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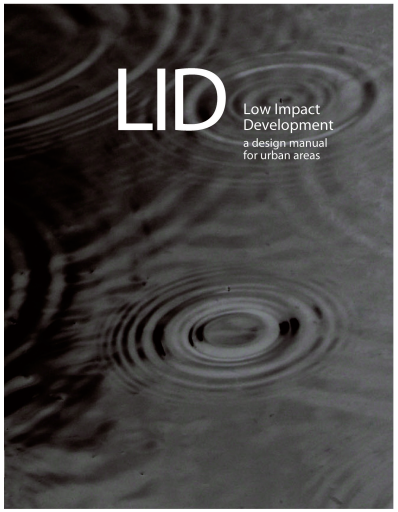
The purpose of the detailed proposal section is to provide design guidelines, schemes, and recommendations. These detailed strategies are based directly off of the concerns and recommendations in the Executive Summary. Each section details the design concepts, phasing, implementation and benefits for each possible change.

The book *Low Impact Development: A Design Manual for Urban Areas* was a useful resource in the compilation of this tool kit. It is highly recommended that a copy be purchased and retained by the City of Butler for continual reference. The information that appears on pages 40-70 was heavily influenced by this book.

University of Arkansas Community *Design Center. Low Impact Development: A Design Manual for Urban Areas*. Fayetteville, AR: University of Arkansas Community Design Center, 2011.



LID COVER **\FIG_DTPRL_39_1**

GREENWAY
\FIG_DTPRL_40_1\

BAD RUNOFF
\FIG_DTPRL_40_2\

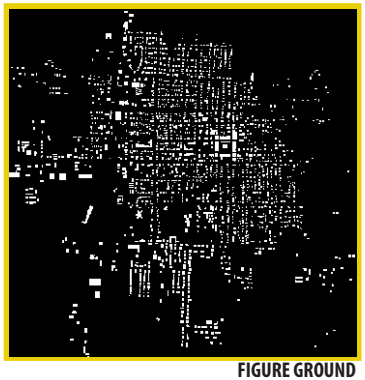


FIGURE GROUND

SELF-SUPPORTIVE COMMUNITIES

Sustainable communities are communities that are planned, built or modified to promote sustainable living. These communities tend to focus on environmental and economic sustainability. This may include sustainable aspects relating to reproduction, water, transportation, energy, waste and materials that focus on sustainable urban infrastructure.

Communities are not just based on sustainable design, but have a lot to do with people to promote sustainable living. This is done by actively seeking to minimize climate change. People are encouraged to recycle and save water, live in homes that do not waste electricity and are built on wasteland so that no new forests/fields are destroyed. Sustainable living also creates cleaner, safer and greener neighborhoods by maintaining pleasant public spaces.

Self-supportive communities need to focus on sun, wind, water, and materials to advocate sustainable living as well. By focusing on these technologies; a thriving, active and well connected community is formed.

These communities analyze codes and obstacles, management (not maintenance), property (lot/block design), streets, building, technology and open space.

Codes and obstacles can't be implemented to their fullest unless zoning is taken into account, codes are changed, covenants are made and obstacles are overcome to create a more eco-friendly community. Also, management is the resourceful use of materials and resources. By managing different ecological facilities such as storm water management, open space renewal and energy production; sustainable communities are created. Analyzing property and streets are also very important when design sustainable communities. Lot/block design should be taken care of and modified to be as ecologically friendly as possible. Streets should be changed and reconfigured to help Butler and the environment rather than just acting as ways for transport.

Green building is an important aspect in sustainable communities. When building, the community needs to focus on economy, utility, durability and comfort while implementing new technologies such as infill development, water harvesting, and solar power. Other technologies that can be implemented are wind turbines and sustainable materials. Lastly, open space needs to incorporate into the design of a community. When designing an open space, conservation development, treatment parks and green ways need to be considered.

The use of all of these design aspects will create a community that will be environmentally sensitive, active, safe, well served, connected, run, built and designed. This will also foster a distinctive, attractive, community with a strong sense of place.

STREETSCAPE \FIG_DTPRL_40_3\

TREEBOX \FIG_DTPRL_40_4\

SUSTAINABLE COMMUNITIES CHART

\FIG_DTPRL_41_1\

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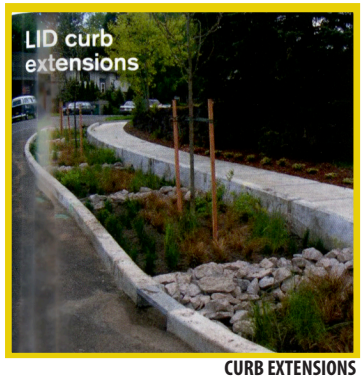
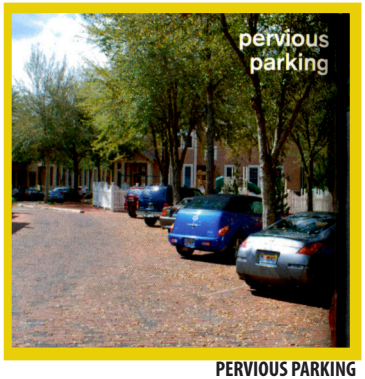


CURB EXTENSIONS
\FIG_DTPRL_42_1\



PERVIOUS PARKING
\FIG_DTPRL_42_2\

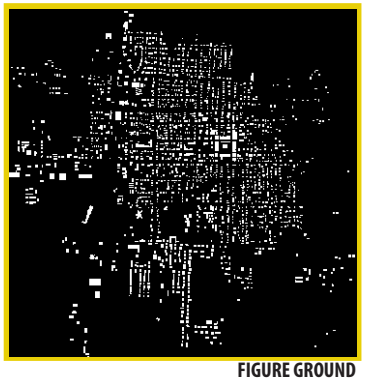


FIGURE GROUND

STREETS

WHY

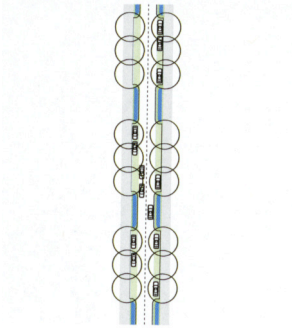
Streets provide the means of movement around and within a community. They facilitate the current primary mode of transportation, motorized vehicles. Streets also take up a lot of space and end up replacing natural landscapes with impervious tracts of concrete. Current streets are not friendly towards bicycles, pedestrians and other alternatives to motorized vehicles. Streets can be easily changed and reconfigured to help the city and the environment rather than just acting as thoroughfares for transportation

TYPES

Streets range anywhere in size from small one way alleys to multi-lane highways and parkways. Each size can get its own treatment that allows the street to give the community aesthetic beauty and identity.

SKINNY

Skinny streets are usefully for the smaller street applications. Residential streets in particular can benefit from becoming "skinnier." Reducing the width of streets provides multiple benefits. These streets are initially seen as unsafe, but actually reduce traffic speeds and accident rates. Benefits are also economic. There are reduced costs for street maintenance and resurfacing. Environmental effects include the reduction of heat island and storm water runoff creation. They are further characterized by use of vegetation on the sides of the street. Parallel parking may be alternated with rain gardens and bioswales on the street edges. Sidewalks with tree plantings line the typical skinny street. To convert a typical street into a skinny street, curb extension may be used to thin the street while allowing a place to put water management systems, trees and other vegetation.

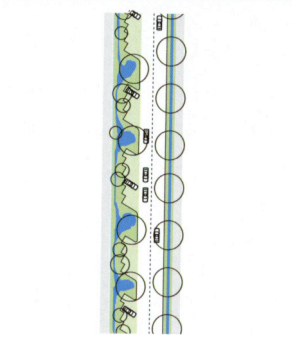


PLAN \FIG_DTPRL_42_3\

SKINNY STREETS \FIG_DTPRL_42_4\

GREEN

Green streets are slightly larger than skinny streets and are more appropriate for larger thoroughfares. It shares the same concepts as skinny streets but is wider and instead of parallel parking may include face in angled parking on the edges. They also may facilitate larger storm water management systems, but the overall concept is very similar.



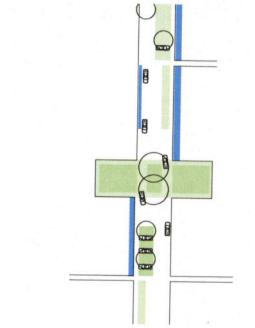
PLAN \FIG_DTPRL_42_5\

GREEN STREETS \FIG_DTPRL_42_6\

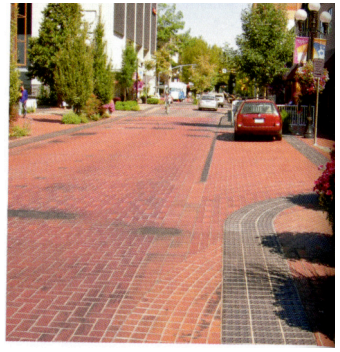
SHARED

Shared streets are public spaces that work with vehicles, pedestrians and bicyclists to cohabit the street without the conventional separators such as sidewalks and curbs. To slow

traffic, the flow and form of the roadway creates mental "speed bumps" instead of regulating signs and humps. These streets deliver multiple social services such as traffic calming and recreation. They also offer many opportunities to construct parking stalls and drive aisles of pervious paving, constructed wetlands in the middle of the street, park areas on the edges and other trees plantings and amenities. Pieces of shared streets can be implemented in mid-sections of other streets to further slow traffic, give a break to the street or provide for a larger public space.



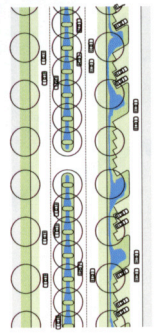
PLAN \FIG_DTPRL_43_1\



SHARED STREETS \FIG_DTPRL_43_2\

ECO BOULEVARDS

Eco boulevards are larger streets that accommodate traffic on the scale of a four lane or divided street. The street is divided to provide a vegetation strip down the middle that shades the street and also serves as water management. There may even be outer lanes divided from the main street that act as slower more local access. The entirety is heavily vegetated with wide sidewalks to facilitate pedestrian movement. The slower streets are also conducive to cycling and can include separate lanes for that use. Medians can be built to accommodate bioswales while the edges can house tree boxes and other vegetation.

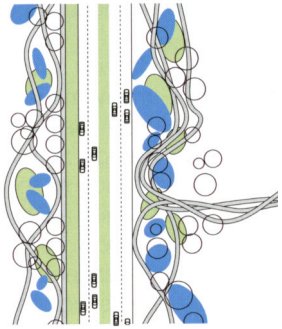


PLAN \FIG_DTPRL_43_3\

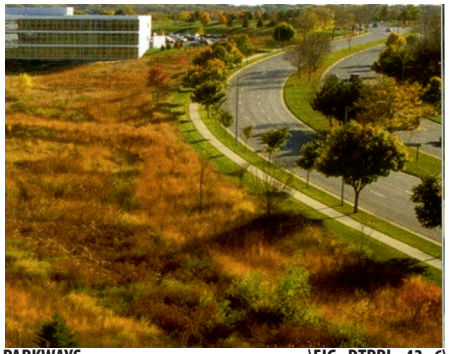
ECO-BOULEVARDS \FIG_DTPRL_43_4\

PARKWAYS

Parkways accommodate traffic up to the scale of an in city divided highway. In this street type, vehicle traffic is separated from bike and pedestrian traffic by the use of vegetated medians. They are much wider and accommodate extended public greenways. They provide a unique urban landscape that can be implemented at regional scales.



