New Braunfels Stormwater Management Strategy

New Braunfels, Texas

Phase II Report

Draft - March 2012

DESIGNWORKSHOP

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II

Phase II Report

Stakeholder Meeting Process

There were two rounds of stakeholder meetings during this process. The purpose was to build upon the four day public input after the recent floods in 2010. Instead of having a large meeting where one faction can control the conversation, our approach is to have a series of two-hour meetings with likeminded stakeholder groups. This enables the conversation to stay focused on the point of view of the stakeholder group.

The first round of stakeholder meetings was a series of focus group workshops over a two day time period on October 9 and 10, 2011. The purpose of this first round of meetings was to introduce the process, gather priorities on stormwater strategies for the community and present best management practices (BMP) as it relates to stormwater management.

The second round of public meetings was a series of focus group workshops over a one day time period on January 22, 2012. These meetings focused on the prioritization and location of specific implementation tools associated with preferred stormwater strategies gathered from the last series of meetings.

Strategy Development

Stormwater strategies were developed through the review of existing documents, review of approved EPA mechanisms and consultation with City Staff.

The City of New Braunfels has an existing MS4 permit and a Drainage Criteria Manual that currently guides stormwater management. A review of these documents was completed as a base understanding of existing stormwater strategies in the City.

The Environmental Review of approved EPA mechanisms supplemented the list of stormwater strategies with green infrastructure options that have multiple benefits for the City.

A final list of potential stormwater strategies was created in consultation with City staff after review of the above strategy options.

Strategy Details

For each stormwater strategy, a brief description was created based upon the common understanding of the strategy in City or governmental materials. This description was followed with a list of benefits and limitation of each strategy. Finally, each strategy included information on the typical scale the strategy is applied at, site, community or regional, and the phase the strategy is most applicable to, policy, design and construction or operations maintenance and monitoring.

The following pages have the above information summarized. The Appendix has full cards that were used for each strategy during the public engagement process.

STRATEGY	KEY FEATURES & COMPONENTS	BENEFITS	LIMITATIONS	PROJECT PHASE			SCALE		
				POLICY	DESIGN & CONSTRUCTION	OPERATIONS, MAINT. & MONITOR	SITE	COMMUNITY	REGIONAL
OPEN SPACE CONSERVATION PLAN	Set aside lands to preserve open space that has high infiltration rates which contributes to reduced peak flow levels and increased infiltration into underground aquifers.	• Preserve the character of the New Braunfels Hill Country • Maintain (or reduce) pervious cover existing in watersheds contributing to New Braunfels • Contribute to TCEQ permit approval	• Not increase infiltration, only maintains existing status • Require funding for potential purchase of land or easements	•					•
FLOODWAY BUILDING PROHIBITIONS	Further limit or restrict new construction in the 100-year floodplain and floodway beyond existing ordinance.	• Reduce flood damage and insurance claims • Increase open space area	• Reduce landowners' area of usable land	•				•	•
STREAM BANK SETBACKS	Establish setbacks from streams for buildings, parking lots and other structures.	• Protect waterways from point source pollution • Reduce flood damage and insurance claims • Prevent or minimize erosion and gully formation	• Reduce direct access to water	•	•		•	•	•
BUILDING MATERIAL REGULATIONS	Limit the use of materials in construction that contribute to water pollution.	• Improve downstream water quality • Improve wildlife habitat • Improve drinking water quality • Increase cost savings over time • Increase energy efficiency	• Be more costly and not as readily available as other strategies	•	•		•	•	
	Enhanced seeding, mulching, sediment traps, silt fencing, erosion control plan beyond existing requirements.	• Be less costly to contractors during construction if implemented from the beginning • Reduce sedimentation in waterways • Increase water quality	• Be costly for small projects	•	•		•	•	•

STRATEGY	KEY FEATURES & COMPONENTS	BENEFITS	LIMITATIONS	PROJECT PHASE			SCALE		
				POLICY	DESIGN & CONSTRUCTION	OPERATIONS, MAINT. & MONITOR	SITE	COMMUNITY	REGIONAL
STORMWATER FACILITIES INVENTORY	Inventory of all stormwater facilities in each watershed, including type, capacity, maintenance responsibility and schedule.	• Be extremely useful for city to have on record and when determining needs for new stormwater facilities	• Be difficult to keep up to date once in place • Require a time-consuming survey	•		•		•	•
MAINTENANCE PLAN AND REGULATIONS	Outline responsibilities for ensuring maintenance is completed and operating correctly and incorporate BMPs into regular City maintenance practices.	• Reduce costs associated with poorly managed facilities and infrastructure • Reduce wasted natural resources	• Require on-going staff training • Require the creation or revision of a maintenance procedures manual	•	•	•	•	•	•
DENSITY BONUSES	Incentives and bonuses for increased density.	• Reduce the impacts such as increased flooding from impervious cover • Allow the City to incentivize increased density in desired areas • Require TCEQ permit approval	• Require additional study to determine which areas could become more dense	•			•	•	•
STORMWATER UTILITY FEE	Implement fee to fund maintenance of stormwater facilities.	• Help defray the costs of maintaining existing facilities as the city grows	• Inhibit new development if fee is perceived as too costly	•		•	•	•	•
CITY INCENTIVES OR FEES	Some examples: Buy into watersheds to pay in lieu or transfer to other properties Impact fee / mitigation fee / linkage fee Expedited permitting process	• Increase revenue that can be used to finance infrastructure or capital projects	• Inhibit new development if fee is perceived as too costly • Cause development in undesirable areas that may not have an impact fee	•			•	•	•

STRATEGY	KEY FEATURES & COMPONENTS	BENEFITS	LIMITATIONS	PROJECT PHASE			SCALE		
				POLICY	DESIGN & CONSTRUCTION	OPERATIONS, MAINT. & MONITOR	SITE	COMMUNITY	REGIONAL
IMPERVIOUS COVERAGE REDUCTIONS OR LIMITS	Increased densities, decreased road sections, reduced parking requirements; ensure no more than x% impervious cover in City Limits or ETJ.	• Be applied at multiple scales with various mechanisms • Decrease the peak flow stormwater runoff	• Require changes in City regulation and standards • Require coordination among land owners when implementing at a community scale	•	•		•	•	
POROUS PAVEMENT	Increase use of pervious paving materials by amending code to allow the use of such materials in roadways and parking lots.	• Reduce volume of runoff • Reduce delivery of associated pollutants to warm water bodies • Reduce need for more involved stormwater drainage, conveyance and treatment systems • Contribute to TCEQ permit approval	• Be costlier than traditional materials • Is typically used for more lightly-trafficked (vehicular) sites • Require more frequent maintenance • Offer different TCEQ benefits depending on concrete or asphalt • Not be applicable for curb and gutter roadway sections		•		•	•	
RETENTION - WITH OR WITHOUT BIOTIC HABITAT	These structures maintain a permanent pool of water in addition to temporarily detaining stormwater. Stormwater capture through wet ponds and stormwater wetlands creates water filtration, habitat and detention of water. Potential for re-use of filtered water for irrigation.	• Be aesthetically pleasing by adding a water feature and plant material • Remove dissolved nutrients • Contribute to TCEQ permit approval	• Increase construction costs • Increase maintenance costs • Contribute to thermal pollution and cause downstream warming • Be a safety concern for children • Cause nuisances such as mosquitoes, odor, algae • Have the potential to dry up during drought without external water source		•		•	•	•

