructing existing system components is to upgrade to current standards where ***"feasible"***. This means that, where feasible, the City, and those involved in redevelopment:

- will upgrade components of an existing storm water conveyance system to accommodate the design storm; and,
- will provide Levels of Protection equivalent to those established for new component construction.

A hierarchy and prioritization of needs, based upon drainage complaints, history of localized flooding and actual property damage will determine improvement and upgrade priorities as established by the City. However, the policy language is not intended to require the City to undergo a comprehensive, feasibility study of the entire existing system to determine whether components can be upgraded to the adopted Level of

Protection. Upgrades will be considered on a case-by-case basis when improvements to an existing system are being planned either as a City ***Capital Improvement Program (CIP)*** project or as a proposed land owner re-development project.

Where feasible, when reconstructed, existing major channels will be upgraded to the extent practical considering right-of-way, water surface and freeboard limitations outlined for new major channels.

Example upgrades to existing major channels include widening of the channel, providing vertical sidewalls along the lower portions of existing trapezoidal shaped cross sections, and adding raised earth berms along the right-of-way while providing greenways to accommodate channel overbank flows.

New System Components. New drainage system components must be designed and constructed to meet the levels of protection outlined herein, and must utilize the "design storm" methodologies described in the City's Storm Water Drainage Criteria and Design Manual.

Minor Storm Sewer Improvements. "Minor Storm Sewer Improvements" must be sized to meet requirements of the 5-year design storm event. Minor Storm Sewer Improvements:

- must be used for local residential, commercial and industrial development less than 200 acres in size;
- must convey runoff from local residential, rural road and residential collector streets;
- for both on and off-site, must be designed as a closed conduit to the full capacity for the local service area; and,
- for rural road sections, may be roadside ditches.

Collector System Improvements. "Collector System Improvements" must be sized to meet requirements of the 25-year design storm event. Collector system improvements:

- must convey the area runoff from 200-500 acres;
- must convey runoff from commercial collector and arterial streets;
- must be designed as either open or closed conduit to full capacity of the service area; and,
- must be designed to convey runoff from assigned minor system sewer connections.

Major System Improvements. **"**Major System Improvements" must be sized to meet requirements of the 100-year design storm event. Major system improvements:

- must convey runoff for an area greater than 500 acres in size;

- must convey runoff from major highways and freeways;
- must be designed as either open or closed conduit to full capacity of the service area; and,
- must be designed to accept runoff from assigned minor and collector system connections.

Tailwater Effects. Due to the flat topography of the Corpus Christi region, design engineers shall ensure that downstream ***tailwater*** effects have been considered in their hydraulic analyses for both new and upgraded storm water system components.

Extreme Event Overflow. In addition, design engineers shall ensure that storm water conveyance systems comply with the provisions of Flood Protection Policy FP 1.1.3, "Extreme Event Overflow".

Given the background and introductory information outlined above, in order to meet the Objective of D-1.1, "Define Design Storms and Levels of Protection", the following policies govern:

Policy D-1.1.1 Storm Water Drainage System Components

a) **Rural Roads with Drainage Ditches and Urban Streets with Curb & Gutter.** The following policies apply to rural roads (no curb and gutter), and urban streets with associated curb and gutter systems. These components must be designed in accordance with the Storm Water Drainage Criteria and Design Manual.

Rural Roads - Rural roads must convey the 5-year design storm within the adjacent drainage ditch without encroaching into the travel lanes of the roadway and must detain and/or convey the 100-year design storm without exceeding the lowest finished floor elevation of adjacent habitable structures and critical facilities.

Local Streets - Local streets must convey the 5-year design storm without ponding overtopping the top-of-curb and must detain and/or convey the 100-year design storm without ponding exceeding the lowest finished floor elevation of adjacent habitable structures and critical facilities.

Collectors- Collector Streets (Residential and Commercial) must convey the 5-year design storm, limiting the depth and spread of ponding to allow a minimum of one open lane of traffic in each direction and must detain and/or convey the 100-year design storm without ponding exceeding the lowest finished floor elevation of adjacent habitable structures and critical facilities.

Arterials - Arterials must convey the 25-year design storm, limiting the depth and spread of ponding to the outside lane of parking or traffic (if no parking) and must detain and/or convey the 100-year design storm without ponding exceeding the lowest finished floor elevation of adjacent habitable structures and critical facilities.

Freeways - Freeways constructed within the jurisdiction of the City of Corpus Christi must convey the 50-year design storm without encroaching upon the main lanes of travel, and must detain and/or convey the 100-year design storm without ponding exceeding the lowest finished floor elevation of adjacent habitable structures and critical facilities.

b) Inlets. Inlets on-grade must intercept 5-year design storm, rural road swale or side ditch and urban street flows prior to or upon equaling ponding depth and spread-of-water limits. Storm water flows in excess of the capacity of an ***on-grade inlet*** must be conveyed to the next inlet downstream, along with any additional runoff generated along the flow path, without exceeding the ponding depth and spread of water limits appropriate to the type of rural road or street classification.

Sump or Sag inlets must capture the 5-year design storm, rural road swale and urban street flows prior to or upon equaling the ponding depth and spread-of-water limits. "Extreme event overflow" conveyance at new sump or sag inlets must comply with the provisions of Flood Protection Policy FP-1.1.3.

c) Minor Underground Storm Sewers. Minor underground storm sewers must be designed with a 5-year design storm. The design ***hydraulic grade line (HGL)*** must be limited to an elevation 6-inches below the gutter line at inlets and 12-inches below the rim elevation at manholes.

d) Minor Channels. Because of historical difficulties with maintenance, and to eliminate the aesthetic problems associated with minor channels, the construction of new minor channels must be prohibited. Where a minor system is warranted for the conveyance of storm water, minor underground storm sewers must be designed and constructed in lieu of an open minor channel system. Ditches adjacent to rural road sections and temporary private ditches are exceptions to this policy.

For upgrades to existing minor channels, where replacement with an underground storm sewer is deemed unfeasible, the existing minor channel will convey the, 5-year design storm. The design water surface elevation will be limited to an elevation one foot below the top of the channel (1 foot of "***freeboard***").

e) **Minor Channel Crossing Structures.** New minor channel crossing structures must be prohibited; underground storm sewers must be utilized.