PLAN \FIG_DTPRL_43_5\



PARKWAYS \FIG_DTPRL_43_6\

PARTS

SIDEWALK

Sidewalks are a very important part of any street. They facilitate any and all pedestrian movement along the street and aid in

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CURB CUTS
\FIG_DTPRL_44_1\

FLUSH CURBS
\FIG_DTPRL_44_2\

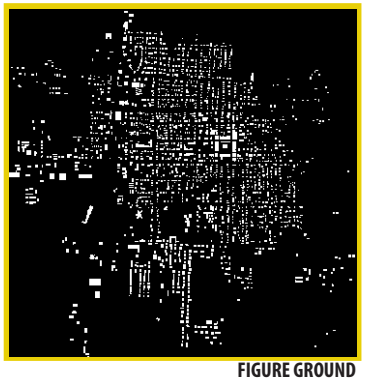
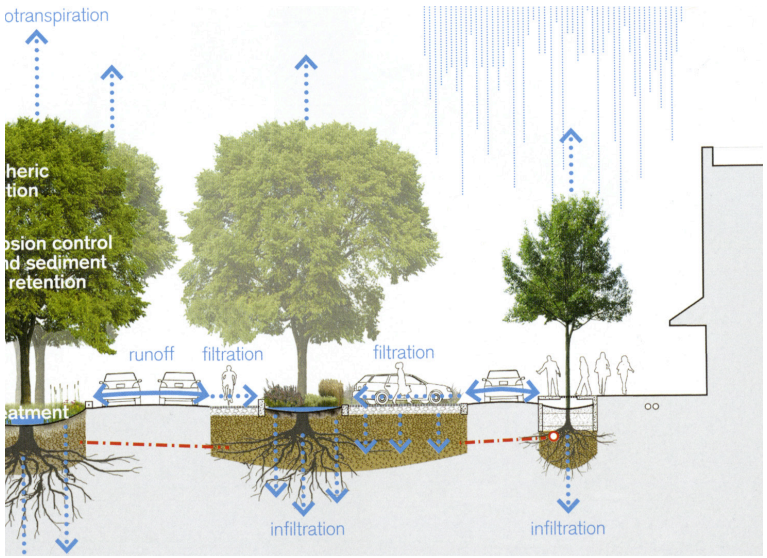


FIGURE GROUND

defining the edges of the vehicular zone. Sidewalks can be made up of many different parts. Working from the street the first part of a sidewalk is the curb, then any vegetation strip, then the walking lane and finally the building or building property.

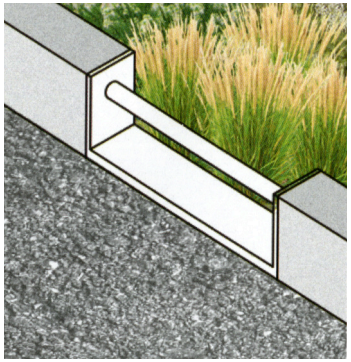


STREETSCAPE \FIG_DTPRL_44_3\

CURBS

There are conventional curbs that are 6 to 8 inch buffers that separate the rest of the sidewalk from the street, but there are many other types of curbs that have benefits to their implementation. The first type is the perforated pre-cast. These are curbs that look much like conventional curbs but have openings in the side to allow water to pass from the street to the vegetation strip. These capture very little sediment but have a high level of maintenance required. Much like the perforated pre-cast, there are pre-fabricated curb inserts. These inserts are used to retrofit an existing curb. They provide an opening that allows water through. They also collect little sediment but requires a high level of maintenance. Another retrofit is curb cuts. These are simple divots taken out of an existing or new curb where water flows over the curb. These require less maintenance than perforated or pre-fabricated inserts.

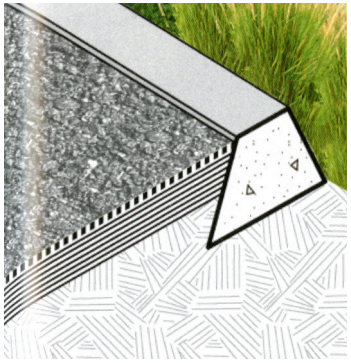
PERORATED PRECAST \FIG_DTPRL_44_4\



CURB INSERTS \FIG_DTPRL_44_5\

Another curb type is the flush curb. These curbs help to distribute water as it passes into the vegetation strip. A small half inch lip represents the curb. This causes water to pool and sediment to fall out as the water passes over the curb. These curbs require very little maintenance beyond typical street cleaning.

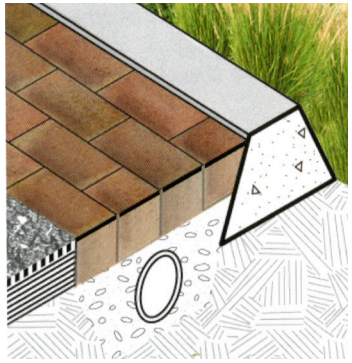
CURB CUT \FIG_DTPRL_44_6\



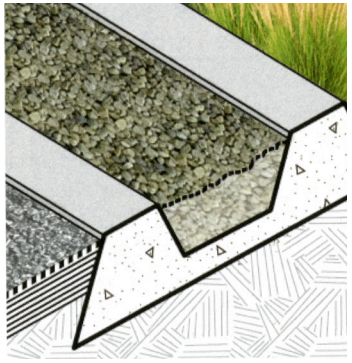
FLUSH CURB \FIG_DTPRL_44_7\

Flush curbs can also be sided with a paving strip towards the road. Pervious pavers further help to filter sediment and also

serve as a visual and tactile warning for vehicles straying too close to the edge. The addition of the pavers helps to capture sediment keeping it out of the vegetation. The final curb type is the double flush with sediment trench. There are two flush curbs with a trench between them filled with aggregate. This system captures the most sediment but also requires a high level of maintenance.



FLUSH WITH PAVERS \FIG_DTPRL_45_1\



DOUBLE FLUSH \FIG_DTPRL_45_2\

VEGETATION STRIP

This zone is where many options are made. Its width can vary anywhere from 3 feet to 10 feet or wider depending on what is being planted. For a bioswale, 2 feet to 8 feet wide is optimal. The size of the street, amount of water flowing into it and length of bioswale will determine the overall width necessary. If trees are being planted, whether it is a single tree or an entire network, tree boxes should be used. Trees are planted down into a layered soil mix that helps to filter and infiltrate water quickly deep into soil. Tree wells need to be a minimum of 5 feet by 10 feet, but may be larger depending on the species. Urban trees have an average lifespan of only 10 years, but if they are properly cared for then they can live long past the average.

WALKING LANE

This zone is where pedestrians are meant to inhabit. This is where amenities such as benches and signs take place. Depending on the size of the street and pedestrian traffic the walking zone may be anywhere from 5 feet to 20 feet wide. The zone should be carefully sized to fit all the accommodations and include plenty of walking space where people do not feel cramped. For residential streets, 5 feet will commonly suffice. For more commercial and mixed use areas, 12 feet to 15 feet should be considered.

RAIN GARDEN \FIG_DTPRL_45_3\

BIOSWALE \FIG_DTPRL_45_4\

PARKING

Street parking is a typical part of most inner city streets. Smaller streets can get by with parallel parking where larger more active streets may opt for angled parking. Either method, parking spaces should be sized as is typical. On some streets, parking may be alternated with vegetation strips or curb bulb outs that house larger vegetation area. These bulb outs and alternations help break up the street and make it more visually interesting. Parking can be on one or both sides of the street depending on demand and availability of space.

VEHICULAR LANES

The lanes of a vehicular street can vary in width depending on type. For skinny streets, 11 feet is a typical width. The thinner street encourages cars to drive slower. Larger streets that handle more traffic and bigger vehicles may need lanes that are 15 feet wide. The number and width of lane should be chosen

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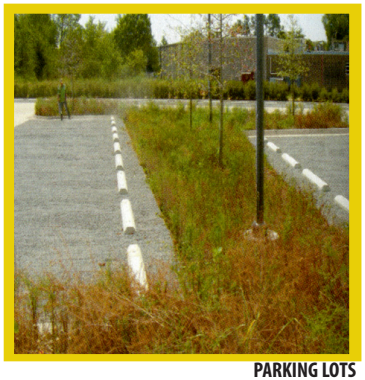
PARKING LOTS
\FIG_DTPRL_46_1\



PARKING LOTS
\FIG_DTPRL_46_2\

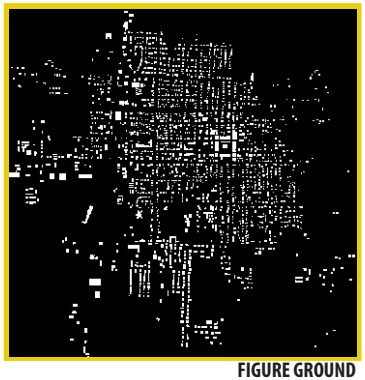


FIGURE GROUND

carefully as modifications to streets are difficult and costly to make. Street systems should be planned with the future in mind. Determining the use of each individual street drives the decisions needed to make crucial choices. Systems should be designed where small streets feed into medium streets that feed into larger streets. If this system is planned out, then modifications to the vehicular lanes will be avoided post street construction.

MATERIALS

As with parking lots, many pervious materials may be substituted for the typical impervious street. Porous asphalt, pervious concrete, alternative paving systems and possibly even gravel or interlocking paver systems are all potential street materials. Coupling these materials with structural soil can greatly reduce the demand on storm water management systems.

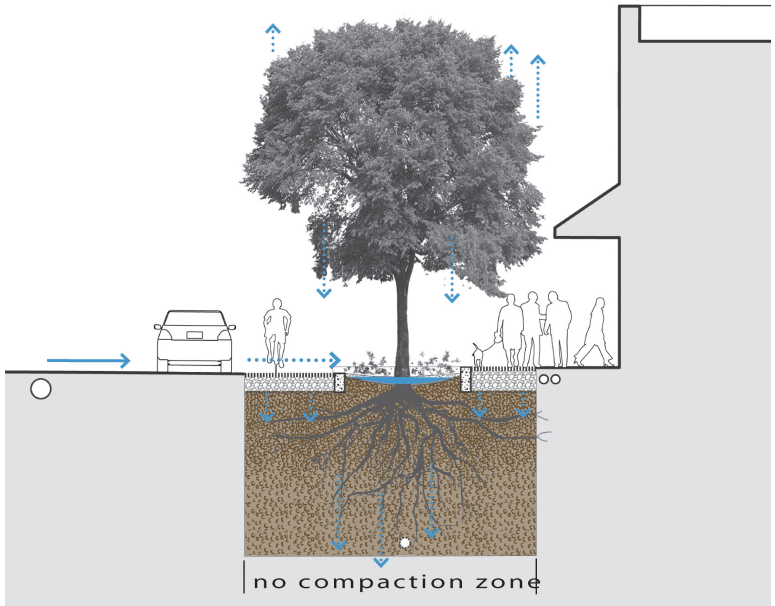
OVERHEAD COMPONENTS

TREES

Trees should be liberally used around streets. They add vegetation that cools the surrounding area, shade that protects from sun and can help protect pedestrians from wind and rain. Beyond this, trees have a unique opportunity to multiply their uses beyond these typical ideas. Planting the streets with fruit bearing trees can help to feed the population. Planting the trees in "tree boxes" can aid in relieving pressure on storm water management systems by helping water to penetrate deep into the soil. Flowering trees can greatly enhance the beauty of a street. Trees can also be layered to mix the different functions and create a diverse street that is beautiful all year long.

SIGNS

Signs and their use can completely change how a street is perceived. Neon lights and flashing signs can give a very active and lively feeling where wood carved signage that has been painted and is only subtly lighted can create an old fashioned feel. Each street and area should develop their own regulations based on how the street is meant to be perceived.



TREE BOX \FIG_DTPRL_46_3\

AWNINGS

Depending on the desired feel of each individual street, awnings may be required to help protect the pedestrian traffic. Awnings can create a unique experience that shortens taller buildings to a more human scale while retaining their size. They can also offer protection from both sun and rain and make a more hospitable sidewalk. Regulations can be implemented to determine the size, height and style of awning allowed.

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LIGHTS
Lighting is one very important component to a street. Lights can make a street feel bright and cheerful or dark and dangerous. They should be chosen to fit in with the rest of the streetscape and enhance the experience. They should be bright enough to light the street and sidewalk and provide a feeling of safety and comfort, but should also be configured so as to contribute as little as possible to light pollution effects.