STRATEGY	KEY FEATURES & COMPONENTS	BENEFITS	LIMITATIONS	PROJECT PHASE			SCALE		
				POLICY	DESIGN & CONSTRUCTION	OPERATIONS, MAINT. & MONITOR	SITE	COMMUNITY	REGIONAL
BUILDING RUNOFF CAPTURE	Capture and storage of rainwater from roofs, cisterns.	• Mitigate or eliminate increased runoff volume • Reduce the required capacity for down-slope retention and sediment control BMPs • Contribute to TCEQ permit approval	• Increase building costs, for example: installing a green roof • Not claim flood control credit unless sized properly • Be hard to enforce		•		•		
INFILTRATION BASIN	Examples include swales, infiltration basins, rain gardens or shallow excavated trenches filled with gravel or crushed stone that is designed to infiltrate stormwater through permeable soils into the groundwater aquifer; often used to treat runoff from parking lots or sidewalks.	• Have relatively low costs of construction • Be aesthetically pleasing • Treat certain pollutants • Contribute to TCEQ permit approval	• Not appropriate for sites where there is a possibility of groundwater contamination or where there is soil with a high clay content that could clog the trench • Require maintenance • Be subject to additional regulation by EAA		•		•	•	•
BIOFILTER	Biofilters may consist of either biological or engineered characteristics. The use of native plants in stormwater facilities increases habitat and evapotranspiration. Examples include grassed channels, swales and filter strips. Engineered medium filter out various contaminants and pollutants.	• Have relatively low costs of construction • Be aesthetically pleasing • Treat certain pollutants • Contribute to TCEQ permit approval	• Require periodic maintenance		•	•	•	•	•

STRATEGY	KEY FEATURES & COMPONENTS	BENEFITS	LIMITATIONS	PROJECT PHASE			SCALE		
				POLICY	DESIGN & CONSTRUCTION	OPERATIONS, MAINT. & MONITOR	SITE	COMMUNITY	REGIONAL
DETENTION BASIN (INCLUDES MULTI-USE STORMWATER DETENTION FACILITIES)	Basins that temporarily detain a portion of stormwater runoff for a specific length of time and can increase water quality. Examples of multi-use detention facilities include parks, open space, bike paths and fields.	• Improve infiltrated water quality • Reduce flooding • Prevent downstream channel scouring • Increase park and open space area • Contribute to TCEQ permit approval	• Require maintenance which is both essential and costly		•			•	
WETLAND BASIN OR CHANNEL	Engineered systems designed to perform the water purification functions of natural wetlands. Best when used in conjunction with other BMPs, such as minimization of initial runoff volumes and use of pervious pavement or swales. May also be restored wetlands.	• Be very effective in removing pollutants • Decrease irrigation needs • Provide groundwater recharge • Contribute to TCEQ permit approval	• Contribute to thermal pollution and cause downstream warming if shallow water is present • Be a safety concern for children • Require frequent and intensive maintenance • Cause nuisances such as mosquitoes, odor and algae • Limit nearby future development due to wetland regulations		•		•	•	•
LITTER CONTROL	Clean up or minimization of litter in rivers, storm drain facilities and along streets to reduce the amount of debris in the rivers, creeks and detention basins.	• Be a cost effective strategy • Reduce maintenance of other stormwater structures • Reduce chances of localized flooding due to drainage blocks	• Require on-going efforts in the community • Limit the use of disposable materials in key locations	•		•	•	•	•
RETROFIT EXISTING STORMWATER FACILITIES	Upgrade existing facilities that are in need of repair to current standards and low impact development techniques.	• Reduce future maintenance costs post-retrofitting • Improve functionality of unmaintained facilities	• Require costly upgrades		•	•	•	•	•

STRATEGY	KEY FEATURES & COMPONENTS	BENEFITS	LIMITATIONS	PROJECT PHASE			SCALE		
				POLICY	DESIGN & CONSTRUCTION	OPERATIONS, MAINT. & MONITOR	SITE	COMMUNITY	REGIONAL
STREAM AND RIVER RESTORATION	Restore hydrology to original functioning. Restores channel and waterway ecosystem.	• Alleviate issues of increased sediment accumulation and nutrient loading • Restores wildlife habitat • Contribute to TCEQ permit approval	• Be a very costly process • Require land use changes		•	•		•	•
CLUSTERING	Allows the same amount of houses on the site as a traditional development, but the houses are on smaller lots and large areas of open space are preserved as open space where structures may never be built.	• Increase open space by focusing development • Manage stormwater more effectively than in conventional developments • Contribute to TCEQ permit approval	• Inhibit development through restrictions	•	•		•	•	

Round One Stakeholder Meetings

Process

A series of stakeholder meetings were held on October 10 and 11, 2011. The stakeholder meetings were used in order to have focused discussion of stormwater issues with like-interested groups regarding specific stormwater concerns. The following groups were represented: Agriculture, Developers and Real Estate, Designers and Engineers, Economic Interest, Environmental, Water -Based Businesses, Agencies, Home Owners Associations (HOAs), Public, Council, and Watershed Advisory Council (WAC).

During each meeting, participants were given a brief introduction and goals for the process and asked to prioritize the strategies using a set of strategy cards. Each group was given 23 strategy cards and asked to identify their top 10 strategies, rank them in order of most appropriate for New Braunfels and asked to identify any strategies that were not at all appropriate for New Braunfels.

Results

As a result of the October meetings, the stakeholder groups indicated that the stormwater strategies most important to them include the following:

	STRATEGY
1	Maintenance and Monitoring
2	Flood Hazard Mitigation
3	Detention Basin
4	Litter Control
5	Open Space Conservation
6	Stream and River Restoration
7	Construction Control Measures
8	Retrofit Stormwater Facilities
9	Impervious Cover Reductions
10	City Incentives or Fees

A detailed account of the results from the stakeholder meetings can be found on the following page.