Regarding upgrades to minor channel crossing structures, which include culverts and bridges at rural (non-highway) roads, and local and collector (residential and commercial) streets: where replacement with an underground system is deemed unfeasible, these structures will be upgraded to convey the 5-year design storm, and the design water surface elevation must be limited to an elevation 1-foot below the top of channel (1-foot of "freeboard").

f) **Collector Underground Storm Sewers.** Collector underground storm sewers must be designed with a 25-year design storm. The design ***hydraulic grade line (HGL)*** must be limited to an elevation 6-inches below the gutter line at inlets and 12-inches below the rim elevation at manholes.

g) **Collector Channels.** Collector channels must be designed with a 25-year design storm. The design water surface elevation must be limited to an elevation 1-foot below the top of the channel (1-foot of "freeboard").

h) **Collector Channel Crossing Structures.** Collector channel crossing structures, which include culverts and bridges at rural (non-highway) roads, and local and collector (residential and commercial) streets, must be designed with a 25-year design storm. The design water surface elevation must be limited to an elevation 1-foot below the top of the channel (1-foot of "freeboard").

i) **Major Enclosed Storm Drain Pipe and Box Systems.** Major enclosed storm drain pipe and box systems must be designed with a 100-year design storm. The design HGL must be limited to an elevation 6-inches below the gutter line at inlets and 12-inches below the rim elevation at manholes.

j) **Major Channels.** Major channels must be designed with a 100-year design storm. The design water surface elevation must be limited to an elevation 2-feet below the top of the channel (2 feet of "freeboard").

k) **Major Channel Crossing Structures.** Major channel crossing structures, which include culverts and bridges at arterial streets, railroads and State highways, must be designed with a 100-year design storm. The design water surface elevation must be limited to an elevation 2-feet below the top of the channel (2-foot of "freeboard").

l) **Pump Stations.** Pump stations must be designed with a 100-year design storm.

m) **Seawalls and Associated Outlet Control Structures.** The design and/or reconstruction of seawalls and their associated outlet control structures must comply with the provisions of State and Federal Agencies under whose

jurisdiction they fall. Unless superseded by more stringent State and/or Federal criteria, at a minimum, the 100-year design storm governs the design of seawall/outlet-related storm conveyance systems.

GOAL D-2: IMPLEMENT STORM WATER MANAGEMENT METHODS

Background: The City is responsible for the overall planning and implementation of surface and sub-surface drainage systems in its jurisdiction. The City is also responsible for flood plain management and controlling the introduction of construction, industrial and municipal pollutants into storm water runoff.

Comprehensive storm water management planning and policy tools combined with technically correct design procedures will foster consistent application of storm water management practices within the city. The City will enforce provisions of the Storm Water Master Plan and supporting Storm Water Drainage Criteria and Design Manual. These documents provide the technical and procedural guidance necessary to support analysis and design of storm water detention and conveyance facilities located within the City's jurisdiction.

Objective D-2.1: Compliance w/ Storm Water Drainage Criteria & Design Manual

In 2003, a Storm Water Drainage Criteria and Design Manual was prepared to serve as the technical guidance for the City's Storm Water Master Plan.

Policy D-2.1.1 Compliance w/Storm Water Drainage Criteria & Design Manual.
Engineering design of storm water facilities in the City and its ETJ must be performed in accordance with the City's Storm Water Drainage Criteria and Design Manual.

Objective D-2.2: Improve Storm Water System Design Process

Policy D-2.2.1 Storm Water System Design Review.
City staff will review and approve storm water detention and conveyance facility designs and documentation in accordance with the City's Storm Water Master Plan and the City's Storm Water Drainage Criteria and Design Manual.

Policy D-2.2.2 Updated Design Information.
Design storms and methods of hydrologic and hydraulic computations will be based on updated information. The City's Storm Water Master Plan will be based on current adopted plans within the watershed.

Policy D-2.2.3 Current Hydrological Information.
The City should continue to collect additional rainfall data from an expanded system of rainfall collection and measurement stations. Using this additional rainfall information, and when appropriate, the City will periodically review and revise the hydrologic analysis parameters located within the Storm Water Master Plan and the Storm Water Drainage Criteria and Design Manual.

ISSUE: CITY/DEVELOPER PARTICIPATION

GOAL CD-1: DEFINE CITY / DEVELOPER PARTICIPATION

Background: The City shares the responsibility for development of storm water system improvements with private and public development interests and agencies (referred to here as the "Developer"). It is important that roles and responsibilities of each party are clearly defined and understood. The purpose of these City/Developer Participation policies is to define these roles and responsibilities.

Objective CD-1.1: Define Storm Water System Responsibilities

Policy CD-1.1.1 Storm Water System - Project Criteria.

The Storm Water Master Plan and Storm Water Drainage Criteria and Design Manual governs the planning, design and construction of storm water system improvements within City jurisdiction.

a) **Authority.** The Storm Water Master Plan and Storm Water Drainage Criteria and Design Manual are adopted by the City Council. The Director of Engineering Services is authorized to approve technical updates and corrections to the Storm Water Master Plan and Storm Water Drainage Criteria and Design Manual. Non-technical revisions to the adopted documents will be made by amendment approval by the City Council.

b) **Public Access.** The City will make available to the public the Storm Water Master Plan, associated topographic mapping, the Storm Water Drainage Criteria and Design Manual, and related hydrologic and hydraulic analysis tools. The City may develop an administrative fee schedule to cover publication and reproduction costs.

c) **Plan and Drainage Report Submission.** When proposing storm water system improvements, the Developer is responsible for submitting for review and approval, engineered construction drawings and a supporting drainage analysis report in conformance with the City's Drainage Criteria and Design Manual. The Developer is responsible for initiating basin hydrologic and hydraulic analysis for areas not yet addressed by the Storm Water Master Plan. A Licensed Professional Engineer authorized to practice in the State of Texas shall prepare plans and drainage analysis reports.

d) **Plan Review.**

The Developer is responsible for any applicable basin hydrologic and hydraulic analysis. Engineering analysis will be prepared and submitted by a Licensed Professional Engineer who is authorized to practice in the State of Texas.

The City is responsible for review and approval of submitted storm water system engineering analysis and construction plans. City review and approval will be by a Licensed Professional Engineer who is authorized to practice in the State of Texas.