OTHER AMENITIES

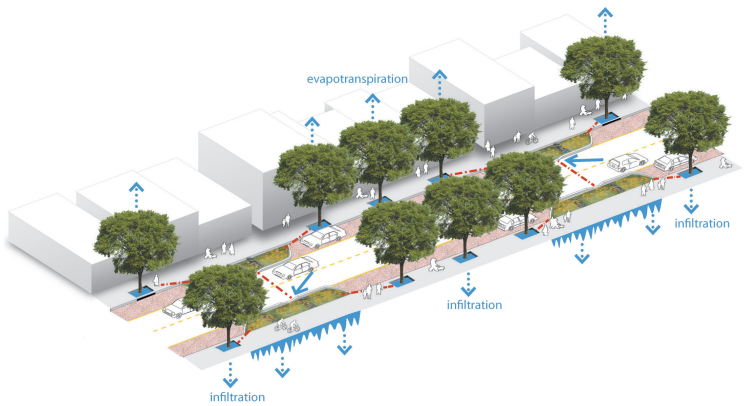
If people are to start utilizing alternative forms of vehicles to get from place to place, amenities made to enhance this experience will have to be implemented.

BIKE RACKS
Bike racks are necessary for cyclists to feel safe leaving their bicycles outside of shops and restaurants. Proper and aesthetic bike racks can be implemented that allow for bikes to be secured to them while also giving the streetscape another layer of unique feel and identity.

BENCHES
As streets are improved and more vegetation is added so is the likelihood that these spaces will be enjoyed by the community. Benches offer a place for people to wait and also temporary respite from their travels through the day. Benches, as with bike racks, aid in creating a unique identity for each street depending on how they are constructed and what materials are used.

RESTROOMS
A factor that is typically overlooked is the need for people to relieve themselves. As people move through the city, their perspective and attitude towards Butler can be greatly influenced by their physical comfort. Allowing opportunities for relief can greatly enhance the experience of visitors and residents alike.

REST AREAS
Rest areas, that may include benches, water closets and bike racks, should be implemented periodically to offer extended respite from travels and also smaller gathering areas. These could take the form of small pocket parks either in the place of a building or in an extended green space offered by shared streets.

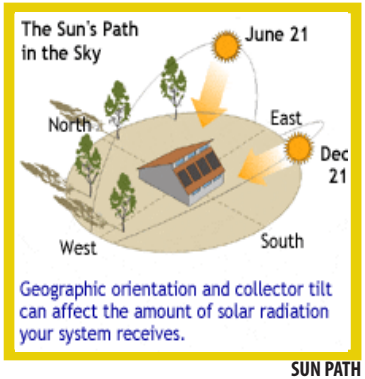


SKINNY STREETS \FIG_DTPRL_47_1\

BENEFITS

Every modified street shares some of the same benefits. Each is more ecologically friendly and helps to manage the rainwater that falls on site. Each also fosters alternative modes of transportation to vehicular traffic by making those other modes more enjoyable and safer. The heat island effect is reduced by adding vegetation to the streets and sidewalks while also creating a more aesthetically pleasing space. Lastly, greater social interaction can be fostered as people move from using cars to biking and walking from place to place and multiple smaller public spaces are created.

BIOSWALE
\FIG_DTPRL_48_1\



SUN PATH
\FIG_DTPRL_48_2\

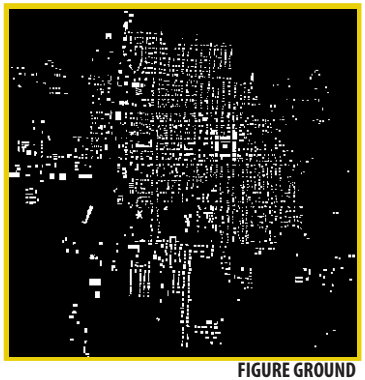


FIGURE GROUND

RECOMMENDATION

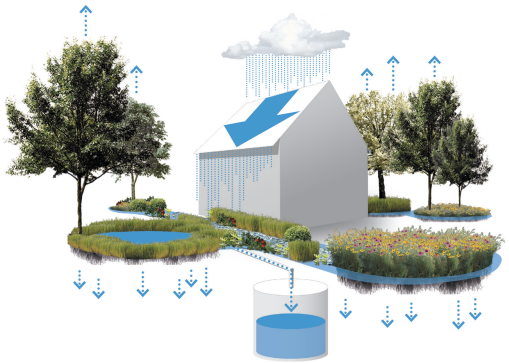
A mix of types depending on the scale of the road is recommended. Each should be implemented where they are most appropriate. Skinny streets should be used in place of conventional residential streets. More commercial oriented or mixed use areas could make use of green streets or eco boulevards with intermittent shared street areas. Major arterial connectors should be modified into parkways.

HOUSING/BUILDING

WHY

Green building refers to a structure and using process that is environmentally responsible and resource-efficient throughout a building's life-cycle. Environmental practices can be optimized in construction, operation, maintenance, renovation and demolition. This practice expands and complements the classical building design concerns of economy, utility, durability and comfort.

New technologies are constantly being developed to complement current practices in creating greener structures. The common objective is that green buildings are designed to reduce the overall impact of the built environment on human health and the natural environment by efficiently using energy, water and other resources; protecting occupant health and improving employee productivity; and reducing waste pollution and environmental degradation. Green building development optimizes feedback between environment and building to achieve energy production or regenerative development. The easiest way to optimize environmental return is groundwater recharge from roof storm water runoff. Gutters and leaders that channel rain water create concentrated discharges and are avoided in favor of devices that slow, spread and soak rain water throughout the site. A higher level of environmental return invokes vegetated or green roofs which absorb and evaporate rain water through a cultivated plant and soil community. Green roofs are superior building insulators that minimize heating and cooling demands. Green walls minimize solar gain during the summer and wind loading during the winter. Placement of these types of facilities on a building site should be carefully considered.



STORMWATER \FIG_DTPRL_48_3\

INFILL DEVELOPMENT \FIG_DTPRL_48_4\

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INFILL DEVELOPMENT

Infill development involves building and developing in vacant areas in city centers or urban settings. This promotes the betterment of these city centers and leaves rural areas and open spaces undeveloped. Advocates state that infill development can reduce traffic congestion, save open space and create more livable communities. The building industry currently consumes over 50 percent of the world's natural resources and products over 40 percent of solid waste stream. By using infill development materials installed have less of an impact on the environment, there is less reliance on fossil fuels, energy and water resources are more efficiently consumed, healthier and ergonomic indoor environments are created, less waste is generated and more materials are recycled.

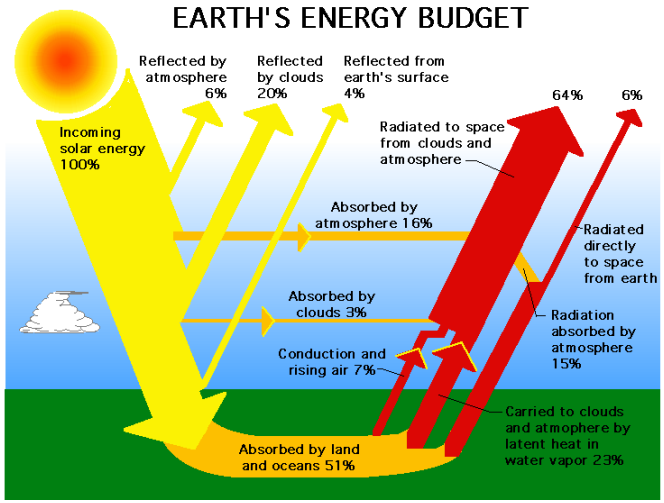
WATER

For conventional roofs, rock swales can transition vertical storm water flow in tandem with facilities to aid in horizontal network distribution. Rock swales slow and convey storm water runoff, acting like a dry creek bed that receives and distributes concentrated runoff. For larger roof areas, wide rock swales and flow control devices like level spreaders will be needed. Also, by implementing a biodiverse treatment train across the property, storm water can be filtered, infiltrated and treated to improve water quality.

These can be designed as habitat for local pollinators and seed distributors such as bees, butterflies and birds. Enhanced urban ecologies are highly productive and self-organizing and provide greater aesthetic value than turf lawns at a fraction of the required maintenance.

SUN ENERGY

The common features of passive solar architecture are orientation relative to the Sun, compact proportion (a low surface area to volume ratio), selective shading (overhangs) and thermal mass. When these features are tailored to the local climate and environment they can produce well-lit spaces that stay in a comfortable temperature range. The most recent approaches to solar design use computer modeling tying together solar lighting, heating and ventilation systems in an integrated solar design package. Active solar equipment such as pumps, fans and operable windows can complement passive design and improve system performance. Urban heat islands (UHI) are metropolitan areas with higher temperatures than that of the surrounding environment. The higher temperatures are a result of increased absorption of the Solar light by urban materials such as asphalt and concrete, which have higher heat capacities than those in the natural environment. A straightforward method of counteracting the UHI effect is to paint buildings and roads white and plant trees. Using these methods, a hypothetical "cool communities" program in Los Angeles has projected that urban temperatures could be reduced by approximately 3 °C at an estimated cost of US$1 billion, giving estimated total annual benefits of US $30 million from reduced air-conditioning costs and healthcare savings.



ENERGY USE \FIG_DTPRL_49_1\

XERISCAPING
\FIG_DTPRL_50_1\

CONVENTIONAL LAWN
\FIG_DTPRL_50_2\

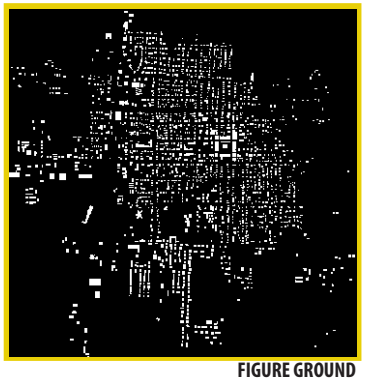


FIGURE GROUND

BENEFITS

Green building can improve the economy, utility, durability and comfort of Butler. By the use of green construction; energy, water and other resources will protect occupant health by reducing waste pollution and environmental degradation.

RECOMMENDATIONS

Infill development promotes the betterment of city centers and leaves rural areas and open spaces undeveloped. This is recommended because materials that will be installed have less of an impact on the environment, there is less reliance on fossil fuels, energy and water resources are more efficiently consumed and less waste is generated. Also, when new development is created in Butler, it is recommended that sun energy is incorporated into the design. By analyzing how the building reacts according to the orientation of the sun, energy bills will be decreased. This is because the building will be cooler in the summer and warmer in the winter. For more on housing design and options, refer to DOWNTOWN CORRIDOR section.

PROPERTY

LOT DESIGN

WHY

In many urban low to moderate densities, many self-sustaining principles can be carried out on individual property parcels. This is because the property is the area that citizens have the most personal control over and investment in. Lots should be taken care of and modified to be as ecologically friendly as possible.

LAWNS AND ALTERNATIVES

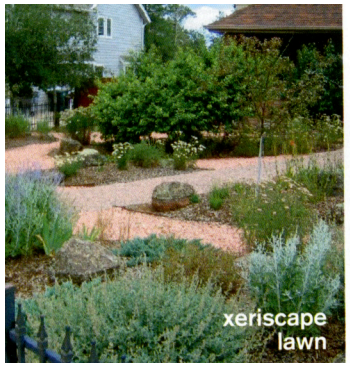
Turf is one of the biggest problems associated with current housing districts. It is a mono culture, a single species, with no variation. It also happens to be the largest agriculture sector in the United States. Many times it is not native to the area. This means there are tons of fertilizers and chemicals necessary to sustain its life cycle. Lawns require more labor, equipment, fuel and toxins than typical agriculture. Couple this with over-fertilization, herbicides and water to maintain the lawn, it becomes a sink of money, resources and greatly harms the environment. The conventional lawn is a linear train of inputs and outputs with no cycle to it. Excess toxins are passed on in either clippings to a landfill or are washed into waterways further polluting them.

Instead of a conventional turf lawn, low impact productive lawns can be established. Lawns could be used as food growing resources. Typical lawns that cover one third of an acre could potentially produce enough vegetables to feed six people. These lawns have a cyclical low impact regenerative loop. Scraps from vegetables produced can be turned to compost and then used to fertilize the plants in a non-toxic way.

PRODUCTIVE LAWN \FIG_DTPRL_50_3\

Another alternative is that of a xeriscaped lawn. Xeriscaping is landscaping using plants that take minimal to no additional

water beyond typical rainfall to sustain. The plants are typically species native to the area that have built in tolerance to both dry and we periods. Xeriscaped lawns have significant economic and environmental benefits. They increase biodiversity, can also produce food, they have deeper root systems than turf and help water to infiltrate deeper, they are also low maintenance. They could be created by plants as simple as a mix of native species of grasses. These lawns only require a mowing every three to five weeks. They could also be more mixed with different trees, shrubs, bushes and plants that are also native and take little maintenance to keep healthy.