STRATEGY	STAKEHOLDER GROUP										
	AGRICULTURE	DEVELOPERS AND REAL ESTATE	DESIGNERS AND ENGINEERS	ECONOMIC INTERESTS	ENVIRONMENT	WATER BASED BUSINESS	AGENCIES	HOA	PUBLIC	COUNCIL	WAC
OPEN SPACE CONSERVATION PLAN	1	8		8	7		8	7	10	7	4
FLOODWAY BUILDING PROHIBITIONS		2	1		2			10			
STREAM BANK SETBACKS		5	5		3	10	9				
BUILDING MATERIALS	X		X	X			X				
CONSTRUCTION CONTROL MEASURES		4	10	X	5	5	10	8	4		
STORMWATER FACILITIES INVENTORY				7		9	1				3
MAINTENANCE AND MONITORING		6	4	2		2	3		3	2	5
DENSITY BONUSES	X		X	X				X			9
STORMWATER UTILITY FEE			X	4			2	X		4	
CITY INCENTIVES OR FEES	X	7				3	5	X			2
IMPERVIOUS COVERAGE REDUCTIONS OR LIMITS				3	1		7		6		
POROUS PAVEMENT			9	X					5	8	10
RETENTION - WITH OR WITHOUT BIOTIC HABITAT	5		7				X	3		10	
BUILDING RUNOFF CAPTURE	4	9				4	6	X	9		
INFILTRATION BASIN	8			9	8			9			8
BIOFILTER	9				9					9	6
DETENTION BASIN		3	8		4		4	4	2	6	
WETLAND BASIN OR CHANNEL								6			
LITTER CONTROL	2			1		6		2	7	5	
RETROFIT EXISTING STORMWATER FACILITIES	6		3	6		8		5	1	3	
STREAM AND RIVER RESTORATION	3	10	6	5	10	7		1			
CLUSTERING	X				6				8		7
FLOOD HAZARD MITIGATION	7	1	2	10		1	X			1	1

Round One On-line Web Survey

Process

The online polling process was introduced to the City of New Braunfels during part of the public outreach for this project during the October 2011 meetings. This online tool, hosted by MetroQuest, allows the people of New Braunfels to access an interactive internet website where they are able to view and receive information about various stormwater strategies in an effort to gain a better understanding of the benefits and limitations of each strategy proposed for the City of New Braunfels. This website also allows each user to provide feedback by prioritizing the strategies by how they think each best represents what the City of New Braunfels should incorporate into its new comprehensive vision for the future of stormwater management in the city.

The online polling opened on October 10, 2011 and was closed on December 7, 2011. The online polling provided the Design Workshop team with a very valuable set of information with which to move forward as we continue work on this project with the City of New Braunfels and other various planning consultants.

Results

At the conclusion of the online polling, the results were collected from the MetroQuest web application and compiled into six separate documents composed of various pieces of information. Among these documents are the *Feedback by Visitor*, *Community Rankings* of the stormwater strategies, *Demographics by Visitor*, and information of *Visits by Location*. All of these document results can be found in the Appendix.

Perhaps of most relevant to this process, the *Community Rankings* document contains the results of the prioritization from all the website visitors who took time to organize their top strategies to be considered. The strategies read in descending order of what is most important to what is least important according to those who participated in the survey. The results of the priorities are as follows:

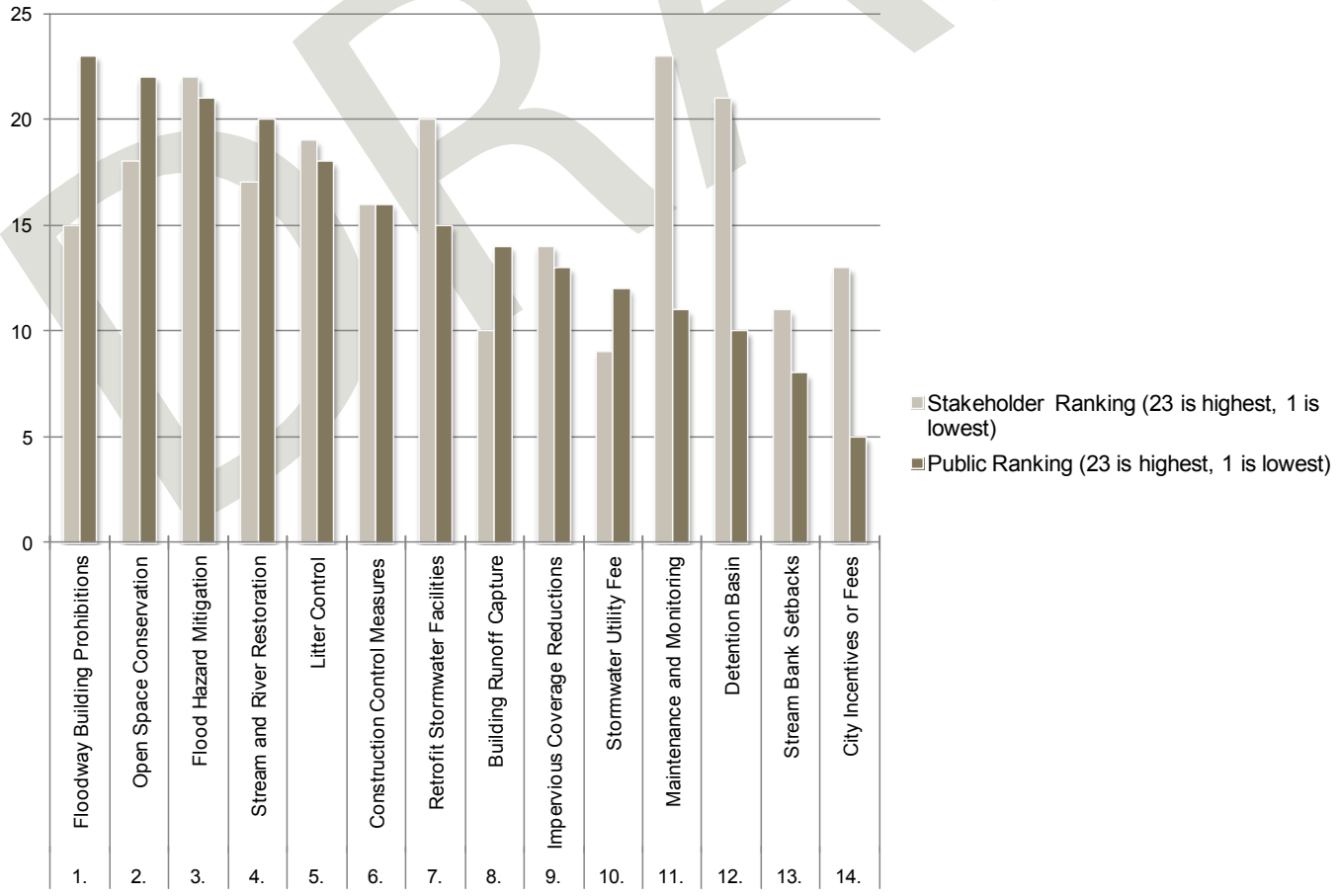
	STRATEGY
1	Floodway Building Prohibitions
2	Open Space Conservation
3	Flood Hazard Mitigation
4	Stream and River Restoration
5	Retention
6	Litter Control
7	Density Bonuses
8	Construction Control Measures
9	Retrofit Stormwater Facilities
10	Building Runoff Capture
11	Impervious Coverage Reductions
12	Stormwater Utility Fees
13	Maintenance and Monitoring
14	Detention Basins
15	Clustering
16	Stream Bank Setbacks
17	Wetland Basins
18	Biofilters
19	City Incentives of Fees
20	Building Materials
21	Stormwater Facilities Inventory
22	Infiltration Basin