Prior to formal review, the City will conduct an administrative review for submission completeness. City plan review comments will be returned to the Developer within 30 calendar days of the date of determination of plan submission completeness.

e) Variance Procedure. The project proponent is responsible for identifying, analyzing, requesting, documenting and mitigating non-conforming development. The Director of Engineering Services has authority to review and approve storm water system improvement design variances. The Director of Engineering Services is authorized to determine if the proposed non-conforming development is eligible for a design variance or is subject to master plan amendment. Requested or directed amendments to the Storm Water Master Plan must be presented to the Planning Commission for an approval recommendation. Then, prior to project construction plan approval, City Council adoption of the applicable Storm Water Master Plan amendment is required.

f) Construction Inspection and Acceptance. The City is responsible for inspecting and accepting the construction of storm water system improvements. The Developer is responsible for constructing storm water system improvements in conformance with approved plans and specifications.

g) Project Close Out. The Developer is responsible for ensuring requisite drainage right-of-way and/or easements are in place prior to City acceptance of public infrastructure. Completion of drainage right-of-way/easement submission compliance is a requirement for plat approval. The City may withhold public infrastructure improvement acceptance pending receipt of the required parcel instrument and/or the record drawings, formatted as prescribed by the City and signed and sealed by the Engineer-of-Record. If necessary, the City may withhold issuance of building occupancy permits and terminate temporary utility service to the subdivision to secure the record drawings.

Policy CD-1.1.2 Storm Water System - Drainage Right-of-Way.

The Storm Water Master Plan and Storm Water Drainage Criteria and Design Manual defines ***drainage right-of-way*** requirements for storm water system improvements within City jurisdiction.

a) Usage. Drainage right-of-way will be acquired by dedication for Collector and Major System Improvements.

b) Delineation. The City is responsible for delineating and/or determining the 100-year flood elevation in natural drainage ways; future greenways and habitat

protection features; and drainage right-of-way width and location requirements for collector and major system improvements and regional detention facilities.

When submitting an independent hydrologic and hydraulic analysis for City review and approval, the Developer shall delineate the proposed right-of-way parcel requirements.

c) Acquisition and Dedication. The City is responsible for the overall planning, acceptance and acquisition of drainage right-of-way.

The Developer is responsible for dedicating requisite on-site drainage right-of-way. For on-site dedication of land in excess of the parcel requirements, a credit in lieu of park dedication will be given.

When development precedes City acquisition, the Developer is responsible for securing and dedicating requisite off-site drainage right-of-way. Subject to availability of funding, the City will participate in the Developer's off-site dedication efforts. The Developer is responsible for carrying the cost of off-site right-of-way dedication until reimbursement is made. City designated key open space areas along natural drainage corridors (greenways) fall within the parameters of off-site drainage right-of-way dedication.

Policy CD-1.1.3 Storm Water System - Drainage Easements.

The Storm Water Master Plan and Storm Water Drainage Criteria and Design Manual defines ***drainage easement*** requirements for storm water system improvements within City jurisdiction.

a) Usage. Drainage easements will be acquired by dedication for Minor Storm Sewer System Improvements.

b) Delineation. The City is responsible for determining drainage easement width requirements. The Developer shall indicate by plat and submit for City concurrence proposed drainage easement dedication.

c) Acquisition and Dedication. The City is responsible for accepting dedicated drainage easements. The Developer is responsible for dedicating requisite on-site drainage easements. When development precedes City infrastructure, the Developer is responsible for securing and dedicating requisite off-site drainage easement by separate instrument. The City may accept a temporary private conveyance agreement in lieu of an off-site drainage easement.

Policy CD-1.1.4 Storm Water System - On-Site Development.

a) **Minor Storm Sewer Improvements.** The Developer is responsible for minor storm sewer construction.

b) **Collector System Improvements.** The Developer is responsible for collector system construction.

c) **Major System Improvements.** In the absence of existing infrastructure, the Developer is responsible for major system construction of sufficient capacity for ultimate development. The City will reimburse the Developer for the cost of major system construction when funding becomes available and is appropriated for this purpose. The Developer is responsible for carrying the cost of construction until reimbursement is made.

Policy CD-1.1.5 Storm Water System - Off-Site Development.

a) **Minor Storm Sewer Improvements.** The Developer is responsible for minor storm sewer construction of sufficient capacity for ultimate development of adjacent off-site property. The City will reimburse the Developer for the cost of over-sizing the minor storm sewer improvements when funding becomes available and is appropriated for this purpose. The Developer is responsible for carrying the cost of construction until reimbursement is made.

b) **Collector System Improvements.** The Developer is responsible for collector system construction of sufficient capacity for ultimate development. The City will reimburse the Developer for the cost of over-sizing the collector system improvements for the off-site capacity contribution only when funding becomes available and is appropriated for this purpose. The Developer is responsible for carrying the cost of construction until reimbursement is made.

c) **Major System Improvements.** In the absence of existing infrastructure, the Developer is responsible for major system construction of sufficient capacity for ultimate development. The City will reimburse the Developer for the cost of major system construction when funding becomes available and is appropriated for this purpose. The Developer is responsible for carrying the cost of construction until reimbursement is made.

Policy CD-1.1.6 Storm Water System – Major System Channel Development.

Upon acquisition of property or rights-of-way, by purchase or dedication, for Major System Channels, the City will allow access and make available channel excavation material in exchange for Major System Channel construction.

Construction must conform to City authorized engineering analysis and construction plans and specifications. Third party interests may submit engineering analysis and construction plans for Director of Engineering review, approval and authorization.

The City will determine the sequence and location of authorized channel excavation.

Objective CD-1.2: Promote Orderly Growth of the Storm Water System

Policy CD-1.2.1 Storm Water System – Orderly Growth Management.

a) **Major System Improvements - Development**. The City is responsible for funding the planning, design, acquisition and construction of major storm water system improvements. The City will promote the orderly development of storm water system by determining when and where major storm water system improvements are required.

b) **Collector System Improvements - Development.** For designated in-fill development, the City will fund the planning, design, and land acquisition and construction of collector storm water system improvements.

ISSUE: MAINTENANCE

GOAL M-1: MAINTAIN STORM WATER SYSTEM

Background: Management of the City's storm water system requires periodic inspection, inventory, maintenance, and rehabilitation or replacement of deficient system components. Storm water systems maintained in good condition help optimize capacity, protect water quality and reduce operational and capital costs.

Objective M-1.1: Storm Water System Maintenance

The components of the City's storm water system are listed in the "Background" section of Drainage Goal "D-1". The following policy statements guide the City's storm water system maintenance program dealing with those components.

Policy M-1.1.1 Design Requirements.

Storm water facility design must consider and address maintenance access, safety and operational requirements. City design review ensures operations and maintenance activity requirements are met prior to design approval. Design must provide the drainage right-of-way and easement requirements specified in the Storm Water Master Plan and/or Storm Water Drainage Criteria and Design Manual.