\FIG_DTPRL_51_1\ XERISCAPING \FIG_DTPRL_51_2\

A third alternative to the typical turf lawn is a rain garden. Rain gardens are an excellent way to increase the infiltration of water while also adding a significant amount of aesthetic benefits. Rain gardens are planted, depressed areas designed to aid infiltration without retaining it. They are best used in fairly small scale and work well along driveways and in low lying areas. Native plants are best suited for rain gardens based on their adaptations to local climate, soil and precipitation without the use of chemicals.

RAIN GARDEN \FIG_DTPRL_51_3\

MATERIALS AND PLANTS

Plants vary from region to regions, but what stays the same is that they are all native. Native plants do not have the same issues and needs for chemicals, fertilizers and supplemental water that nonnative and potentially invasive species do. They are also not mono cultures. They support a variety of animal and insect life that would typically be found in the area. Native plants also provide the sought after "evergreen" look for lawns being as they are capable of surviving both dry and wet periods. Native plant species have deeper root systems that aid the infiltration of water which lightens the load on storm water management facilities.

NON CONVENTIONAL LAWN \FIG_DTPRL_51_4\

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GREEN ALLEY
\FIG_DTPRL_52_1\

FRONTAGE
\FIG_DTPRL_52_2\

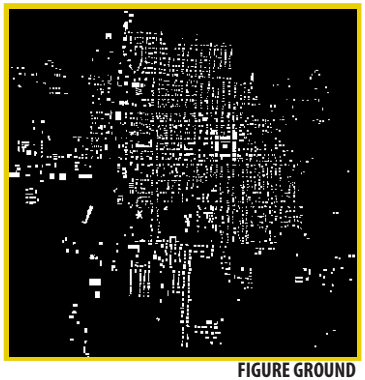


FIGURE GROUND

BENEFITS

There are multiple benefits for each alternative to the typical turf lawn. These benefits can be enhanced by blending different aspects or pieces of each. Some include: storm water mitigation, food production and aesthetic interest. These lawns also require less care which ends up saving lot owners money on water, chemicals, fertilizers and care.

RECOMMENDATIONS

It is recommended that lawns move away from turf and towards food production and xeriscaping. At the very least, lawns should be comprised of a mix of native species of grasses. These lawns retain much of the feel of conventional lawns without the upkeep. Moving forward into rain gardens and more intensive xeriscaping as well as food production is a much better and more beneficial option for both current and future conditions.

BLOCK DESIGN

WHY

Just as the design of each individual lot is important, block design happens as a conglomeration of multiple lots and allows for the implementation of larger more intensive treatments. The block should be treated as a larger version of the lot, although individual lots may implement different practices, each can work with one another. Some larger scale practices are easements, alleys and frontage methods.

TYPES

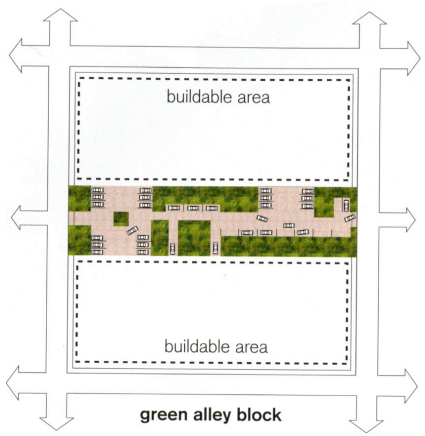
MIDBLOCK EASEMENT

A midblock easement is an area through the block that has been sectioned off for specific ecological use. The easement connects individual lots to a shared open space. Existing habitat, trails, ponds and vegetation can all be implemented in the area. The easement needs to be coordinated with current utility easements as they typically prohibit the planting of trees. Trees and other vegetation are a crucial component to the easement's success.

MIDBLOCK EASEMENT \FIG_DTPRL_52_3\

GREEN ALLEY

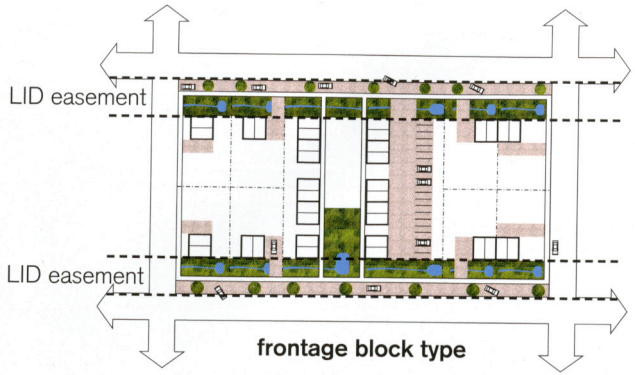
A green alley can be implemented in lieu of the conventional alley. It combines the functions of parking and access with more eco-friendly ideas. For current alleys, retrofitting to function more ecologically by resurfacing with pervious paving and lining it with bioswales allows for storm water to be managed on site. These alleys are alternatives to overburdened streets and improve the livability of urban cores. New alley require at least 18 feet of right-of-way with another 10 feet of travel lane. These alleys could be created on existing blocks as the density of an area increases.



GREEN ALLEY \FIG_DTPRL_53_1\

FRONTAGE

A final block type is the frontage system. It combines ideas from green alleys and midblock easements into one idea. It moves the easement from the interior of the block to the outside edge. This allows facilities that may be implemented on the streetscape to connect seamlessly to those located on the block. The area behind the buildings is then utilized for access and parking. This process can create a cohesive and connected webwork of storm water management, vegetation and aesthetics that can improve the overall beauty and connectivity of a block.



FRONTAGE \FIG_DTPRL_53_2\

BENEFITS

These block designs share the same benefits as the lot suggestions but are implemented on a larger scale with greater impact.

RECOMMENDATION

As the density of an area increases, care should be taken to move towards the block strategy that is most appropriate. A frontage design may be more appropriate for areas with a much higher density that is looking to mix commercial and residential uses. The midblock easement could be more fitting for slightly less dense areas where residents seek to have more private outdoor space behind their lots.

PARKING LOTS

WHY

Parking lots and other places to park vehicles are some of the largest and most environmentally harmful spaces in a community. Parking lots in particular are huge parcels of land that many times end up being larger than the building it services. This land also gives parking lot design the importance to be just as thought out and planned as the building design. Both, working together, can end up creating an ecologically friendly site instead of one that is harmful. There are many different styles of parking, each with their different amount of ecological influence.

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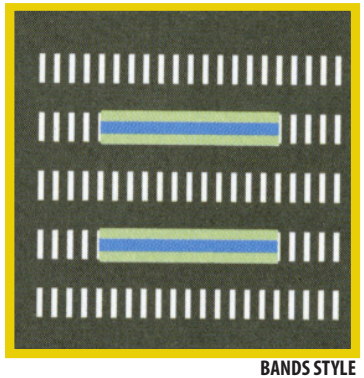
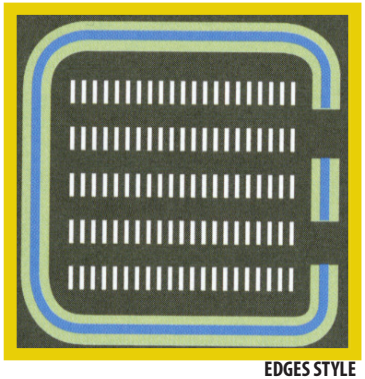


BANDS STYLE
\FIG_DTPRL_54_1\



EDGES STYLE
\FIG_DTPRL_54_2\

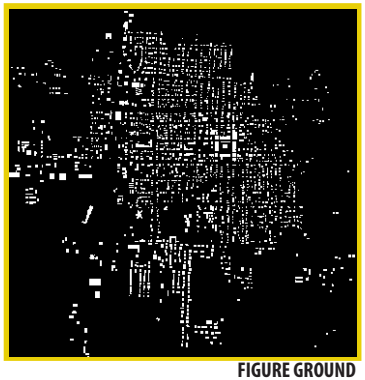
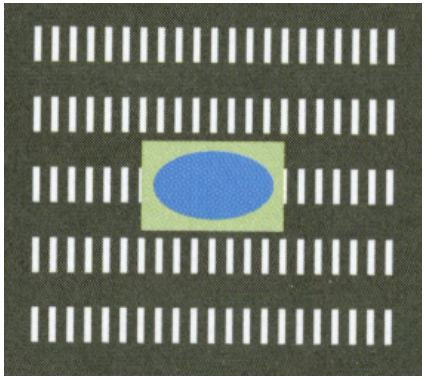


FIGURE GROUND

TYPES

CENTER STYLE

This is a typical parking style characterized by one central green space. The space is vegetated and could be planted with trees. It many times becomes either a bioswale or small pond. A bioswale is an open, vegetated and slightly sloped ravine that retains water as it is cleaned by the plants and infiltrated into the soil. The lot is sloped so that the water runs towards this center space. It potentially provides shade for cars that park near it. The center style reduces the impervious surface of the lot and offers a location for water to go other than storm sewers. The vegetation helps to reduce the temperature of the lot and surrounding by evapotranspiration, the passing of water from vegetation into the air.



CENTER STYLE \FIG_DTPRL_54_3\

CENTER \FIG_DTPRL_54_4\

BANDS STYLE

The bands style breaks the center style up into thinner strips that can fall in line with parking. It is predominately configured as a bioswale. The lot slopes towards the bands to aid water movement to them. It contains many of the same benefits as the center style, but has an even higher likelihood of shading vehicles if there are trees present in the bands and it is overall more effective than the center style.

BANDS \FIG_DTPRL_54_5\

EDGES STYLE

The edge is a permeation off of the bands style that rings the lot in a green space. The lot is then sloped from the center towards the exterior band. It is more effective than the bands style at dealing with water, but not as effective at providing shade for the parking lot.

EDGES \FIG_DTPRL_54_6\

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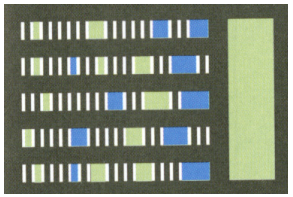
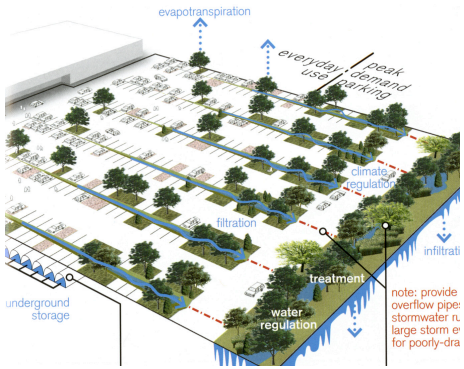
PARKING PIXELS

This parking style reduces impervious surfaces by breaking the parking up into pixels and filling some with pervious paving and landscaping. This is a very adaptive solution that is ideal when retrofitting an existing parking lot. Water from the impervious parking flows to the either pervious stalls or to the vegetated islands. Through using curb cuts or flush curbs the water runs directly into these places and begins to infiltrate the soil. These islands are then connected to either a bioswale or an underground oversized pipe that takes the water to a larger facility on the outer edge of the lot. Since 40 percent of the commercial parking lot is used only during peak demand (twice a year maximum) sacrificing the furthest stalls allow the opportunity to create a public garden. This garden is where the water runs to. It is where the water is finally treated through bioremediation and infiltrated into the earth. If the ground is particularly poor, underground storage of water can take place to slow the flow to the garden, but this is typically only for 10 to 25-year storm events. Pixilating the parking gives the most opportunity for shading and cooling the lot of any parking lot design.