Priority Strategies

Based upon the results from the stakeholder meetings and the online poll, 12 strategies were identified as top strategies to pursue in the City of New Braunfels.

The category of "Implementation Tools" consists of the Stormwater Utility Fee, Density Bonuses and City Incentives or Fees strategies, which is shown with an average.

	STRATEGY	STAKEHOLDER RANKING (23 IS HIGHEST, 1 IS LOWEST)	PUBLIC RANKING (23 IS HIGHEST, 1 IS LOWEST)
1.	Floodway Building Prohibitions	15	23
2.	Open Space Conservation	18	22
3.	Flood Hazard Mitigation	22	21
4.	Stream and River Restoration	17	20
5.	Litter Control	19	18
6.	Construction Control Measures	16	16
7.	Retrofit Stormwater Facilities	20	15
8.	Building Runoff Capture	10	14
9.	Impervious Coverage Reductions	14	13
10.	Maintenance and Monitoring	23	11
11.	Detention Basin	21	10
12.	Implementation Tools	6	10



This graph represents both the stakeholder and public ranking order for the strategies.

Analysis Categories

The strategies were analyzed according to:

- The goals for the Stormwater Management Strategy
- The governing authority (City Limits, Extraterritorial Jurisdiction (ETJ) or Other)
- The time frame of implementation (Past or Future)
- The method of implementation (Policy, Design and Construction or Operation and Maintenance)
- The scale of the strategy (Site, Community and/or Regional)

Goals

The first level of analysis was to measure the amount of times that each goal was met by the chosen strategies. The frequency of the times that the goal is met indicates whether or not the goal may be achieved with the voted strategies.

Each of the 13 goals was met by at least one strategy. The goals to encourage development patterns that improve stormwater management opportunities, ensure stakeholder buy-in on stormwater strategies and to develop stronger stormwater standards without stifling growth and development were met through the higher-voted strategies, while the goal to align the city's tourism industry practices with sensible stormwater management was only in two of the top twelve strategies.

The significance of this is that the plan's recommendations will need to ensure that the alignment with tourism industry practices goal is met.

STRATEGY	GOAL 1: ENCOURAGE DEVELOPMENT PATTERNS THAT IMPROVE STORMWATER MANAGEMENT OPPORTUNITIES.	GOAL 2: MINIMIZE IMPERVIOUS SURFACES.	GOAL 3: PREVENT FLOODING AND EROSION CAUSED BY STORMWATER RUNOFF.	GOAL 4: PROTECT WATER QUALITY OF RECEIVING WATERS, PARTICULARLY THE STREAMS AND LANDA LAKE.	GOAL 5: ENSURE CONSTRUCTION DOES NOT CREATE ENVIRONMENTAL DEGRADATION, EVEN ON A TEMPORARY BASIS.	GOAL 6: ENSURE STAKEHOLDER BUY-IN ON STORMWATER STRATEGIES.	GOAL 7: MAKE SURE RESPONSIBILITY FOR OPERATIONS AND MANAGEMENT OF STORMWATER INFRASTRUCTURE IS CLEAR.	GOAL 8: UTILIZE PARKS AND OPEN SPACE FOR STORMWATER STORAGE AND INFILTRATION.	GOAL 9: ALIGN THE CITY'S TOURISM INDUSTRY PRACTICES WITH SENSIBLE STORMWATER MANAGEMENT.	GOAL 10: DEVELOP STRONGER STORMWATER STANDARDS WITHOUT STIFLING GROWTH AND DEVELOPMENT.	GOAL 11: ENSURE THAT THE INVESTMENT IN INFRASTRUCTURE HAS A POSITIVE RETURN ON INVESTMENT FOR THE COMMUNITY.	GOAL 12: STORMWATER INFRASTRUCTURE SHOULD BE VISUALLY PLEASING.	GOAL 13: ENSURE CRAFTSMANSHIP OF STORMWATER INFRASTRUCTURE WILL RESULT IN PERMANENCE.
Floodway Building Prohibitions	X				X			X		X			X
Open Space Conservation	X			X				X			X	X	
Flood Hazard Mitigation	X					X			X				
Stream and River Restoration	X	X	X	X		X		X	X	X		X	
Litter Control	X				X	X	X			X	X		X
Construction Control Measures			X	X	X		X			X			X
Retrofit Stormwater Facilities			X	X		X	X			X			X
Building Runoff Capture		X	X		X	X					X		X
Impervious Coverage Reductions		X	X			X				X		X	X
Maintenance and Monitoring	X			X			X	X		X		X	
Detention Basin	X	X	X	X		X		X		X		X	
Implementation Tools	X		X	X		X				X	X		X

Governing Authority

Strategies that are applied within the City limits will use implementation tools based on City regulation and incentives. Ones that are applied in the ETJ will require partnerships and cooperation with other jurisdictions for implementation.

The chart below shows that all of the strategies fall within the City Limits governing authority, while approximately half will have both City Limits and ETJ purview.

STRATEGY	CITY LIMITS	ETJ
Floodway Building Prohibitions	X	
Open Space Conservation	X	X
Flood Hazard Mitigation	X	X
Stream and River Restoration	X	X
Litter Control	X	X
Construction Control Measures	X	
Retrofit Stormwater Facilities	X	
Building Runoff Capture	X	
Impervious Coverage Reductions	X	X
Maintenance and Monitoring	X	
Detention Basin	X	X
Implementation Tools	X	

Time frame of Implementation

Each of the strategies were evaluated based upon applicability to past or future actions.