Policy M-1.1.2 Drainage Right-of-Way Requirements.

a) **Improvements and Maintenance Access.** Collector and Major storm water system improvements must be located within a Drainage Right-of-Way (ROW). Drainage ROW must be sized to accommodate maintenance access and operational requirements.

b) **Public Use.** Public joint use amenities in Drainage ROW such as bike paths, greenbelts, and other utilities will be encouraged and permitted where it is safe and feasible and where it enables the City to maintain drainage infrastructure. Where feasible, joint occupancy utilities should be placed underground.

c) **Private Use.** Private improvements may not encroach upon the Drainage ROW.

d) **Temporary Fill Restrictions.** Requests to allow the temporary placement of fill material during construction within a Drainage ROW must be submitted for review and approval by the City.

Policy M-1.1.3 Drainage Easement Requirements.

a) **Improvements and Maintenance Access.** Minor storm water improvements must be located in Drainage Easements. Drainage Easements must be of sufficient size to accommodate maintenance access and operational requirements.

b) **Public Use.** Joint occupancy with other public utilities may be permitted so long as other utility occupancy does not impede or interfere with City operations and maintenance activity. Where feasible, joint occupancy utilities should be placed underground.

c) **Private Use.** At the owner's risk, private amenities may be located within a drainage easement, subject to a Use Privilege Agreement, as long as such amenities do not impede or interfere with operations and maintenance activity. The City is not be responsible for damages to private property within the drainage easement that result from normal operations and maintenance activities.

d) **Temporary Fill Restrictions.** During construction, the temporary placement of fill material within a drainage easement requires written City authorization.

Policy M-1.1.4 Drainage Right-of-Way and Easement Additions.

When necessary and feasible, the City will secure additional drainage right-of-way and/or drainage easement width for existing systems in order to improve access and enhance operations and maintenance activities.

Policy M-1.1.5 Utility Relocation Requirements.

Joint occupancy utilities located within a Drainage ROW or Drainage Easement are required to relocate at no cost to the City when the City determines that a utility's occupancy interferes with storm water operations and maintenance activities.

Policy M-1.1.6 Update System Criteria and Data Periodically.

a) **Hydrologic Research.** The City will continue to research and investigate local rainfall information. On a periodic basis not to exceed 5 years, the City will review and update as appropriate, the methods used for estimating the discharges of given storm recurrence intervals.

b) **Storm Water Master Plan.** The City will review and post appropriate updates as necessary.

c) **Storm Water Drainage Criteria and Design Manual.** The City will review and update as appropriate the Storm Water Drainage Criteria and Design Manual on a regular basis, not to exceed 5 years.

d) **Incremental Development and Approved Variances.** The City will monitor and document incremental development and/or approved variances that depart from the approved Storm Water Master Plan and Storm Water Drainage Criteria and Design Manual. The City may develop a fee schedule and collect a fee to cover the administrative costs of tracking incremental development and/or approved variances. The City may authorize, on an individual basis, a private third-party to conduct system modeling and submit requested revisions to the Storm Water Master Plan for staff review and subsequent presentation for Planning Commission approval/rejection. All third-party modeling analysis and Master Plan revision requests must be prepared by a Licensed Professional Engineer authorized to practice in the State of Texas.

Policy M-1.1.7 Private Conveyance Maintenance Agreements.

Off-site storm water conveyance by means of a private system is strongly discouraged, and are subject to the following provisions:

a) **Maintenance Agreement.** For any temporary private conveyance, the developer shall agree in writing with the City, to provide regular, periodic maintenance for the life of the agreement or until such time that permanent underground storm water improvements are put in place.

b) **Term.** Temporary private conveyance agreements will be limited to no longer than a five-year term. Prior to expiration of the agreement, the responsible party shall design and build the permanent storm water improvements and provide a dedicated drainage easement or right-of-way at no cost to the City. Upon expiration of the five-year term, if permanent improvements are not in place, the City may elect to use the performance bond to complete construction.

c) **Connection.** Connection of a private storm water facility to the City's storm water system must be in conformance with the City's Storm Water Drainage Criteria and Design Manual.

d) **Restrictions.** Temporary private ditches are prohibited from accepting additional third party runoff. Temporary private ditches may not connect to the City's storm water system prior to written agreement.

Policy M-1.1.8 MS-4 Co-Permittees.

a) **Coordination.** The City and its MS4 Co-Permittees should develop intergovernmental agreements, mutual courtesy notification procedures and other measures that promote storm water system operations and maintenance.

b) **Responsibility**. MS4 Co-Permittees are responsible for the operation and maintenance of the storm water system under their jurisdiction.

GOAL M-2: ENVIRONMENTALLY SENSITIVE MAINTENANCE

Background: Existing maintenance operations include ditch and channel mowing, channel side-slope re-grading and erosion repair, debris removal, street sweeping, and pipe and inlet cleaning operations. City maintenance operations should seek to minimize impacts to habitat and natural "quality of life" features.

Objective M-2.1: Incorporate Procedures That Protect the Environment

Policy M-2.1.1 Channel Maintenance and Channel Bank Degradation.

The City is responsible for the maintenance of open channels including sediment, trash and debris removal. The City will promote maintenance practices that decrease erosion, reduce silt, and avoid degradation or destruction of natural channel bank vegetation. Unless open channel banks have experienced slope instability or erosive failure, the practice of open cut grading and clamshell excavation should be discouraged where feasible. The establishment or restoration of native groundcovers and vegetation on channel banks will be encouraged.

Policy M-2.1.2 Adoption Programs.

Under appropriate conditions of safety, supervision, and security, the City will consider allowing local community groups to participate in an "Adopt-a-Drainage Corridor" and/or an "Adopt-a-Greenway" program. The City will sponsor a similar "Adopt-a-Neighborhood Inlet" program to promote local awareness of the potential impacts to receiving waters that an inlet can produce.

Policy M-2.1.3 Silt Removal.

The City will remove silt material in an environmentally responsible manner from ditches, channels and storm sewers.

Policy M-2.1.4 Wetlands and Natural Drainage Corridors.

The City will evaluate and encourage maintenance practices that enhance or preserve wetlands and native vegetation for purposes of water quality filtration, erosion control, storm water velocity reduction and riparian habitat protection.