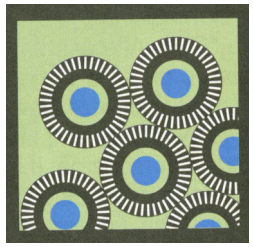
PLAN \FIG_DTPRL_55_1\



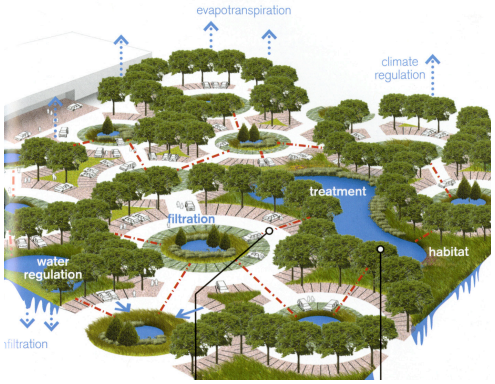
PIXELS \FIG_DTPRL_55_2\

PARKING GARDENS

Parking gardens, although a type of lot is much more than just a parking lot. These lots serve the site. Cars park in their own unique water treatment basins. The lot itself becomes a garden that cars just happen to park in. The entire site works as a water treatment facility with maximum levels of pervious surfaces, from pervious concrete to bioswales and infiltration basins. There are smaller, tighter groupings of parking spaces closer to the building where there are larger parking sets with more green space further towards the edges. These facilities provide a unique and sustainable parking solution and offer far more opportunities to shade cars and reduce parking heat than any other parking solution.



PLAN \FIG_DTPRL_55_3\



PARKING GARDEN \FIG_DTPRL_55_4\

PARKING GARDEN \FIG_DTPRL_55_5\

GRAVEL PARKING
\FIG_DTPRL_56_1\

TURF PAVER SYSTEM
\FIG_DTPRL_56_2\

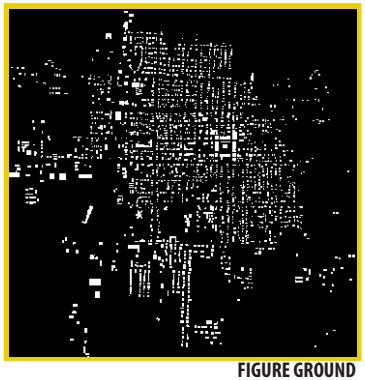


FIGURE GROUND

MATERIALS

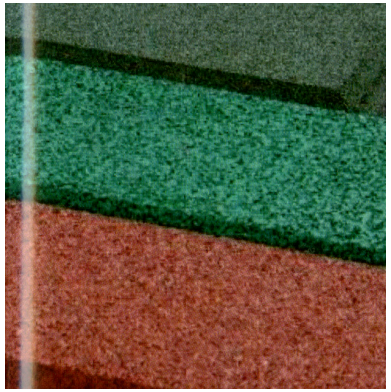
Besides typical vegetation for the different functions of bioswales and infiltration basins, many different materials can be applied to the parking surface that is ecologically friendly. Pervious materials, predominantly aim at reducing water runoff (impervious surfaces generate double if not six times more runoff than the natural site), but also are very durable and mitigate the heat island effect. Porous asphalt allows water to drain through into a stone recharge bed that then allows the water to infiltrate into the earth below. It is not very effective at mitigating heat island and only has a typical 15 percent void space. It is only about 10 percent more expensive than conventional asphalt and has a durability of between 10 and 30 years. Pervious concrete, depending on the color, can mitigate heat island better than porous asphalt. It shares the same cost and life of the asphalt, but has more void space and therefore increased rainwater perviousness.

PERVIOUS ASPHALT \FIG_DTPRL_56_3\

PERVIOUS CONCRETE \FIG_DTPRL_56_4\

A third material, an interlocking paver system, mitigates heat in the same way as pervious concrete, but has a much higher initial cost. It does let more water pass and has a potentially higher durability, up to 50 years. There area also alternative paving solutions that could be made of recycled rubber. It has moderate heat mitigation properties with a medium initial cost. It is typically durable for up to 50 years. Gravel systems, depending on the color, can be extremely effective at mitigating heat island. With a medium to high cost, the typical upkeep is only the addition of gravel. Durability is about 20 years, but it is extremely effective at letting water infiltrate through. The most effective system is a grass concrete and turf paver system. This system is extremely effective at mitigating heat island. Management of the system usually includes watering and the occasional mowing. It has a high installation cost with a durability of up to 40 years. The concrete provides a load bearing surface that protects roots from being compacted. Voids in the concrete allow for the vegetation to grow through and water to pass.

CONCRETE PAVERS \FIG_DTPRL_56_5\



ALTERNATIVE MATERIALS \FIG_DTPRL_56_6\

BENEFITS

Benefits include heat island mitigation and storm water management. Different parking systems can also add shade for pedestrians and cars. Different parking configurations can make for a different and unique experience.

RECOMMENDATION

For Butler the recommendation is to follow a pixel approach to parking. It is the easiest to implement as retrofitting and refurbishing of existing lots. Combining this approach with materials, at the minimum pervious concrete, that allows water to pass will aid the city as a whole in storm water management. It will reduce runoff and help water to infiltrate deep into the soil. The pixel approach allows lots to maintain their same basic layout while reducing unused spaces and providing a more pleasing and enjoyable experience for people coming in contact with the parking.

OPEN SPACE

WHY

Open spaces offer recreational, aesthetic, and ecological functions, however with planning; they can deliver more comprehensive ecological services. Vegetated open space at the scale of the city and region can deliver vital ecological services not feasible at the scale of the lot, block, or neighborhood. To achieve this, open space should be comprehensively planned as a green network that maintains water body functioning and ecosystem connectivity through use of designed parks, greenways, and self-organizing conservation areas. Well-planned urban open space systems yield compounding economic, environmental, and social returns far beyond expectations that motivated initial project investments.

TRANSFORMED PARKS \FIG_DTPRL_57_1\

CONSERVATION DEVELOPMENT

Conservation development, also known as Conservation design, is a controlled-growth land use development that adopts the principle for allowing limited sustainable development while protecting the area's natural environmental features in perpetuity, including preserving native vegetation, sensitive ecological habitat, and open space by using conservation development techniques. This type of development can still maintain the character of rural communities.

MIXED LAND \FIG_DTPRL_57_2\

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GREENWAY
\FIG_DTPRL_58_1\

GREENWAY
\FIG_DTPRL_58_2\

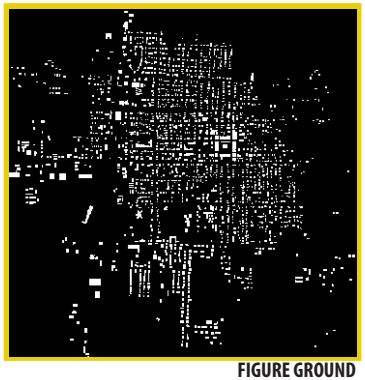

FIGURE GROUND

Compact residential development conserves 30%-80% of a site's buildable land as permanent, undivided open space. While lots in conventional neighborhoods may be large, their natural landscapes are usually replaced by industrial lawns that diminish ecological functioning. By having low densities, sprawling subdivisions ruin views that initially attract people to the site. It is a growing trend in many parts of the country. In the eastern U.S., conservation development has been promoted by some state and local governments as a technique to help preserve water quality. The steps to create conservation development include sitting houses, roads, and trails in clustered configurations without sacrificing privacy. By using shared open space, clustered development, preserved trees and pervious pavement, this allows for the same number of homes as a conventional neighborhood with savings in local infrastructure costs. Due to shorter street lengths savings can be greater because local roads cost $300-600 per linear foot. Increased density and shared open space also offer spatial unity and ecological integrity while creating premium market value.

TREATMENT PARK \FIG_DTPRL_58_3\

TREATMENT PARKS

Treatment parks introduce storm water management as another ecological service delivered by urban parks.
Public parks are typically conceived as places for passive or active recreation and when people consider sustainable development, they think of buildings. Yet, parks can integrate recreation while improving environmental performance, greater community benefits and reduced maintenance costs. An emerging trend for retrofitting existing urban infrastructure involves the incorporation of storm water treatment parks. Parks should be considered as interdependent and interconnected spaces that share systems of soil, water, vegetation and topography. A treatment park can use design solutions to promote natural processes that control water. Treatment parks are designed to filter storm water from surrounding public streets, which is currently being piped and transferred elsewhere. Community participation in park planning is important to encourage public ownership beyond public agency management. Steps in developing a treatment park include creating recreation, water retention, natural water treatment and filtration. Open space design with multiple functions will contribute to the adoption of eco-friendly design practices if they are sponsored by the surrounding community.

WATER HARVESTING

Water harvesting is the accumulating and storing of rainwater for reuse before it reaches the aquifer. It can be used to provide drinking water, water for livestock and water for irrigation. Rainwater collected from roofs of houses and local institutions can make an important contribution to the availability of drinking water. Also, it can supplement the subsoil water level and increase urban greenery. Harvesting rainwater is not a new concept, just a forgotten one. Before the development of centralized municipal water supply systems, communities relied on rainwater harvesting as a source for households,

landscapes and agricultural water needs. A renewed interest in resource use has emerged in response to the rising energy cost of moving water around. One inch of rainfall on a 1000 sq. ft. yields about 623 gallons of water. When considering rainwater harvesting, keep in mind that petroleum-based roofing and treated wood products can leach toxins. Studies have shown that these products are known to cause cancer and mental defects. Harvested rain water from these surfaces should only be used for ornamental landscape irrigation. Harvesting rainwater from roofs that have safe harvesting potential is safe for use on edible landscapes because they do not pose contamination risks, but require filtration and disinfection for drinking water uses.

GREENWAYS \FIG_DTPRL_59_1\

GREENWAYS

Greenways connect open spaces to create an urban greenway that maintains nutrient, natural resource, and habitat flows through the city. A greenway is a long-narrow piece of land that is often used for recreation and pedestrian and bicycle user traffic and sometimes for streetcar or retail uses. The land may be newly developed, but usually it is redeveloped, having been formerly occupied by a railroad, highway, or other transportation route. Many greenways in urban centers or developed areas are linear parks. Greenways often are defined by municipal governments as having the characteristics such as vegetation and multi-purpose. Greenway pathways preserve and restore nature in urban developments, and have the ability to revitalize under utilized urban sectors. The delivery of ecological, economic and social services ensure their favored status as important planning tools. Besides creating economic activity, greenways provide alternative transportation systems free of traffic conflict and are ideal for casual transit and recreation. They also improve health by accommodating active living and physical activity. The use of a greenway also creates a riparian buffer. A riparian buffer is part of a larger system known as the riparian corridor, which consists of a floodplain, stream banks, and a stream channel. These buffers are important between land and water, offering unique habitat while regulating sediment inputs from upland land uses. Riparian buffers are essential to sustaining healthy streams and watersheds.

BENEFITS

Open Space can deliver vital ecological services not feasible at the scale of the lot, block or neighborhood. Well-planned urban open space can yield compounding economic, environmental and social returns.

RECOMMENDATIONS

The use of conservation development can still maintain the character of rural communities but conserves 30%-80% of the space which will increase ecological functioning. Also,

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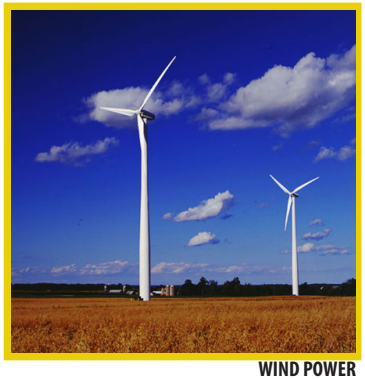
HOUSING
\FIG_DTPRL_60_1\



WIND POWER
\FIG_DTPRL_60_2\

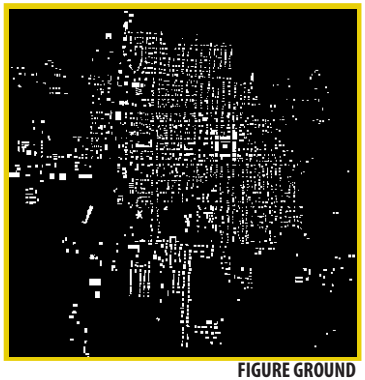


FIGURE GROUND

by harvesting water, Butler should store and reuse rainwater before it reaches the aquifer. This rainwater will be reused in households, landscapes and other agricultural water needs. Finally, Butler should use greenways to connect open spaces. These greenways will maintain nutrients, natural resources and habitat flows throughout the city. Greenway pathways also preserve and restore nature in urban developments, and have the ability to revitalize under utilized urban sectors. Greenways also improve health by accommodating active living and physical activity.

