LEVEL 2: “Stormwater Management”

* ***Stormwater Management****:*
	+ ***Goal:*** *Understand key stormwater management concepts and strategies, their benefits, drawbacks and how they compare to each other.*
	+ ***Key Concepts Learned:*** *Learn what stormwater management is , and also understanding how urbanization impacts water movement promoting flooding in unwanted areas, and what strategies can ameliorate its negative effects.*

**What happens when it Rains?**

*Why does rain cause flooding in some areas and not in others, why does it happen sometimes, and not others, and what happens to the rain once it falls from the sky? As you learned in Level 1, when rainwater falls, it is absorbed by the soil or directed to rivers, lakes and other water bodies. When water is not absorbed by the soil, and does not flow directly into a waterway, but instead moves across land, parking lots, and roads that is called “stormwater runoff”. Runoff usually flows into the nearest stream, creek, resaca, river, lake or ocean, evaporates, or gets trapped in a low lying area. and is not treated or cleaned in any way***.**

*Why do we care about runoff?*

*Ideally stormwater is absorbed into the soil, where the water is naturally filtered and ultimately replenishes aquifers (groundwater) or flows into streams and rivers.. But when it is not absorbed and becomes stormwater runoff, it can increase erosion, contribute to localized flooding, and increase pollution of area lakes, rivers, resacas, reservoirs, and ocean. As runoff moves across roofs, yards, streets, parking lots, and other hard surfaces it picks up many different forms of pollution including, . pesticides, trash, bacteria, oil and grease, or nutrients that affect plants and animals. Adding roads, driveways, parking lots, rooftops and other surfaces ~~are~~ added water increase the amount of stormwater runoff, and make it harder for water to soak into the ground.*



*Other Impacts:*

* + As the Valley grows so will the impact of the added impervious surfaces, infrastructure, and loss of natural ways to collect and filter our water. Without strategies to lessen the affects of additional development we will likely see increased flooding, more localized flooding, increased erosion of waterways, and increased concerns over the quality and availability of usable water.
	+ Stormwater runoff can be a significant contributor to pollution in rivers, rasacas, lakes, and reservoirs.
	+ Much of the Valley’s drinking water comes from surface water, or water found in streams, lakes, or reservoirs. Reducing the amount of pollutants in our water is important for our health, and for the health of our environment. This means reducing the amount of pollution that gets carried into our waterways by runoff.
	+ *Roads, railroads, and other infrastructure can change the way water moves. Creating basins or something similar to a bathtub for water to collect; this can lead to increased frequency of flooding, increased intensity of flood events, and an increase in the demand for drainage infrastructure capacity.*

**How do we deal with water and runoff?**

*There are a number of ways to lessen the effects of stormwater runoff; some key strategies include planting trees and plants that absorb and hold water, building and maintaining infrastructure to collect and move water away, and reducing the amount of surfaces that don’t absorb water. Managing stormwater and its runoff is called stormwater management. While some may think managing water means building more drainage infrastructure, it is also important to manage the health and cleanliness of our water. The Environmental Protection Agency says “Sustainable stormwater management focuses on reducing runoff and improving water quality.” Today’s infrastructure and water management strategies don’t always achieve both goals. In understanding our infrastructure and future projects we hope to better understand how the goals of moving water and protecting our water quality are being achieved.*

**HOW DO WE CURRENTLY MANAGE OUR WATER?**

*People have been controlling the movement of water for centuries; to help control flooding, to irrigate crops, to drink, and to power industry. This section will focus primarily on the systems for managing flooding, or stormwater management. There are two key elements in stormwater management; conveyance (moving water) systems, and retention or detention systems (holding water). The majority of stormwater infrastructure achieves one or both of those purposes. When looking at how to manage water, and the type of infrastructure used to achieve your stormwater management goals, there are two primary systems;conventional and Low Impact Development (LID) systems.*

***Conventional Stormwater Management Systems***

*Conventional drainage management systems focus primarily on moving or storing water quickly through underground or above ground drainage systems like pipes, curb and gutters, and others, mainly made from hard or impervious surfaces like concrete, plastic or metal.*

1. ***Conveyance systems (to move water):***
	1. ***Pipes:*** *are used to move water underground and are usually made of concrete, metal or plastic.*
	2. ***Curb:*** *Vertical separation at the edge of the road, they are used to direct and restrict storm runoff and to provide safety for pedestrians along the road edge.*
	3. ***Gutter:*** *paved drainage channel or swale*
	4. ***Ditch/Swale:*** *it is an exposed vegetated channel that allows to move water from one point to another. Mostly used in less densely populated, more open areas where flow of water above surface can be accommodated fairly easily (like rural areas).*
2. ***Retention and Detention (holding water)***
	1. ***Retention Pond:*** *also known as a wet pool or wet pond, is a constructed stormwater pond that retains a permanent pool of water, with minor biological treatment.*
	2. ***Detention Pond:*** *also known as dry ponds, are stormwater basins designed to intercept stormwater runoff and hold it temporarily and released gradually to a conveyance system or a receiving waterbody*