ISSUE: WATER QUALITY

INTRODUCTION

The Water Quality policies are designed to protect water quality within City jurisdiction through measures that address storm water quality in conjunction with compliance with federal, state, and local storm water pollution control requirements. A comprehensive water quality management program:

- Protects community health and welfare;
- Maintains ecosystems and preserves the natural environment; and
- Complies with State and Federal statute.

Accordingly, water quality policies are divided into two goals:

1) **Water Quality Protection** policies which confirm the community desire to protect the local environment within City jurisdiction; and

2) **Water Quality Regulatory Compliance** policies which express the City's commitment to adhere to State and Federal requirements concerning storm water discharge into waters of the United States within City jurisdiction.

BACKGROUND

Urban Development and Water Quality

Urban development may impair water quality. Waste and residual materials generated from urban land use activities can, if improperly handled, contaminate surface runoff.

Typically, municipal storm water systems discharge many substances in addition to water. As storm water collects and flows over pavements, lawns, driveways and other urban surfaces, it often picks up considerable quantities of pollutants such as oil and grease, fertilizers, pesticides and metals. Sediment from active construction sites often discharges into the storm water system.

Urban Development Pollutants

Primary pollutants generated by urban land use include sediment, nutrients, oil and grease, floatable debris, trace metals, toxic chemicals and pathogens. Dissolved oxygen levels in receiving waters can also be adversely affected.

Federal Response to Water Quality

The U.S. Environmental Protection Agency (EPA) developed the ***National Storm Water***

Program (NSWP) in response to legislation passed by Congress. The NSWP is a federal government initiative with the voluntary cooperation of authorized states and mandatory participation of many local government agencies.

The program is being implemented in two phases with respective effective dates of October 1992 and March 2003. The first phase includes discharges associated with industrial activity (including construction activity) and discharges from all public storm water systems serving urban populations of 100,000 or more.

The second phase includes all other public storm water systems within urbanized areas (population of at least 50,000), plus other small public storm water systems meeting EPA or state criteria for designation. The second phase of the NSWP also reduces the minimum amount of soil disturbance for construction projects from 5 acres to 1 acre.

The *Federal Clean Water Act of 1972* (CWA) established the National Pollutant Discharge Elimination System (NPDES) and has been amended several times. One such amendment was the *Water Quality Act of 1987*, which established a phased approach for storm water discharge regulation in the United States. Anyone wishing to discharge pollutants must obtain a permit to do so, and the permit must limit the composition of the discharge and pollutant concentration.

Waters Subject to Water Quality Protection within City Jurisdiction

Waters within City Jurisdiction that are subject to water quality protection include:

- Corpus Christi Bay
- Nueces Bay
- Oso Bay
- Upper Laguna Madre
- Nueces River
- Oso Creek
- West Oso Creek
- Port of Corpus Christi Inner Harbor
- Petronila Creek
- The Gulf of Mexico

State Authority

The CWA allows states to request EPA authorization to administer the NPDES program within their borders. Once the EPA determines that the state has adequate legal authorities, procedures and ability to administer the program, authorization may be granted.

Following authorization, the state NPDES programs must be consistent with minimum federal requirements. The EPA is also obligated to adopt standard requirements for state NPDES programs with guidelines that include monitoring, reporting, enforcement, personnel and funding.

The Texas Commission on Environmental Quality (TCEQ) is the state agency that administers NPDES permitting for the EPA. The State of Texas has established standards

that protect the ways that water bodies will be used and has defined measurements that will assure the water quality is good enough to maintain those uses.

Using these standards, the TCEQ monitors and assesses which water bodies meet the standards set for their use. The TCEQ publishes *The State of Texas Water Quality Inventory* or CWA Section 305(b) Report. This 305(b) report along with other available data and information on water quality are used to produce *The State of Texas List of Impaired Water Bodies* or CWA 303(d) List.

Local Storm Water Regulation

City municipal discharges have a broad set of requirements mandated by the NWSP:

- The City is responsible for obtaining permit coverage (MS4 Permit) for the discharges from the storm water system and meeting various requirements regarding the system operation (Storm Water Management Plan);

- The City is responsible for obtaining permit coverage for any industrial facilities or construction sites that they own; and

- The City is responsible for record keeping, inspection, and enforcement of storm water permit requirements for construction activities and certain types of industrial operations within their jurisdiction.

The City, along with local ***MS4 Co-Permittees,*** has permission to discharge to Waters of the United States by authority given by MS4 Permit No. TXS000601.

The City has developed a "*Storm Water Management - Guidance Document for Developmental Planning & Construction Activities*" May 1997 includes numerous examples of Best Management Practices designed to reduce the amount of pollution entering receiving waters. This document provides governing criteria within City jurisdiction.

GOAL WQ-1: WATER QUALITY PROTECTION

Background: Non-point pollution, carried by storm water runoff, can contribute to the decline of receiving waters. Storm water has been shown to convey elevated amounts of lead and other heavy metals, nutrients, bacteria, sediment, and silt. Pollutant concentration in storm water runoff is variable, dependent upon buildup during dry periods and runoff during rain events.

Section 303(d) of the Clean Water Act requires the state of Texas to identify waters that do not meet, or are not expected to meet applicable water quality standards. For each listed body of water that does not meet a standard, the Texas Commission on Environmental Quality (TCEQ) must develop a total maximum daily load (TMDL) for each pollutant identified as contribution to the impairment of water quality in that water body.

A TMDL is a quantitative plan that determines the amount of a particular pollutant that a water body can receive and still meet its applicable water quality standards. TMDL's are also used to estimate how much the pollutant load needs to be reduced from current levels in order to achieve water quality standards.

To protect receiving waters, the City requires best management practices be implemented.

Objective WQ-1.1: Protect Community Health and Safety

Policy WQ-1.1.1 Minimize Degradation of Water Quality.

Human activity within a watershed area tends to degrade the water quality of local receiving waters. The following practices will minimize such degradation:

a) Design. Storm water facility design must consider and address local soils; topography and transport velocities in order to minimize scour and soil erosion. Open channels must be designed to prevent side slope toe failure, to prevent bottom scour, to use vegetative lining where feasible, and to provide vegetative buffer strips.

b) Best Management Practices. Storm Water Pollution Prevention Plans prepared in compliance with NPDES storm water discharge permits must incorporate and use the City's Best Management Practices (BMP's). Storm water system improvements must incorporate and use the City's BMP's.

c) Natural Filtration Initiatives. When practical and economically feasible, natural ecosystem filtration methodologies such as storm water wetlands should be employed where collector and major channels discharge into receiving waters. Storm water discharges will not adversely degrade natural wetlands.