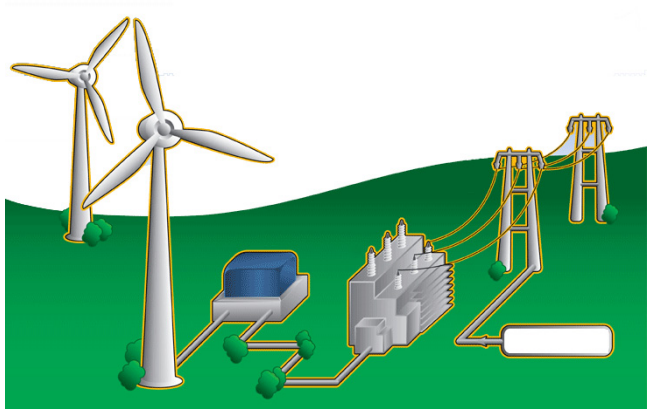
TECHNOLOGY

WHY

Environmental technology is the application of one or more of environmental science, green chemistry, environmental monitoring, conservation of the natural environment and resources and curbing the negative impacts of human involvement. Sustainable development is the core of environmental technologies. The most criticized issue about constructing environmentally friendly buildings is the price. Photo-voltaic, new appliances, and modern technologies tend to cost more money. Most green buildings cost a premium of <2%, but yield 10 times as much over the entire life of the building. The savings in money come from more efficient use of utilities which result in decreased energy bills. It is projected that different sectors could save $130 Billion on energy bills. Studies have shown over a 20 year life period, some green buildings have yielded $53 to $71 per square foot back on investment.

TURBINES

Wind power is the conversion of wind energy into a useful form of energy, such as using wind turbines to make electricity, windmills for mechanical power, wind pumps for water pumping or drainage, or sails to propel ships. The total amount of economically extractable power available from the wind is considerably more than present human power use from all sources. Wind power, as an alternative to fossil fuels, is plentiful, renewable, widely distributed, clean, produces no greenhouse gas emissions during operation, and uses little land. In operation, the overall cost per unit of energy produced is similar to the cost for new coal and natural gas installations. For small wind turbines, maintenance costs can be a deciding factor at sites with marginal wind harnessing capabilities. At low-wind sites, maintenance can consume much of a small wind turbines revenue. Wind turbines begin operating when winds reach 8 mph, achieve energy production capacity at speeds of 32-37 mph, and shut off to avoid damage at speeds exceeding 55 mph. The energy potential of a wind turbine is proportional to the square of the length of its blades and to the cube of the speed at which its blades spin. Though wind turbines are available that can supplement power for a single building, because of these factors, the efficiency of the wind turbine depends much upon the wind conditions at the building site. For these reasons, for wind turbines to be at all efficient, they must be installed at locations that are known to receive a constant amount of wind (with average wind speeds of more than 15 mph), rather than locations that receive wind sporadically. Turbines for residential scale use are available. They are usually approximately 7 feet (2 m) to 25 feet (8 m) in diameter and produce electricity at a rate of 900 watts to 10,000 watts at their tested wind speed. In the United States, residential wind turbines with outputs of 2-10 kW, typically cost between $12,000 and $55,000 installed ($6 per watt), although there are incentives and rebates available in 19 states that can reduce the purchase price for homeowners by up to 50 percent, to ($3 per watt).



WIND POWER \FIG_DTPRL_61_1\

MATERIALS

WHAT

Building materials typically considered to be green include lumber and forests that have been certified to a third-party forest standard, rapidly renewable plant materials, insulating concrete forms, dimension stone, recycled stone, recycled metal, and other products that are non-toxic, reusable, renewable and/or recyclable. Building materials should be extracted and manufactured locally to the building site to minimize the energy embedded in their transportation. Where possible, building elements should be manufactured off-site and delivered to site to maximize benefits of off-site manufacture including minimizing waste, maximizing recycling and high quality elements.

ROOF MATERIALS

ASPHALT/FIBERGLASS SHINGLES

Storm water runoff from these roofs can have high levels of pollution. Asphalt/Fiberglass shingles have a low initial cost and can last up to 15-20 years. Yet, treatment is needed at the wall and/or ground for water runoff.

MEMBRANE ROOF SYSTEM

Membrane roofs, like EPDM, modified bitumen, and tar and gravel are petroleum based and have high levels of pollutants. These have low-medium initial cost and can last up to 10-30 years. Water treatment is going to be needed at the wall and/or ground for water runoff.

WOOD SHINGLES

Leaching from treated wood products may contain toxins and carcinogens. Cedar is the safest type of wood shingle because it is typically untreated and thus a safe water harvesting alternative. Wood shingles have a medium initial cost and can last up to 10-20 years.

CLAY TILE

Storm water runoff from a clay tile roof may produce minor sediment. Clay tiles offer excellent water harvesting potential. The initial cost is medium and clay tiles can last up to 50-75 years.

METAL ROOF

Metal roofs offer very low pollutant levels and have excellent water harvesting potential. The initial cost is medium to high and metal roofs can last up to 40-60 years.

GREEN ROOF

Green roofs can treat and retain 60-100% of the storm water they receive. Other benefits include improved air quality, heat island mitigation, and urban biodiversity. Green roofs have a high initial cost but can last 40+ years. Green roofs are intended to be closed loop systems, and they collect rainwater

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GREEN WALL
\FIG_DTPRL_62_1\

SOLAR ARRAY
\FIG_DTPRL_62_2\

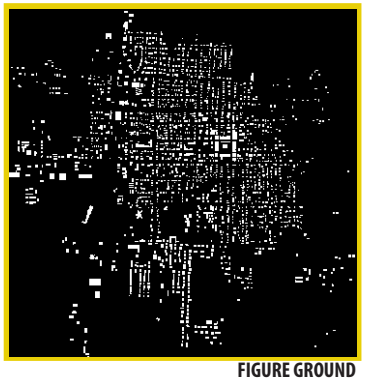

FIGURE GROUND

at its source. These roofs also regulate building temperature through additional thermal insulation, reducing heating and cooling loads. Green roofs are especially effective in controlling intense, short-duration storms and have been shown to reduce cumulative annual runoff by 50% in temperature climates. Flat or sloped roofs can provide installation for green roofs however flat roofs are easier to install. Roofs with steep slopes usually require the addition of cross-battens to secure drainage layers and to control soil erosion.

METAL ROOF \FIG_DTPRL_62_3\

GREEN ROOF \FIG_DTPRL_62_4\

SURFACE MATERIALS

VEGETATED/GREEN WALLS

A vegetated wall, also known as a living or green wall or vertical garden, is an extension of the building envelope laminated with vegetation and a soil or inorganic growing medium.

Vegetated walls are classified as passive or active systems. While active systems address air quality, passive systems address water quality and thus are more applicable to self-sustainable communities. Similar in application to green roofs, vegetated walls harvest water to reduce storm water runoff loads. These walls also regulate building temperature through additional thermal insulation, reducing heating and cooling loads. Structural loads and proper moisture barriers must be carefully considered, as well as plant types suitable for the intended solar orientation.

SOLAR

Solar power is the conversion of sunlight into electricity, either directly using photovoltaic cells or indirectly using concentrated solar power. Photovoltaic solar panels help to provide sustainable electricity for any use. Electrical output of a solar panel is dependent on orientation, efficiency, latitude, and climate—solar gain varies even at the same latitude. Roofs are often angled toward the sun to allow photovoltaic panels to collect at maximum efficiency. In the northern hemisphere, a true-south facing orientation maximizes yield for any solar panel. If true-south is not possible, solar panels can produce adequate energy if aligned within 30° of south. However, at higher latitudes, winter energy yield will be significantly reduced for non-south orientation. Solar water heaters—also called solar domestic hot water systems—can be a cost-effective way to generate hot water for a home. They can be used in any climate, and the fuel they use-sunshine is free. There are two types of solar water systems- active and passive. An active solar collector system will cost approximately $2,500 to $3,500 installed and produce about 80 to 100 gallons of hot water per day. A passive system will cost about $1,000 to $2,000 installed but will have a lower capacity. There are also two types of circulation, direct circulation systems and indirect circulation systems. Direct circulation systems loop the domestic water through the panels. They should not be used in climates with temperatures below freezing. Indirect circulation loops glycol or some other fluid through the solar panels and uses a heat exchanger to heat up the domestic water.

ROOF MOUNTED ARRAY \FIG_DTPRL_63_1\

BENEFITS

Environmental technology can conserve the natural environment and curb the negative impacts of human involvement. Even though some technologies can be expensive to install, the savings on energy and utility bills can be paid back within 20 years.

RECOMMENDATIONS

The use of green roofs and walls are highly recommended for Butler. The installation of these technologies is high, yet not as extreme as PV cells or wind turbines.

ZONING, CODES AND OBSTACLES

None of these tools can be implemented, or at least not to their fullest extent, unless zoning is taken into account, codes are changed, covenants are made and obstacles are overcome. Some common obstacles and setbacks to creating a more eco-friendly community have been included.

Greywater Recycling for Household Use
Greywater is wastewater created by dish washing, laundry and bathing. It does not include blackwater from toilets. Not all municipalities allow this water to be recycled. Many allow the water to be reused for landscape irrigation, but only a few allow it to be recycled for household use provided it is accompanied by a treatment system. As the cost of transporting water increases, recycling of greywater will become increasingly more affordable. Allowing the use of greywater for household use is an important step towards a more sustainable community.

WATER COLLECTION \FIG_DTPRL_63_2\

WATER COLLECTION \FIG_DTPRL_63_3\

Rainwater Recycling for Household Use
Codes vary greatly on if and how rainwater can be used. In some areas it is a requirement for all new construction to implement rainwater harvesting. Other areas prohibit the collection of rainwater all together. There are many permeations on the allowance of rainwater to be used and if and how it can be combined with a public water source. Allowing rainwater to not only be harvested for irrigation but for household uses can help supplement the public water supply taking strain off the local aquifer.

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PARKING AREA
\FIG_DTPRL_64_1\

TRAILS
\FIG_DTPRL_64_2\

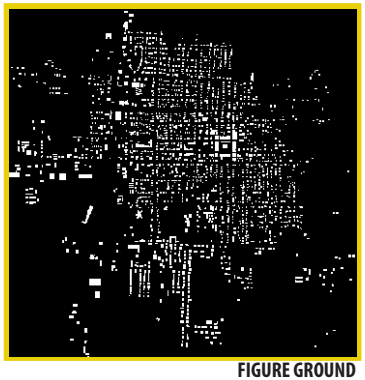
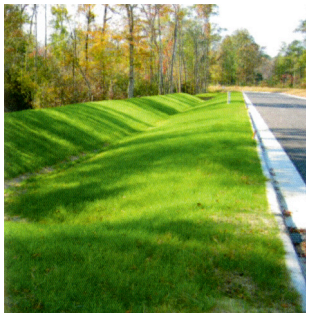


FIGURE GROUND

WATER COLLECTION \FIG_DTPRL_64_3\

WATER COLLECTION \FIG_DTPRL_64_4\

STREETSCAPE \FIG_DTPRL_64_5\



STREETSCAPE \FIG_DTPRL_64_6\

GUTTER REQUIREMENTS

More common than not, subdivisions and municipalities require the use of gutters to help evacuate water from the site. This requirement eliminates the options of rain gardens and other water managing strategies that rely on roof-based runoff. These requirements should be abolished as requirements for water managing strategies that are more low impact are implemented and required.

BUILDING SPRAWL

The height of buildings is regulated directly by city zoning codes. Often these codes encourage low-density and sprawling buildings. The modification of city zoning codes is imperative to encouraging more density with a smaller building footprint making use of more compact building designs. This also will leave more open space to be enjoyed by the community.

TURF SPECIFICATIONS

The lawn of a building can be one of the most regulated areas on a site. From turf type to maximum height every bit is outlined. The problem is that turf is a chemical laden, water intensive, invasive plant. Removing the regulations for all lawns to be turfed allows for different landscaping options. Lawns can be xeriscaped, which currently is classified as a nuisance in many municipalities. The municipalities could also encourage alternative turf which give the desired appearance but use native grasses and do not require the intensive maintenance regimen.