**Low Impact Development and Green Infrastructure Water Management**

*Low impact development is an approach to development (both buildings and infrastructure) that works with nature to manage stormwater. LID principles and practices seek to manage water through reducing the impact of development, and promoting the natural movement of water as presented in Level 1. These practices include controlling water movement (flow), retaining or holding rainwater, infiltration (the way water on the ground is absorbed into the soil), and treating contaminants in the water. These strategies help reduce the runoff that enter streets, storm sewer and and larger canals, alleviating pressure on the system and alleviating chances of flooding.*

1. ***Conveyance systems (to move water):***
	1. ***Bio-swales:*** *these are vegetated swales designed to move water and although similar in concept with the conventional swale or ditch, in many cases the soils are modified to promote more filtration and absorption through the ground. Additional vegetation is added to assist with filtration of contaminants and slow water down.*
2. ***Retention and Detention (holding water)***
	1. ***Retention/detention ponds:*** *similar to the ones described above, however, LID and GI promote the use of native vegetation and creating habitat that assists with filtration of contaminants.*
	2. ***Bioretention cells****: are landscaped, shallow depressions that capture and temporarily store stormwater runoff.*
	3. ***Rain Gardens:*** *is a shallow depression in the landscape that is meant to capture stormwater running off from your roof, driveway and sidewalks. Also known as biofiltration ponds, rain gardens are not meant to hold water but rather are meant to soak up and filter pollutants while they infiltrate or absorb the water.*
	4. ***Subsurface collection facilities, cisterns, or rain barrels:*** *capturing rainwater can help reduce the amount of water that runs to the street and drainage canals or pipes. In addition, captured rainwater can be used to irrigate plants and reduce potable water consumption.*

Besides the strategies discussed above, there are other strategies that are not meant to move or hold water, but to reduce the amount of runoff that needs to be managed.

*Impact Reduction Strategies:*

1. *Decrease the amount of impervious surfaces such as asphalt roads, concrete driveways, parking lots, etc.*
2. *Break up (disconnect) impervious surfaces or use pervious materials such as porous concrete, permeable pavers, or site furnishings made of recycled waste: these strategies are used to allow some water to be absorbed by the soil. Based on the type of soil in an area these strategies may work differently - many places in the Valley have a lot of clay in their soil which doesn’t absorb water well - soils can be modified to absorb water by adding sand, gravel and other materials.*

*Infiltration Systems:*

1. *These strategies reduce impervious surfaces and provide vegetated areas than can absorb water and filter contaminants. Examples include filter strips, tree box filters, bioretention cells, and infiltration trenches. By absorbing water, it minimizes runoff entering streets and drainage canals, ditches, sewers, etc,*

***Which System is Better?***

*There is no clear answer to that. On a large, regional scale convention conveyance and retention systems are necessary, particularly during a large rain event, tropical storm, or hurricane. However, conventional systems have been shown to negatively impact the local environment, local water quality, and drinking water supply; while not always ensuring flood protection. At the lot, neighborhood, and municipal scale LID strategies are highly effective at reducing runoff and managing the conveyance and retention of water, while typically being less expensive. LID, unlike conventional system has shown to improve the quality of water in urbanized areas, contribute to healthier waterways, and provide more attractive alternatives to conventional system.*

*Ultimately the answer is we need both, but in the future the question should be which system, or combination of the systems makes the most sense for the problem we are seeking to solve.*

**Story**

Curry Estates is a subdivision near the City of Edinburg which was designed with a drainage system of swales or ditches that ran behind private properties and into an outfall or exit to a larger ditch to the south of the colonia. Over time neighbors filled part of the swales running through their properties, making the water to back up and flood the colonia. The flooding blocked access to cars and school busses, impacting the everyday lives of residents. To resolve the flooding problem, the county government developed an underground system of pipes to direct the water towards the southern ditch.

Many colonias or rural subdivisions have been developed with drainage infrastructure, but there is a challenge on maintaining it or for residents to understand the importance of how it works. In this colonia, an expensive underground system had to be developed in order to take the water out. Understanding the different systems can help residents and county officials with the maintenance of infrastructure.