Policy WQ-1.1.2 Drinking Water Supply Protection.

Storm water drainage systems that discharge directly into waters that contribute to the region's surface drinking water supply, will be designed to meet acceptable runoff constituent levels.

a) **Storm Water Runoff Collection.** In concert with local and State agencies, the City should conduct or secure a pollutant mass loading analysis of storm water discharges into those waters that provide drinking water supply. Pollutant mass loading will be collected on a regular schedule, not to exceed a three-year period.

b) **Storm Water Runoff Analysis.** The calculated results of pollutant concentrations (pollutant mass loading modeling) will be used to determine when further load reduction measures are required.

c) **Section 303(d) Clean Water Act.** The City will maintain and update when published the state of Texas listing of identified waters that do not comply with applicable water quality standards commonly referred to as the "303d list". The City will work with the State to determine the critical condition assimilative capacity of the impaired water body.

Objective WQ-1.2: Maintain Ecosystems and Preserve the Natural Environment

Policy WQ-1.2.1 Local Environmental Protection

Whenever practical and feasible, storm water system improvements will maintain existing ecosystems and preserve wildlife habitat.

a) **Natural Drainage Corridors.** The City will identify, acquire and preserve natural drainage corridors for the purpose of preserving natural habitat, promoting public recreation and maintaining water quality.

b) **Wetlands Preservation.** The City will identify, acquire and preserve existing wetlands where feasible and practical. Where feasible, the City will maintain the integrity of existing wetlands downstream of development. The City will be consulted, review and comment on any proposed wetlands mitigation initiative within its jurisdiction.

c) **Detention.** When feasible, the City will construct regional detention facilities that temporarily hold storm water, providing time for natural processes to have a positive impact upon water quality.

GOAL WQ-2: WATER QUALITY REGULATORY COMPLIANCE

Background: Compliance with the requirements of the NPDES MS4 permit is mandatory; enforcement of these requirements is the responsibility of the City and its Co-Permitted agencies. The City Storm Water Department maintains a copy of both the current NPDES MS4 permit, and the companion ***Storm Water Management Program*** document.

Objective WQ-2.1: Storm Water Regulation Compliance

Policy WQ-2.1.1 Comply with NPDES MS4 Permit Requirements.

a) The City and those within its jurisdiction must comply with the U.S. Clean Water Act and associated Federal and State water quality regulations through the City's existing National Pollution Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit.

b) The City will maintain an inventory of industrial operators within City jurisdiction that require and/or operate under the authority of a NPDES storm water discharge permit.

c) The City will monitor construction activity within City jurisdiction for compliance with the provisions of applicable individual NPDES or general storm water discharge permit.

ISSUE: QUALITY OF LIFE

GOAL QOL-1: ENHANCE THE QUALITY OF LIFE FOR THE COMMUNITY

Background: Storm water drainage facilities can deteriorate and become a citizen-perceived nuisance. In addition, neglected facilities are more difficult to maintain and can become a hazard to the surrounding community.

One solution is the establishment of ***Greenways*** and linear parks that serve to enhance the appearance of these open channels. When properly planned, greenways convey intermittent storm water runoff, provide habitat areas for wildlife and native vegetation, and serve as buffer zones. These features should be promoted and protected.

Future land use planning should encourage the integration of recreational areas, native habitat and storm water facilities. Detention ponds or detention basins with proper design and maintenance should optimize use of public land use. Wherever feasible, creek environments and natural floodplains should be left in their unimproved state.

Objective QOL-1.1: Transform Existing Facilities into Neighborhood Assets

The Storm Water Department's Capital Improvement Program will explore opportunities to reconstruct aging storm water facilities and in the process remove hazards, improve safety, enhance environmental quality and promote the aesthetic value of the facility.

Policy QOL-1.1.1 Beautification.

The City aspires to beautify those existing channel and detention facilities where improvements can be made without suffering loss of hydraulic capacity. Where feasible, and where space is available, the City will acquire adjacent land to serve as open space, buffer zones, and greenways.

Policy QOL-1.1.2 Parks and Recreation.

The City will coordinate and promote the creation of multi-use facilities and greenway inter-connected park areas without compromising public safety or impeding storm water system operations and maintenance activities.

The City will explore means and methods to preserve open space areas within its jurisdiction. Preservation mechanisms of open space include property acquisition, acquisition by other non-profit agencies, and development restrictions through negotiated landowner agreements.

GOAL QOL-2: COMBINED GREENWAY/ DRAINAGE FACILITIES

Background: ***Greenways*** can provide a connective function between residential areas and parks, schools, shopping centers, and other areas of activity. Greenways established in conjunction with drainage corridors (such as open channels, creeks and streams) can provide a unique location for walkways, bikeways, and jogging trails away from automobile traffic.

Within City jurisdiction there exist many opportunities for combined greenway/drainage facility development. Greenways designed in combination with drainage ditches and open channels will be encouraged where dedication of sufficient right-of-way allows space for proper facility design and function.

Objective QOL-2.1: Establish Greenway Corridors

Policy QOL-2.1.1 Establish & Protect Greenway/Drainage Facility Corridors.

a) **Identification of Greenways.** The City's Storm Water Master Plan, City of Corpus Christi Parks, Recreation & Open Space Master Plan and Area Development Plans will identify those greenway/drainage facility corridors, along with key pieces of habitat-supportive land, that will be protected from encroachment by other uses.

b) **Purpose.** Greenways may provide a number of amenities including bikeways and walkways as alternative modes of transportation, regional detention facilities, and linkage routes between neighborhood and community parks.

c) **Right-of-Way Requirements.** Minimum right-of-way requirements for the establishment and/or protection of natural, enhanced or constructed wetlands, wildlife and vegetative habitat, recreational corridors, and buffer zones will be established for drainage corridors throughout the City. Right-of-way will be sufficiently wide enough for drainage, flood protection, operations activities and maintenance functions, along with greenway improvements. Greenway alignment will generally follow natural drainage corridors and future storm water facilities.

d) **Restrictions.** Private encroachment into designated greenways may not be allowed. Joint use recreation opportunities will not destroy passive elements of the greenway such as native habitat, wetlands, marshes, riparian areas, and buffer zones.

e) **Promotion.** Through developer requirements and incentives, capital improvements, and retrofitting of existing facilities, the City will promote and encourage the establishment of greenway drainage corridors and their interconnectivity with parks, residential neighborhoods, schools and shopping centers.

f) **Design.** The design of these multi-use facilities will also consider the creation and/or protection of wetlands, ponds and marshes, the enhancement of wildlife and vegetative habitats, and the establishment of buffer zones and riparian areas.

g) **Community Participation.** The City will promote and encourage local citizen and interest group participation in the planning, design, and creation of greenways and associated improvements.