The majority of the strategies will effect future actions. Only the stream and river restoration and retrofitting of stormwater facilities will have impacts that affect structures or actions retroactively. Discussion on how to address existing infrastructure needs to continue.

STRATEGY	PAST	FUTURE
Floodway Building Prohibitions		X
Open Space Conservation		X
Flood Hazard Mitigation		X
Stream and River Restoration	X	
Litter Control		X
Construction Control Measures		X
Retrofit Stormwater Facilities	X	
Building Runoff Capture		X
Impervious Coverage Reductions		X
Maintenance and Monitoring		X
Detention Basin		X
Implementation Tools		X

Method of Implementation

A balanced approach to stormwater management requires strategies to be implemented at the policy, design and construction and operations and maintenance phases of projects. This ensures long term solutions and changes in the approach to stormwater management.

These strategies focus more on policy and design and construction projects. Through building in operations and maintenance into some of the design and construction projects, a balanced approach to stormwater management could be achieved.

STRATEGY	POLICY	DESIGN AND CONSTRUCTION	OPERATIONS AND MAINTENANCE
Floodway Building Prohibitions	X		
Open Space Conservation	X		
Flood Hazard Mitigation	X		
Stream and River Restoration		X	X
Litter Control	X		X
Construction Control Measures	X	X	
Retrofit Stormwater Facilities		X	X
Building Runoff Capture		X	
Impervious Coverage Reductions	X	X	
Maintenance and Monitoring	X	X	X
Detention Basin		X	
Implementation Tools	X		

Scale

Understanding the most appropriate scale for implementation of strategies is needed to make sure that stormwater is being managed comprehensively. Many of the management tools are best applied based upon drainage patterns and should not be applied based upon jurisdictional lines.

The strategies provide a balance among site, community, regional scales. Most of the strategies will be implemented at multiple scales, reinforcing a balanced distribution of approaches.

STRATEGY	SITE	COMMUNITY	REGIONAL
Floodway Building Prohibitions		X	X
Open Space Conservation			X
Flood Hazard Mitigation		X	X
Stream and River Restoration		X	X
Litter Control	X	X	X
Construction Control Measures	X	X	X
Retrofit Stormwater Facilities	X	X	X
Building Runoff Capture	X		
Impervious Coverage Reductions	X	X	
Maintenance and Monitoring	X	X	X
Detention Basin		X	
Implementation Tools	X	X	X

Priority Strategy Implementation Options

In order to best understand the implementation options, the current conditions in New Braunfels were evaluated specific to each strategy. This evaluation provided an existing conditions specific to each strategy.

A series of case studies around each of the strategies was then completed to better understand how other cities similar to New Braunfels have implemented each strategy. These case studies were based upon four criteria: comparable size to New Braunfels, economy has river-based tourism, regionally similar with priority to Texas examples, and presence of MS4 permit. Full explanation of each case study is included in the Appendix.

The proposed strategies are based on the case studies and extensions of the strategies that New Braunfels currently has in place. These proposed strategies are summarized at the end of this chapter as well.

The following pages outline each strategy, explaining the actions that New Braunfels has already taken to address each strategy, the recommendations that were pulled from the corresponding case studies and the proposed implementation options for New Braunfels.

Floodway Building Prohibitions

New Braunfels Existing Conditions

Fences constructed in drainage easements must not restrict the flow of drainage water.

New development must not increase the water surface elevation of the base flood level more than one foot.

The lowest floor of new construction must be elevated to at least two feet above the base flood level.

Floodway encroachments are prohibited unless it can be demonstrated that the proposed encroachment would not result in any increase in flood levels within the community during the occurrence of the 25-year and base flood discharge.

The Federal Emergency Management Agency's Hazard Mitigation Grant Program (HMGP) provided New Braunfels with funds for a buyout program for flood damaged properties following the Flood of 2002.

Case Study Recommendations

King County, Washington | Prohibit "flood fringe" development.

King County, Washington | Increase floodway to encompass nearly the entire floodplain.

Proposed Implementation Options

Prohibit (versus regulation of) new structures from being constructed in the floodway.

Establish a funding source for removal of structures damaged in the 2010 floods from the floodway.

Re-evaluate the floodway boundaries to include more of the floodplain.

Open Space Conservation

New Braunfels Existing Conditions

New Braunfels defines an “Open Space” park land as land which is not programmed for any specific active recreational purpose. Its value is typically defined as visual, ecological and providing compensation for impermeable surfaces.

The recommended level of service for Open Space park land is 10 to 15 acres per 1,000 residents. The year 2015 need with 77,726 projected residents is 777-1,166 acres and the 2020 need with 99,200 projected residents is 992-1,488 acres. New Braunfels has three existing Open Space parks including portions of Cypress Bend park, Solms Park and Fischer Park.

The 2010 New Braunfels Strategic Parks and Recreation Master Plan recommends that land banking should be considered crucial and a program to be put in place to ensure the acquisition of parkland. Available land to address current and future needs may include existing vacant land, land subject to flooding along the creeks and drainage channels and land dedicated as parks as a requirement of developers to fulfill the City’s Parkland Dedication Ordinance.

Case Study Recommendations

Maricopa County, AZ | Natural drainage channel includes recreational uses while increasing floodwater conveyance capability.

Roseville, California | Permanently protected site guarantees the site will always be used for flood control, wetland habitat and public recreation.

Hays County, Texas | Assemble 10-15,000 acres of preserve land over 30 years through a phased conservation banking approach.

Proposed Implementation Options

Create a city program (staff and funding source) for conservation banking of floodway and floodplains.

Partner with Comal and Guadalupe Counties for conservation land acquisition of floodway, floodplains, recharge areas and other open space.

Partner with existing conservation programs (i.e. Hill Country Alliance) to promote awareness of conservation programs and issues.

Encourage responsible infiltration to the Edwards Aquifer Recharge Zone through education and incentives.

Flood Hazard Mitigation

New Braunfels Existing Conditions

New Braunfels submitted the following mitigation action items for inclusion in the Alamo Area Council of Governments Regional Mitigation Action Plan:

- Remove trees and debris from Dry Comal Creek and the Guadalupe River to allow for better creek drainage.
- Acquire flood-damaged structures along the Guadalupe River to remediate repetitive flood losses and convert those areas to open space.

New Braunfels is currently underway or has completed the following flood mitigation projects:

- North Tributary Regional Flood Control Project
- South Tributary Regional Flood Control Project
- Dry Comal Flood Control Project
- Landa Dam culvert repair

In April 2011, eight sirens were installed along the Comal and Guadalupe Rivers, which will serve to warn residents about hazardous flooding conditions.

In January 2011, the City Council approved Resolution No. 2011-R02 which authorizes the City Manager to support the Guadalupe-Blanco River Authority's application for flood protection planning grant assistance filed with the Texas Water Development Board.