SETBACKS

Current codes have considerable regulations on property setbacks. This reduces the ability for the building to be oriented more freely on the site whether in response to sun, wind, or water. It also reduces the ability for the building to help preserve sensitive ecological areas that could be present on the site. Additionally, large setbacks create longer driveways to homes which in turn raise the total of impervious surfaces on the site. Setback reduction or freedom can reduce the total impervious surfaces used while also creating a more shared and cohesive streetscape. It not only helps the ecology but can also create a more beautiful streetscape.

FACILITY PROTECTION

Facilities designed to help be more environmentally friendly currently have no protection from being removed. Any systems put in place should require a permit by the municipality to remove. Plant systems and trees are all part of the storm water management infrastructure and should be considered as such by the municipality. Removing parts of this infrastructure could in turn lead to failures.

WATER MANAGEMENT \FIG_DTPRL_65_1\

WATER SPREADING \FIG_DTPRL_65_2\

PARKING SURFACES

Currently, municipalities and subdivisions many times require hard surfaces for on-site parking. The regulation is not without cause as dirt drives generate a four times greater sediment load than that of paved surfaces. However, these regulations eliminate the possibility for the use of permeable pavers, decorative gravel or a turf and field stone court. Lower density areas should consider the implementation of limits for lot coverage by impervious surfaces, such as 15 percent. Additionally, overflow parking and stalls could use permeable paving to reduce the impervious surface area. This is an easy way to provide parking without putting additional strain on the storm water systems.

PARKING REQUIREMENTS

The requirements for parking in most municipalities end up requiring an excessive amount of parking that leads to lot sized that can be as 1.5 times larger than the actual building footprint. Office buildings require one stall for every 100 square feet of office space. Taking into account that the average parking stall is 300 square feet, this leads to vast parking lots 300 percent larger than the building. Allowing and encouraging lot sharing between different land uses can lower the total number of stalls required without compromising the lot capacities.

ON-SITE STORM WATER REQUIREMENTS

Municipalities are all moving towards the tightening of storm water run-off requirements, but many still do not monitor the discharges from each individual property. During periods of peak discharge, downstream properties many times end up experiencing damage. Requiring the management of storm water on site can protect downstream properties by reducing the load on the municipality's storm water systems.

PROTECTION OF TREES

Most municipalities do not protect their trees. The requirement of preservation or mitigation of existing trees is something that should be a part of any set of codes. Codes should be implemented that favor trees that are considered "heritage trees," larger than eight inches in caliper. Removal of trees, when necessary, should be required to be replaced with heritage type trees within the development.

SIDEWALK MATERIALS

The requirement of concrete sidewalks by municipalities is only in the interest of satisfying the Americans with Disabilities Act (ADA) and streamlining maintenance. This ends up excluding the consideration of permeable materials or recyclable materials such as rubber. Rubber adapts to unstable ground conditions where concrete will crack and heaves over time. This creates impassable and unsafe pedestrian environments. Allowing for permeable and recyclable materials for the use of sidewalks creates a more pedestrian safe and friendly environment.

SIDEWALK REQUIREMENTS

Municipality requirements to have sidewalks on both sides of the street are a thing of the past. Allowing low density residential neighborhoods to locate a sidewalk on only one side of the street reduces the impervious surface area of the street. Also, allowing pedestrian facilities in parks and greenways

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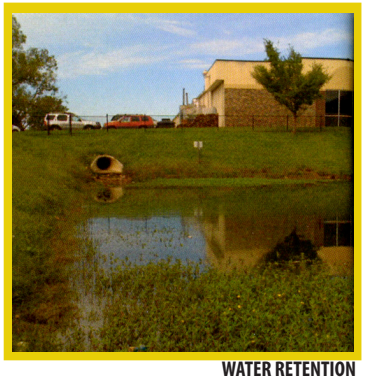
STREET VEGETATION
\FIG_DTPRL_66_1\



WATER RETENTION
\FIG_DTPRL_66_2\

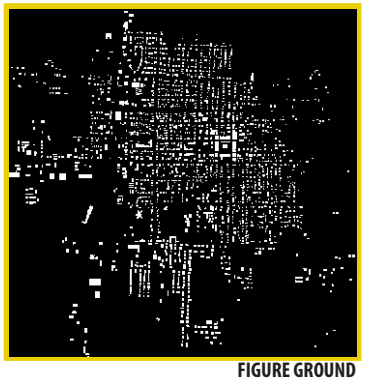


FIGURE GROUND

parallel to the street to act as the sidewalk ends up reducing the total impervious surface area. These can also have cost saving benefits for the community.

VEGETATION NEAR INTERSECTIONS

Current codes prohibit the implementation of vegetation that grows above three feet in height within twenty-five feet of an intersection. This is meant to secure traffic lines-of-sight, but it limits the implementation of water managing facilities as well as pedestrian amenities. Vegetation can be used in combination with other traffic calming devices such as chicanes and bulbouts at intersections. Not only does it help manage water and provide pedestrian amenities, it can slow the traffic to create a more peaceful environment.

BIOSWALE \FIG_DTPRL_66_3\

FACILITIES IN PUBLIC RIGHT OF WAY

Due to maintenance concerns, many municipalities prohibit the use of low impact water management facilities in the public right-of-way. The location of these facilities on private land meets storm water management needs for streets. This shift undermines the shared responsibilities for storm water management. Municipalities should allow facilities to be placed on public land and use it as an example of the benefits of storm water management using limited impact practices.

PERVIOUS MATERIALS IN THE PUBLIC RIGHT-OF-WAY

Similar to the requirements for driveways, many municipalities prohibit the use of pervious paving for city streets due to the concern for maintenance. Granted, most municipalities have yet to acquire the street vacuums and other equipment necessary to manage permeable streets. This should not rule out the forward thinking that acquiring this equipment and development of management protocols displays.

STREET WIDTHS

Current street widths are predominately the outcome of codes influenced by the fire department's requirements for emergency access. This ends up leading to streets in contemporary residential areas having 36 foot-wide sections. This width is unnecessary when 18 to 20 feet would suffice fully. This yields a dramatic increase in storm water runoff created by the street. The establishment of "skinny street" programs improve the pedestrian experience, storm water concerns, as well as slow traffic for safety.

DENSITY REQUIREMENTS

Excessive road lengths are created by the low-density construction in residential areas. The length of the road in proportion to the number of buildings served is excessively high. Incentivizing and zoning such that compact development is created leads to clusters of the same amount of units in a

smaller footprint. This reduces road lengths, cost to build the roads, maintenance costs, utility costs, and the coverage of impervious surfaces.

STREET CURB REQUIREMENTS

Municipalities typically require curbs to differentiate between pedestrian and vehicular traffic zones. While other means are readily available to establish the difference, the requirement of curbs eliminates the ability to have shared streets. It also eliminates the implementation of other viable right-of-way configurations that employ surfaces that are flush with the street. Eliminating the requirement for there to be curbs, allow for more options to distinguish the difference between vehicular and pedestrian traffic.

ARTERIAL LANDSCAPING

Due to statutes set in place by the American Association of State Highway and Transportation Officials ecological functions were not included in the road's designated level of service. Street trees are considered FHOs, "fixed and hazardous objects," and the sidewalk is designated as an "auto recovery zone." "Auto recovery" does not sound too good for the pedestrians. These designations caused boulevards and avenues that are traditionally outfitted with trees to fall out of favor. Decades of streets have been constructed in a way that lacks walkability and ecological functioning. The addition of statutes that designates an ecological function for all streets will return beauty and vegetation to the streetscaping.

STREET TREES

Street trees soften he urban environment. They reduce air pollution, cool the ambient temperatures, provide shade, elevate property values and provide habitat for animals. Street tree requirements should be adopted for all new street construction. Cyclic pruning programs and tree standards should be incorporated into municipality's street specifications. Designating trees as "fruit bearing" can add another use and purpose for the planting.

WATER MANAGEMENT \FIG_DTPRL_67_1\

EROSION

Local ordinances for hillsides are an important tool to conserve and protect property from erosion. The resultant sediment from this erosion can lead to the loading of streams. This is all due to careless development on hillsides. At the same time, ordinances for trees ensure that forested and vegetated areas are managed appropriately. Ordinances can easily be put in place to protect these natural resources.

WATERBODY BUFFERS

Significant waterbodies like wetlands, floodplains, lakes, streams and rivers need significant vegetated buffers around them. These waterbodies are vital in ecological functioning. Buffers prevent untreated urban runoff from reaching waterbodies. Buffers should be established in accordance with the ecological significance of the waterbody. Guidelines should be established by the municipality in charge of the waterbody.

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BIOSWALE
\FIG_DTPRL_68_1\

PERVIOUS PARKING
\FIG_DTPRL_68_2\

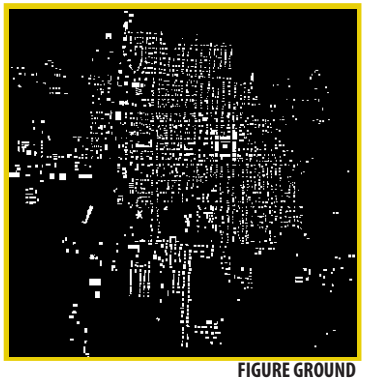

FIGURE GROUND

CONSERVATIONS REQUIREMENTS

Environmentally critical areas on private property are currently not protected by municipality ordinances. Ordinances and incentives should be provided to encourage development that is sensitive to these areas.

NON-CONFORMING INFRASTRUCTURE

Allowing environmentally friendly development to be a by-right system, allowing the techniques to be used in a positive and responsible manner, and incentivizing these techniques will greatly enhance the quality of communities. Municipalities should raise permit fees for conventional developments while reducing the fees associated with developments seeking to be more ecological. Setting guidelines that are a standard for all construction will raise the value of the entire community.

MANAGEMENT NOT MAINTENANCE

Management of ecological facilities whether they be for storm water management, open space renewal, energy production or any other facility is paramount in utilizing it for any extended period of time. Management, not maintenance is the goal. Management is the skillful or resourceful use of materials and resources. Maintenance is simply care or upkeep. In many cases, such as in storm water management, the management of limited impact facilities is the same as conventional ornamental landscapes. Other management principles have been included.

CONSTRUCTION MANAGEMENT AND SOIL COMPACTION

Protecting soil from being compacted during construction is incredibly important to future plant growth. The compaction of soil is the number one cause for premature tree death. Most root structures are located within three feet of the ground surface. The top 18 inches are responsible for water and nutrient absorption. Existing and future trees should have measures taken to protect them from soil compaction during construction. Rather than grading an entire site in a conventional practice, strategies should be taken to minimize the site disturbance. Planning when each stage of construction takes place can minimize erosion, compaction and sedimentation. Simply managing the construction site and fencing off “no compaction zones” will save current and future trees and plants.

SITE PROTECTION

Development of a site protection plan, implementing and enforcing it is crucial in building more ecologically. It starts back in the design of the building. Orienting the length of the building along contours minimizes the need to cut and fill land. Limiting soil disturbance as best as possible to roads, utilities and building systems leaves more natural state for vegetation.

SOIL MANAGEMENT

Simple soil analysis can determine if soil has poor organic or physical properties. Amending the soil using compost, biosolids and other renewable substances can improve the porosity and infiltration rates for water. If the soil is highly contaminated, additional bioremediation will be required to eliminate the toxicity.

FACILITY MONITORING

Monitoring and managing facilities is important to keep each piece working correctly. It is important to create a checklist for each type of facility for inspection and management routines. Performance should also be assessed on a regular basis to aid future facility implementation.

UTILITY COORDINATION

Sharing trenches and utility ducts between dry and wet utilities minimizes the environmental impact of their installation and

management. Various companies are allowed to synchronize work and share the upkeep expenses. Utilities such as phone, electric and gas can be stacked in the same trench while wet utilities can share the same easements. Management is more cost effective than that of traditional trenching.

TRENCHLESS TECHNOLOGY

There is a family of methods that fall under the term of "trenchless technology." They all share the common maintenance of underground utilities without the need for excavation. Since it is a non-invasive technology to repair and upgrade, it allows vegetation based facilities to remain intact without disturbance. This is crucial since the maturity of each facility directly relates to its improved performance. Management levels are typical of utility trenches.