Policy QOL-2.1.2 Greenway Safety.

The City is responsible for greenway safety. Safety measures and criteria will be developed with a focus on separating and protecting the public from hazards within the drainage corridor.

Policy QOL-2.1.3 Greenway/Drainage Facility Coordination.

The City will identify and designate greenways, major system channels and detention facilities in an integrated fashion. Planning will consider the City's adopted Master Transportation Plan, City of Corpus Christi Parks, Recreation & Open Space Master Plan, Storm Water Master Plan and applicable Area Development Plans.

Policy QOL-2.1.4 Native Habitat Protection.

Where feasible, the City will protect native riparian habitat and vegetation within and along natural drainage corridors. In addition, where feasible, natural drainage corridors and their water sources will be delineated for preservation.

GLOSSARY OF "KEY WORD" DEFINITIONS

Area Development Plan: A component of the City's Comprehensive Plan that give major consideration to land use issues and address allocation of services, facilities and other area-specific issues. Their purpose is to provide decision-makers with a guide to manage future development.

Base Flood: A base flood is the national standard on which the floodplain management and insurance requirements of the National Flood Insurance Program (NFIP) are based. Special Flood Hazard Areas (SFHA's) are depicted on FEMA Flood Insurance Rate Maps (FIRM's) and are areas subject to inundation by the base flood having a one-percent or greater probability of being equaled or exceeded during any given year (also known as a 100-year flood event).

Base Flood Elevation (BFE):
An elevation of the water surface within a drainage corridor at which the storm water from a 100-year event is estimated to rise based upon a FEMA-approved hydrologic and hydraulic analysis of that corridor.

Best Management Practices (BMP's):
Means or methods that reduce pollutant loading to downstream elements. BMP's can be either structural controls or practices or non-structural controls and practices. Non-structural practices include but are not limited to inlet cleaning, street sweeping and detention pond maintenance.

Buffer Strip: Strip or area of vegetation used for removing sediment, organic matter, and other pollutants from storm water runoff.

Capital Improvement Plan or Program (CIP): A projected schedule of capital projects based on estimated costs and expected funding levels.

Channel: An open storm water conveyance facility with side slopes ranging from two to four units horizontally to one unit vertically.

Clean Water Act (CWA): Contains a number of provisions to restore and maintain the quality of the nation's water resources.

Collector Channel: Open channels and other pertinent drainage structures associated with open channels that serve drainage areas between 200 and 500 acres.

Conduit: A "conduit" is any open or closed device for conveying flowing water.

Criteria: A standard or rule on which a judgment or decision is based.

Critical Facility: A facility that serves a critical function for the community. Examples include, but are not limited to water and wastewater treatment and conveyance systems, emergency operations facilities, and key telecommunication and electrical systems.

Design Capacity: The amount of water that a storm water facility is designed to manage usually expressed in cubic feet per second for flow and cubic feet or acre feet for detention.

Design Storm Event: "Design Storm Event" means the rainfall intensity upon which the drainage facility will be sized.

Detention or To Detain: To temporarily hold storm water in such a way as to regulate its rate of flow, either to limit downstream impacts or to provide time for natural processes to have a positive impact upon water quality.

Detention Basin: A storm water facility designed to capture and limit storm water flow (by releasing it at a reduced rate) in order to reduce downstream impacts or to treat storm water to improve its quality.

Developer: A proponent of a project that alters the natural state of the land upon which that project is to be built. A Developer can be a private individual, a landowner, a tenant, a business partnership, company or corporation, or a government entity or agency.

Drainage Basin: Any land area from which the runoff collects into a common point or receiving water. The area of land that drains water, sediment, and dissolved materials to a common outlet at some point along a stream channel. Also called a watershed.

Drainage Easement: Property right, which enables the City to install, operate and maintain minor storm water facilities. Although the land is still owned by others ("fee simple") the City has proprietary right of use.

Drainage Right-of-Way: Property right, which enables the City to install, operate and maintain major storm water facilities. Right-of-Way dedication may be a fee simple transaction.

Elevation: "Elevation" means height above mean sea level. The vertical control system (benchmarks) referenced in the most current Flood Insurance Study must be used except in coastal areas where subsidence has occurred. Any future studies changing the Flood Insurance Rate Map (FIRM) which is referenced to a later re-leveling of the vertical control system must be used whenever a revised FIRM becomes effective.

Evapotranspiration: The total evaporation of rainfall from all sources such as free water, ground and plant-leaf sources.

Extra Territorial Jurisdiction (ETJ): The region outside of the City limits within which the City retains authority for enforcement of City ordinances, policies, codes and regulations. For the City of Corpus Christi, the ETJ is a line that is 5 miles beyond the City limits line.

Feasible: Refers to whether a project approach is technically viable. Although consideration to the economic practicality is included, it is understood that when a project uses design criteria that is less than the desired level it will be less costly. Project economics alone is not sufficient reason to state that meeting the desired criteria is not feasible.

Federal Emergency Management Agency (FEMA): Federal Agency which administers the ***National Flood Insurance Program.***

Flood Insurance Rate Map – "FIRM": A map created by the Federal Emergency Management Agency, under the National Flood Insurance Program, that delineates flood hazard areas.

Flooding: "Surcharge" that exceeds the level of protection of a facility. A surcharge that a community cannot live with. Hydraulic head or a hydraulic grade line above a certain unacceptable level.

Geographic Information System - GIS: A digital, electronic data and information storage and retrieval format tied to a geographical reference such as a map of a city.

Greenway:
A linear open space established along either a natural corridor, such as a riverfront or stream or overland along a railroad right-of-way converted to recreational use, a canal, a scenic road, or other route.

Hydraulic Grade Line (HGL): A hydraulic profile of the piezometric level of the water, representing the sum of the depth of flow and the pressure head. In open channel flow, the HGL is the water surface.

Impervious: Land surfaces which do not allow (or minimally allow) the penetration of water. An increase in the amount of impervious area will increase the rate and volume of runoff from a given drainage basin.