In June 2011, New Braunfels adopted a flood damage prevention ordinance, which seeks to minimize losses due to flood conditions.

Case Study Recommendations

State of South Carolina and King County, Washington | Include prevention measures, property and natural resource, emergency service, reduction of risk to structures and critical facilities and public information activities in Flood Hazard Mitigation Plans.

Proposed Implementation options

Continue to fund long-term, cost-effective and environmentally-sound flood risk reduction structural projects such as dams and channels.

Implement life and property protections through a land acquisition program that will simultaneously benefit New Braunfels residents by providing recreational open space.

Provide public information to both visitors and property owners about flooding hazards.

Implement prevention measures through stringent building elevation and floodproofing requirements.

Add two-year storm to the range of design storm frequency requirements in the Drainage and Erosion Control Design Manual.

Update the Drainage and Erosion Control Design Manual to add language that specifies the mitigation of peak flow downstream beyond the requestor's property line. Expand on the discussion to not transfer the problem downstream. Explain in more detail how calculations should be performed further downstream to improve it.

Stream and River Restoration

New Braunfels Existing Conditions

New Braunfels is affiliated with the Geronimo and Alligator Creeks Watershed Partnership. They provide outreach materials and programs related to how bacteria and nutrients affect water quality.

The Partnership seeks:

- To provide nutrient management training to appropriate parties regarding proper nutrient application and soil testing.
- To provide educational programs for homeowners who have septic systems.
- To repair, replacement or upgrading of failing septic systems.
- To expand sanitary sewer system to areas currently served by septic.
- Funding for more frequent and expanded household hazardous waste and bulk waste cleanups in the watershed.

Case Study Recommendations

Georgia | Increase pollution awareness through education.

Georgia | Provide citizens with opportunities to monitor waterways.

Georgia | Encourage relationships between citizens and government.

Georgia | Collect quality water data through citizen involvement.

Boston, Massachusetts | Remove built-up sediment to restore original dimensions of river.

Boston, Massachusetts | Daylight and install large culverts.

Boston, Massachusetts | Remove invasive vegetation.

Buford, Georgia | Protect naturally vegetated riparian buffers through enforcement of a 50-foot undisturbed buffer with an additional 25-foot impervious surface buffer along intermittent streams.

Proposed Implementation options

Partner with local groups and universities to implement ecological and habitat restoration projects, research and studies.

Establish an Adopt-a-Stream program using grants.

Establish a funding source for sedimentation and invasive vegetation removal.

Fund and strategize long-term projects that expose and restore sections of streams that have been diverted through underground pipes.

Currently, New Braunfels does not have a defined stream and riparian corridor setback requirement. Create a stream and riparian corridor setback requirement, which can vary per watershed and creek size. Add an additional buffer for impervious surfaces along intermittent streams.

Update the Drainage and Erosion Control Design Manual to require tree mitigation. Specify a fixed replacement ratio for native trees above a specified trunk diameter.

Update the Drainage and Erosion Control Design Manual to require the preservation of natural channels and drainage patterns.

Update the Drainage and Erosion Control Design Manual Erosion Hazard Setback Regulation to contain more detail and specific setback requirements. Remove the bank stabilization option.

Litter Control

New Braunfels Existing Conditions

It is illegal in the City of New Braunfels to dump any type of debris into a canal, stream, river or drainage ditch. A fine between $200-$2,000 can be imposed. The violator will also be responsible for cleanup.

In November of 2010, the City Council voted unanimously to support the Edwards Aquifer Recovery Implementation Program, which is a collaborative, stakeholder process involving stakeholders to formulate a plan to protect species affected by management of the Edwards Aquifer.

The City passed Ordinance 86-14 in November 2011 to prohibit all disposable containers on certain public waterways, including the Guadalupe River. The ordinance will go into effect in January 2012.

In December 2011, City Council will consider a proposal to charge visitors a fee to access the river. The proceeds from the fee will help to offset the $1 million per year that goes towards cleanup and river management.

Case Study Recommendations

Monterey, California | Provides legal authority to regulate illicit discharges in Stormwater Discharge Management Ordinance.

Wichita Falls, Texas | Require loads to be covered with a tarp during transfer to waste station and landfill.

Wichita Falls, Texas | Provide annual operator awareness training.

Proposed Implementation options

Fund a city-wide regular cleanup program.

Enact an ordinances that limits disposable items, such as bags and cups.

Implement annual employee awareness training.

Enact a Stormwater Discharge Management Ordinance to regulate illicit discharges.

Establish a Pet Waste Ordinance.

Construction Control Measures

New Braunfels Existing Conditions

New Braunfels requires a soil erosion and sediment control plan submittal for commercial permits.

Case Study Recommendations

Douglas County, Colorado | Pre-submittal meetings are encouraged prior to Storm Water Pollution Prevention Plans (SWPPP).

Douglas County, Colorado | Site inspections throughout the construction process.

Eugene, Oregon | Outcome-based erosion control program.

Charolette, North Carolina | All construction activity, regardless of size, must meet minimum standards.

Charolette, North Carolina | Inspections that do not meet standards can be fined up to $3,000 per day.

Proposed Implementation options

Require pre-submittal SWPPP meetings that produce outcome-based performance measures specific to each project.

Fund and staff a greater frequency of construction site inspections through permit fees, enforcement and stormwater utility funds.

Provide benefits for exceeding minimum construction control requirements, such as expedited review time or reduced fee costs.

Update the Drainage and Erosion Control Design Manual to be more specific regarding the use of sediment fencing.

Update the Drainage and Erosion Control Design Manual to meet or exceed EPA standards.

Include specific Best Management Practices in the Drainage and Erosion Control Design Manual.

Retrofit Stormwater Facilities

New Braunfels Existing Conditions

Digital submissions of all drainage reports and structures are required to be submitted to the CIty of New Braunfels.

New Braunfels created a Watershed Advisory Committee (WAC) due to a federally-mandated stormwater requirement. The WAC is comprised of a committee of nine voting members from a broad spectrum of professional backgrounds.

In February 2011 the committee advised on a list of potential stormwater improvement projects, including channel lining, road reconstructions, culvert construction and detention ponds.

In June 2011, New Braunfels approved a budget adjustment for the Stormwater Development Fund. This funds operations and maintenance expenses for personnel and equipment that provides upkeep to drainage facilities and easements.

Case Study Recommendations

Seattle, Washington | The city regularly inspects all privately-owned stormwater detention, treatment and conveyance systems.

Seattle, Washington | Property owners are responsible for maintaining drainage systems to ensure long-term functionality.