In-Fill Development: The development of isolated, discontinuous, undeveloped tracts of land in areas where urban development has already taken place.
Intermittent Stream: A stream, or reach of a stream, that does not flow year-round and that flows when it receives base flow solely during wet periods, or it receives groundwater discharge from other erratic surface and shallow subsurface sources.

Inlet: A structure that allows storm water to flow into a conveyance system. On-Grade Inlets are on a surface that slopes away from the opening, such that flow could bypass the inlet if clogged or at capacity. "Sump" or "Sag" Inlets are at low points.

Level of Protection: The level of flooding that a community decides is acceptable given a storm event of a certain frequency and intensity, balancing costs against property protection and convenience benefits.

Major Channel: Open channels and other pertinent drainage structures associated with open channels that serve drainage areas equal to or greater than 500 acres.

Major Storm Sewers: Inlets, laterals, and main storm sewer pipe or box systems that serve drainage areas more than 500 acres. These typically serve subdivisions, residential streets, collector streets, and arterials.

Master Basin Plan or Study: An in-depth investigation and analysis of drainage and storm water management needs of a particular watershed or study area. Usually limited to large basins where the expected improvements will entail large expenditures and phasing.

Minor Channel: Open channels and other pertinent drainage structures associated with open channels that serve drainage areas less than 200 acres.

Minor Storm Sewers: Inlets, laterals, and main storm sewer pipe or box systems that serve drainage areas less than 200 acres.

These typically serve subdivisions, residential, collector and arterial streets.

Mitigate: Measures taken to eliminate an adverse impact caused by an action.

Model (Analysis): **Approximations** of the hydraulics and hydrology of a drainage basin based upon mathematical derivations of quantifiable relationships between various factors. These factors usually include, but are not limited to, area, slope, soils, drainage system characteristics, rainfall and land use.

MS4: **M**unicipal **S**eparate **S**torm **S**ewer **S**ystem – A conveyance or system that is owned or operated by a State, City, Town, Association, or other public body which is designed or used for collecting or conveying storm water.

MS4 Co-Permittees: City of Corpus Christi and TXDOT-Corpus Christi District, Corpus Christi Junior College, Port of Corpus Christi Authority, and Texas A&M University-Corpus Christi.

Must: A requirement.

National Flood Insurance Program: Created by U.S. Congress in 1968 provides Federally backed flood insurance that encourages communities to enact and enforce flood plain regulations.

National Pollutant Discharge Elimination System (NPDES): The national program for issuing permits and enforcing requirements of the Clean Water Act.

National Storm Water Program (NSWP): A Federal government initiative directed by the U.S. E.P.A. with voluntary cooperation with authorized States and mandatory participation of local government agencies. This program regulates storm water discharges throughout the United States.

Non-Structural Controls and Practices: Pollution prevention behaviors and methods which do not include physical or "*Structural Controls*"; encouraged as first step in water quality protection.

Outfall: Location where storm water leaves a given conveyance system. The ultimate outfall of a system is usually a "receiving water".

Perennial Stream: A stream that flows continuously during all the calendar year as a result of groundwater discharge or surface runoff. The water in a perennial stream is generally lower than the water table adjacent to the region adjoining the stream.

Pervious: Land surfaces that allow the penetration of water. A decrease in pervious area will increase the rate and volume of runoff from a given drainage basin.

Policy: A plan or course of action, as of a government, political party, or business, intended to influence and determine decisions, actions, and other matters

Pollutant: Generally, any substance introduced into the environment that adversely affects the usefulness of the resource.

Pollution: Generally, the presence of matter or energy whose nature, location, or quantity produces undesired environmental effects. Under the Clean

Water Act, the term is defined as the human-made or human-induced alteration of the physical, biological, chemical or radiological integrity of water.

Proponent: An entity, public or private that initiates, promotes, and advocates the planning, design, and construction of a particular project. A proponent can be the City, another government agency, a developer, or other private citizen or group.

Receiving Water: A body of water that receives and stores storm water flow. Typical bodies include, but are not limited to, lakes, creeks, bayous, rivers, bays and oceans.

Redevelopment Project: A change in land use that alters the impervious cover from one type of development to either the same type or another type, and takes advantage of the existing infrastructure in place as a drainage outlet.

Rehabilitation Project: The restoration or renovation of an existing structure.

Retention or To Retain: To store storm water to prevent its discharge into receiving waters or to provide a storage facility for storm water where no outfall is available.

Retention Basin: A storm water facility that has no structural outfall and the discharge from, which is limited to percolation, evaporation and evapotranspiration.

Runoff: The residual precipitation remaining after deduction of interception and evapotranspiration losses. It appears in surface channels, natural or man made whose flow is perennial or intermittent. Classified by the path taken to a channel, runoff may be surface, subsurface or groundwater flow.

Shall: A directive or requirement.

Sheet Flow: Overland storm runoff that is not conveyed in a defined conduit and is typically in excess of the capacity of the conduit or roadside ditch.

Should: An expectation.

Special Flood Hazard Areas: Those drainage corridors that have been designated by FEMA as 100-year flood plains.

Storm Sewer Capacity: The ability of a storm sewer system to manage runoff without flow "surcharging" into the street.

Storm water: Flow of water, which results from, & which occurs immediately after a rainfall event.

Storm Water Management Facility:
A feature that collects, conveys channels, holds, inhibits or diverts the movement of storm water.

Structural Controls and Practices: Physical means and methods to control storm water runoff or to reduce any potential pollutants from being introduced into receiving water.

Surcharge: The runoff in excess of the actual capacity of a storm water facility.

Swale: A very shallow open storm water conveyance facility.

Tailwater: The water into which an outfall discharges.

***Water Quality-Based Limitations*:** Effluent limitations applied to discharges when more technology-based limitations would cause violations of water quality standards. Usually applied to discharges in small streams.

Water Quality Criteria: Levels of water quality expected to render a body of water suitable for it's designated use. Criteria are based on specific levels of pollutants that would make the water harmful if used for drinking, swimming, farming, fish production, or industrial processes.

Water Quality Standards: State-adopted and EPA-approved ambient standards for water bodies. The standards prescribe the use of the water body and establish the water quality criteria that must be met to protect designated uses.

Watershed: The land area that drains into a stream. The watershed for a major river may encompass a number of smaller watersheds that ultimately combine at a common delivery point.

Wetland: An area that is saturated by surface or groundwater with vegetation adapted for life under those soil conditions, such as swamps, bogs, fens, marshes and estuaries.

Will: An expectation of performance that, although not mandatory, is generally accepted as being a responsibility. (Can be overridden by feasibility issues though).