Montgomery County, Maryland | Consistently update database of stormwater facilities.

Montgomery County, Maryland | Construct bypass weirs, add wetlands or retention and dredge to capture and treat additional volumes of rainfall runoff.

Proposed Implementation options

Fund and staff an on-going facilities and upgrades needs database.

Update the Drainage and Erosion Control Design Manual to require the incorporation of Low Impact Design techniques in new and retrofitted construction projects.

Fund and staff city inspections of privately-owned stormwater detention, treatment and conveyance systems.

Update the Drainage and Erosion Control Design Manual to define the minimum slope and velocity to avoid sedimentation accumulation in culverts. Require the minimum size of culverts to be 18 inches.

Building Runoff Capture

New Braunfels Existing Conditions

New Braunfels Utilities (separate from the City) offers a rebate toward the purchase of rain barrels or cisterns to help offset the cost of rainwater harvesting systems. The rebate reimburses $0.50 per gallon of water storage installed and is for residential only.

Case Study Recommendations

Los Angeles, California | Install greywater systems, dry wells and cisterns.

Los Angeles, California | Strategically plant and maintain vegetation near impervious areas to help in cleaning stormwater runoff.

Portland, Oregon | Remove or replace impervious pavement with pervious materials.

Portland, Oregon | Direct roof runoff to swales and planters.

Portland, Oregon | Re-grade paved areas so they drain into new or existing landscaping.

Portland, Oregon | Install roof gardens that reduce stormwater flow into sewers.

Lacey, Washington | The Zero Impact Development Ordinance provides developers with the opportunity to demonstrate zero effective impervious surfaces. It requires developers to maintain a site's original hydrologic function after development.

Lacey, Washington | Low Impact Development is a legal alternative to conventional site design.

Proposed Implementation options

Expand current city-sponsored cistern program through grants to provide no-cost cisterns or rain barrels to both residential and commercial.

Provide permitting or fee incentives for new or retrofitted construction that directs downspouts to rain gardens.

Enact a voluntary zero impact development ordinance, with incentives.

Provide permitting or fee incentives for new or retrofitted construction that re-grades paved areas to direct stormwater to detention.

Provide permitting or fee incentives for new or retrofitted construction that removes pavement and replaces it with porous materials.

Impervious Coverage Reductions

New Braunfels Existing Conditions

New Braunfels existing impervious coverage restrictions currently focus on landscape. The planning director may require a professional arborist's report that defines the impact of a development upon existing trees affected by proposed construction and impervious cover limitations adjacent to protected trees.

Landscaping is accepted as adding value to property and is in the interest of the general welfare of the city. The provision of landscaped area also serves to increase the amount of a property that is devoted to pervious surface area which, in turn, helps to reduce the amount of impervious surface area, stormwater runoff and consequent non-point pollution in local waterways. Therefore, landscaping is hereafter required of new development as provided in this section, except landscaping is not required for single-family and two-family, and agricultural uses.

Case Study Recommendations

Austin, Texas | The Edwards Aquifer Recharge Zone Building Limitations limits impervious cover and density in the Edwards Aquifer Recharge Zone. Developers may transfer impervious cover or development rights. The Limitations also specify stormwater treatments and construction management, require detention and stream bank setbacks or buffer zones.

Seattle, Washington | Neighborhood blocks have allowable percentage of impervious surface overage.

Seattle, Washington | Reduce street widths.

Seattle, Washington | Maintain a future redevelopment threshold database.

Proposed Implementation options

Require a parking maximum in addition to a parking minimum.

Reduce street lane width requirement.

Evaluate, determine and regulate areas of the city that limit the density and amount of impervious cover. Consider developer transfer rights within this zone. (Revise wording)

Incorporate Low Impact Design techniques into building requirements.

Incentivize the use of pervious paving options with expedited review processes or reduction of permitting fees.

Maintenance and Monitoring

New Braunfels Existing Conditions

New Braunfels Utilities periodically contracts outside sources to test the water quality in water bodies throughout the New Braunfels area. The purpose of the studies is to provide additional water quality data to assist in determining whether nutrient limitations on point source discharges from New Braunfels Utility's wastewater treatment plants will prevent growth of excessive aquatic vegetation.

The Guadalupe-Blanco River Authority (GBRA) partners with the Texas Commission on Environmental Quality (TCEQ) and has several Comal County water quality monitoring sites located in New Braunfels. They are funded entirely by fees assessed to wastewater discharge and water rights permit holders. The sites are monitored on a monthly or quarterly basis for bacteria and water flow.

Case Study Recommendations

Monroe County, New York | Enlist citizens to monitor water quality, and vegetate riparian corridors.

Monroe County, New York | Establish a stormwater outfall adoption pilot program.

Hillsbrorough County, Florida | Volunteer Adopt-a-Pond Maintenance Program reduces pollution and litter while increasing citizen awareness of stormwater impacts.

Central New York | Engagement of local schools teaches children about stormwater impacts and water quality which at the same time benefits the city by allowing for the collection of scientifically-valid data for water quality monitoring.

Proposed Implementation options

Create a citizen-based monitoring program through grants.

Create a Home Owners Association maintenance education program through online material and brochures.

Fund and staff expansion of city monitoring and maintenance programs.

Create a school-based monitoring program and curriculum that teaches children about stormwater issues and provides scientifically-valid data to the city for water quality monitoring purposes.

Update the Drainage and Erosion Control Design Manual to identify maintenance standards.

Detention Basin

New Braunfels Existing Conditions

The Drainage and Erosion Control Design Manual requires that most development types include post-development discharge mitigation through detention or some other technique. Participation in neighborhood or regional mitigation is also an option.

New Braunfels 2010 Open Space Master plan prioritizes detention over other areas. (Need more details)

Case Study Recommendations

Chicago, Illinois | Detain stormwater on-site, which is then maintained as park or open space by the Parks Department. The Parks Department has an agreement with the community that the stormwater detention facility will only be maintained if it has a recreational use.

Chicago, Illinois | Land can be used for golf courses, sports fields, tennis courts and nature areas.

Tuson, Arizona | Detention basins used as recreational areas provide opportunities for environmental restoration of degraded riparian ecosystems while improving neighboring communities.

Proposed Implementation options

In conjunction with the 2010 Open Space Master Plan, prioritize park improvements based upon the possible use as a detention facility.

Update building code to designate the use of detention basin water for irrigation and provide incentives for developers that implement greywater systems.

Update the Drainage and Erosion Control Design Manual section on Detention Pond Design to clearly define the methodology for silt removal based on vegetation.

Implementation Tools

New Braunfels Existing Conditions

New Braunfels approved stormwater utility fees in July 2011. This fee would potentially raise $2.3 million per year to fund drainage work in New Braunfels. The fee would amount to $4.60 per month for a 2,000-3,000 square foot home. Smaller homes would receive a $3.00 fee and larger homes could pay up to $6.60. Commercial properties would pay approximately $4.60 per month.

The City also provides incentives regarding the drainage facility criteria. A fee may be utilized in place of a detention or retention system. Collected fees will be used to construct public flood control improvements.

Case Study Recommendations

Arlington County, Virginia | Require development site pollutant removal based on the amount of existing and proposed impervious cover. Compliance options include additional on-site or off-site treatment or monetary contribution to the Watershed Management Fund.

Portland, Oregon | The Clean River Rewards Incentive and Discount Program allows property owners who manage stormwater on-site or on the public right of way to be eligible for discounts at 35% of the stormwater charge for on-site and 65% for the public right of way.

Centennial, Colorado | An annual stormwater fee for improved lands is based on impervious area and is charged to the property owner based on the impact that the property will have on the drainage system.

Proposed Implementation options

Base stormwater fees associated with improved land on impervious area.

Reward property owners who manage stormwater on-site or in the public right-of-way with stormwater fee discounts.

Allow compliance options, such as contribution to a fund or additional on-site or off-site treatment.

Update the Drainage and Erosion Control Design Manual to require detention or fee-in-lieu for Types 1 and 2 Development.

Update the Drainage and Erosion Control Design Manual to include a section delineating Low Impact Design methods.

STRATEGY CATEGORY	IMPLEMENTATION OPTION
FLOODWAY BUILDING PROHIBITIONS	Prohibit (versus regulation of) new habitable structures from being constructed in the floodway.
	Establish a funding source for removal of existing buildings from the floodway.
	Re-evaluate the floodway boundaries to include more of the floodplain.
OPEN SPACE CONSERVATION	Create a city program (staff and funding source) for conservation banking of floodway and floodplains.
	Partner with Comal and Guadalupe Counties for conservation land acquisition of sensitive recharge areas and other open space.
	Fund existing conservation programs (i.e. Hill Country Alliance) with mitigation fees and agency grants.
	Encourage responsible infiltration to the Aquifer Recharge Zones per the efforts of TCEQ through education and incentives.
FLOOD HAZARD MITIGATION	Fund additional long-term, cost-effective and environmentally-sound flood risk reduction structural projects such as regional detention and channel improvements. Improve process to select and rank priorities city-wide.
	Implement life and property protections through a land acquisition program.
	Enhance public information to both visitors and property owners about hazards.
	Improve prevention measures through more stringent building elevation and floodproofing requirements.
STREAM AND RIVER RESTORATION	Partner with local groups and universities to implement ecological and habitat restoration projects, research and studies.
	Establish an Adopt-a-Stream program via grants.
	Establish a funding source for sedimentation and invasive vegetation removal.
	Fund long-term projects that restore sections of streams that have degraded or have been diverted through underground pipes.
	Create a stream and riparian corridor setback requirement, which can vary per watershed and creek size. Add an additional buffer for impervious surfaces along intermittent streams.
LITTER CONTROL	Fund a city-wide regular cleanup program.
	Enact an ordinance that limits disposable items, such as bags and cups.
	Enact a Stormwater Discharge Management Ordinance to regulate illicit discharges.
	Establish a Pet Waste Ordinance.
CONSTRUCTION CONTROL MEASURES	Require Storm Water Pollution Prevention Plans that produce outcome-based performance measures specific to each project.
	Fund and staff a greater frequency of construction site inspections through permit fees, enforcement and stormwater utility funds.
	Provide benefits for exceeding minimum requirements, such as expedited review time or reduced fee costs.
	Update the Drainage and Erosion Control Design Manual to be more specific regarding the use of sediment fencing.
	Update the Drainage and Erosion Control Design Manual to exceed EPA standards.
RETROFIT STORMWATER FACILITIES	Fund and staff an on-going facilities and upgrades needs database. Require digital submissions for all drainage reports and design/as-built plans.
	Enact an ordinance that requires the incorporation of Low Impact Design techniques in new and retrofitted construction projects.
	Fund and staff City inspections of privately-owned stormwater detention, treatment and conveyance systems. Limit future private systems and gradually acquire existing private systems.
	Update the Drainage and Erosion Control Design Manual to define the minimum slope and velocity to avoid sedimentation accumulation in culverts. Require the minimum size of pipes to be 18 inches.

STRATEGY CATEGORY	IMPLEMENTATION OPTION
BUILDING RUN-OFF CAPTURE	Expand current City-sponsored cistern program through grants to provide no-cost cisterns or rain barrels.
	Provide permitting or fee incentives for new or retrofitted construction that directs downspouts to rain gardens.
	Enact a voluntary zero impact development ordinance, with incentives.
	Provide permitting or fee incentives for retrofitted construction that re-grades paved areas to direct stormwater to detention.
	Provide permitting or fee incentives for new or retrofitted construction that removes pavement and replaces it with porous materials.
IMPERVIOUS COVERAGE REDUCTION	Require a parking maximum in addition to a parking minimum.
	Reduce street lane width requirement.
	Evaluate, determine and regulate areas of the city that limit the density and amount of impervious cover. Consider developer transfer rights within this zone.
	Incorporate Low Impact Design techniques into building requirements.
	Incentivize the use of pervious paving options with expedited review processes or reduction of permitting fees.
MAINTENANCE AND MONITORING	Create a citizen-based monitoring program through grants.
	Create a Home Owners Association maintenance education program through online materials and brochures.
	Fund and staff expansion of city monitoring and maintenance programs.
	Create a school-based monitoring program and curriculum that teaches children about stormwater issues and provides scientifically-valid data to the city for water quality monitoring purposes.
	Update the Drainage and Erosion Control Design Manual to identify maintenance standards.
DETENTION BASIN	In conjunction with the 2010 Open Space Master Plan, prioritize park improvements based upon the possible use as a detention facility.
	Update building code to designate the use of detention basin water for irrigation and provide incentives for developers that implement greywater systems.
	Update the Drainage and Erosion Control Design Manual to allow for fee-in-lieu (rather than detention) in lower portions of the watershed, where detention may be counterproductive.
	Require or provide incentives for specific design enhancements to detention basins to also improve their water quality functionality.
IMPLEMENTATION OPTIONS	Base stormwater fees associated with improved land on impervious area.
	Allow compliance options, such as contribution to a fund or additional on-site or off-site treatment.
	Update the Drainage and Erosion Control Design Manual to require detention or fee-in-lieu for Types 1 and 2 Development.
	Update the Drainage and Erosion Control Design Manual to include a section delineating Low Impact Design methods.