SPACE FOR TREES

Trees need space for their root systems. This is a simple fact. It is essential for phytoremediation of polluted runoff and soil stabilization that root systems and their microbial communities have plenty of room to function. To function, trees must be spaced appropriately based on their type as well as conflicts with power lines, buried utilities, streets and sidewalks should be minimized or avoided. Strips along streets should be six to eight feet wide and filled with a good growing medium of sandy loam. Perforated drains underground can also be used to remove excess water.

STREET VEGETATION \FIG_DTPRL_69_1\

STREET VEGETATION \FIG_DTPRL_69_2\

STRUCTURAL SOILS

Where it is appropriate to do so, structural soils should be implemented. They are an engineered medium of aggregate and soil that create a load-bearing system that is also porous. It allows for drainage and root growth under pavements. It is capable of supporting mature trees and can increase their life expectancy four to five times that of the average urban tree. Management is the same as traditional structures.

PERVIOUS PAVING MANAGEMENT

Pervious paving fails when it becomes clogged from sedimentation. Infiltration is reduced by small pieces of sediment deposited by vehicle, foot traffic, wind and storm water becomes lodged in the pore spaces. Management includes vacuum sweeping four to five times each year. Most municipalities already have some sort of vacuum sweeping equipment for current street maintenance. Catastrophic clogging from inappropriate management can be remediated by drilling half-inch holes every few feet through many paving systems. Cost to manage these surfaces is equivalent to conventional paving.

NATIVE LANDSCAPE PROTECTION

Mature native vegetation is more effective than rehabilitated areas at renewing and cleaning water, reducing air temperature, providing shade and providing habitats to animals. Areas of key concern for protection include riparian corridors, floodplains, connected habitat areas and open space within developed sites. Little or no management is required as long as the areas are protected.

REHABILITATION

Should an area need to be disturbed, rehabilitation of the area will need to take place. This may include soil enhancement, replanting of native trees and replanting of other vegetation. A

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long-term vegetation and soil management plan will need to be developed and followed. The management for these areas varies for each site.

CONCLUSION

Each recommendation should be taken and implemented in its own unique way at the appropriate time. Those methods that are free, of minimal cost or must be implemented in order to allow for future improvements must be implemented first. After those, mid-level building blocks can be implemented. These are methods that may take between 5 and 10 years to implement or raise funds for. They predominately include utilizing current systems merely upgrading and retrofitting them. The final goals are the long range aims of self-sustaining communities. This includes the end goal of all new building being constructed in a self-sustaining way.

These communities attract people of all ages. It heightens community interactions by raising the density and mixing different groups and people together. It gives the elderly a chance to mix with young adults.

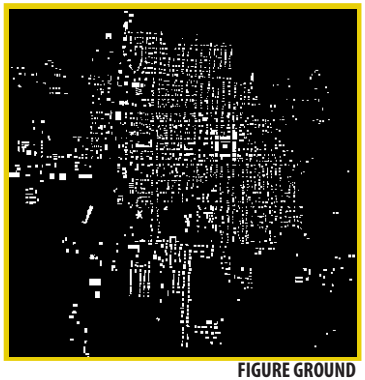
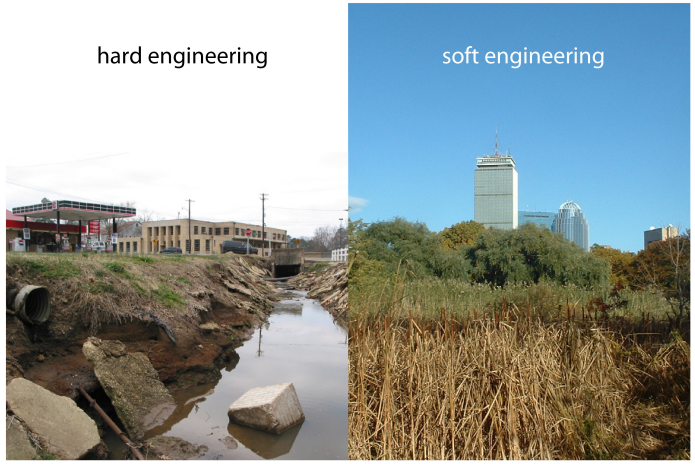


FIGURE GROUND



ENGINEERING STYLES

\FIG_DTPRL_70_1\

These communities attract younger people who are typically more interested in new technology and desire to live in places with more active living and walkability.

IMPLEMENTATION

The first step is to make changes to zoning and regulations to make way for new improvements. Without these changes, many different pieces to the community will not be able to be implemented. Another early step is the application of all the new regulations to all new construction. If all new construction is required to adhere to the new standards, the community can begin to see the benefits take place. As the benefits are realized, retrofitting can begin. Starting with streets and civic buildings, the city can lead by example. Additions to current buildings and major repairs should be carried out using green materials. Also, retrofitting to current housing should take place that includes utilizing new technologies to heat, cool and power the home. Existing neighborhoods can then be retrofitted to raise density. Empty lots and areas can be either filled with new housing of a higher density, or can be utilized as open space that begins to create a network of greenways and water treatment parks. As building age and deteriorate, this opens the possibility to infill with new development that raises density and exhibits environmentally friendly methods without physically expanding Butler. The most long term goal is to develop new self-sustaining communities as Butler expands in the future. These new areas can fully embody the forward thinking identity of Butler as it progresses into the future.

SHORT TERM

IMPLEMENT ZONING AND REGULATIONS TO ALLOW FOR CHANGES
REFER TO PG. 63-69

APPLY REGULATIONS TO ALL NEW CONSTRUCTION.
REFER TO PG. 63-69

ENCOURAGE ENVIRONMENTAL AND ECONOMIC SUSTAINABILITY
REFER TO PG. 63-69

RETROFIT EXISTING CIVIC BUILDINGS
REFER TO PG. 60-62

RETROFIT EXISTING STREETS
REFER TO PG. 42-48

MID TERM

RETROFIT EXISTING HOUSING BY USING GREEN MATERIALS AND TECHNOLOGY
REFER TO PG. 60-62

RETROFIT EXISTING NEIGHBORHOODS TO RAISE DENSITY
REFER TO PG. 52-53

IMPLEMENT OPEN SPACE TO ALLOW FOR GREENWAYS AND TREATMENT PARKS
REFER TO PG. 57-59

LONG TERM

IMPLEMENT CONSERVATION AND INFILL DEVELOPMENT
REFER TO PG. 48-49

BUILD NEW FULL SELF-SUSTAINING COMMUNITIES AS BUTLER EXPANDS
REFER TO PG. 40-71

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HIGHWAY PARK
\FIG_DTPRL_72_1\

HIGHWAY PARK
\FIG_DTPRL_72_2\

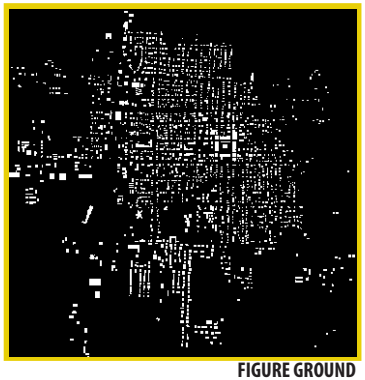

FIGURE GROUND

In Butler, one major concern is that there are not enough visitors coming into the city. According to different precedents, one of the ways smaller cities were able to bring visitors into the community was reconsidering the city's initial entry.

The economic growth of a community can be depended on a small area of the city such as an entry into a city. The entry to the city can be a gateway park. A precedent that supports this statement is the parks found within the state of Wisconsin. In Wisconsin there is a broad mixture of urban and rural areas. Within the rural areas there are parks specifically located close to main streets. Based on surveys done in Wisconsin, because these parks were placed next to main interstates, there were large influxes in tourism; thus increasing their economy.

The ways in which the parks in Wisconsin got people to their respective parks were using attractive signage, it provided a place where there are a lot of greenery that provide people a place to interact, an identifying landmark for each park and bathrooms.

Category	Group spending/trip	Spending/ visit day	Total annual spending
groceries and liquor	$51.24	$5.89	$81,847,702.29
restaurants and bars	$32.66	$5.81	$80,802,150.28
casinos/ gambling	$4.23	$1.03	$14,385,762.38
gasoline, automobile service	$33.64	$5.54	$77,001,491.52
lodging at hotels, motels or resorts	$25.48	$7.20	$100,049,846.97
recreational equipment purchases	$10.71	$4.96	$68,982,659.41
recreation equipment rental	$3.45	$0.49	$6,850,689.41
gifts, toys and souvenirs	$15.18	$3.23	$44,951,187.29
bait and tackle	$3.82	$1.14	$15,780,165.38
museums & amusement parks	$6.54	$0.80	$11,127,572.25
recreational licenses	$4.57	$1.24	$17,284,104.78
Total	**$191.51**	**$37.34**	**$519,063,331.96**

PARK STATISTICS \FIG_DTPRL_72_3\

Because Butler is located next to an interstate, a gateway park could be a benefit. If this is done, the gateway park would serve as the welcome sign for the community. Visitors would be more receptive to the thought of stopping in the city which would give them more reason to spend further time in Butler.

Gateway parks also help to create an identity for a community. One of the cities that implement such as idea was the city of Woodville, Washington. The city uses a gateway park to help bridge the gaps of socialization. The features that were implemented to support their goals are as follows:

- Covered picnic areas
- Play areas and a large grassy spaces perfect for open play
- Walking paths

Because of these features in the park, it improved the city's socialization. It provided a place where the citizens can meet, socialize, and be active. While the gateway may not really appeal to the citizen if some of these feature are put it place in the gateway entry area, those who are passing would want to stop.

PARK \FIG_DTPRL_72_4\

The city of Butler can be a memorable place that people would want to return to again and again. As for now Butler is known as the "Electric City", but it can be known for so much more, such as a "Sustainable, Self-Supportive Active City". In order for Butler to be known as such a place there are a few things to be consider. Because Butler is situated next to an interstate there is a lot of opportunity to display the qualities and amenities that are offered within the city.

As the city of Butler expands to the north, east, south and west of the interstate each area needs to be explored and developed to offer something different and exciting. On the east side of the highway north of Fort Scott street a park should be placed there that provides seating, walking areas and bathroom facilities.

On the south side next to the Wal-Mart a rest stop for truckers and RV driver should be developed. On the west side of the highway the south of Fort Scott a fueling station should be incorporated like the Better Place charging station discussed in the transportation section.

On the northwest quadrant of the interchange retails stores and restaurant needs to be established. At each of these locations there will be information posted about the historic and trolley transportation will be available for get people into the city.

BENEFITS

Benefits of having a gateway in Butler;

- It would create a point of entry
- It would attract travellers from the highway
- It would help with the overall beautification of Butler.
- It would provide a space of socialization.
- It would help with economic growth by bringing more people into the community.
- It would promote the idea of an active lifestyle

GATEWAY PARK \FIG_DTPRL_73_1\

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RECOMMENDATIONS

Steps to follow in order to implement such an idea into the city of Butler:

- Lighted signs made of bricks should be placed along the highway 25 feet from the entry which will announce to the drivers that they are approaching the city.
- The location: a beneficial location would be on the north side of Fort Scott Street as you turn off of Highway 71-- the park would be seen from the highway as cars pass by.
- Lighting: along the perimeter of the parks nearest the highway. The lights would illuminate the park at night and show off the beauty of Butler.
- Walkability: there would be concrete walkways. This would further promote active living within the community, and allow visitors to get a sense of what Butler is about.
- Seating and social aspects: Seating areas, boundary walls and sidewalks will be clad in brick.
- Aesthetic features: water features, such as man-made ponds and water fountains. These ponds would serve several purposes.
- It provides a habitat for native plants and animals
- It provides a place of peace and serenity.

The Rest Area:

- This will be placed next to the Wal-Mart: This provide a place close to the park and a shopping area.
- This needs to be a paved area so the vehicles would be able to park.
- Bathroom facilities need to be placed on the site.
- Lighting: There needs to be adequate lights on the site for safety purposes, also so that it can be seen from the highway.
- Landscape: Softscape needs to be placed along the perimeter of the site.

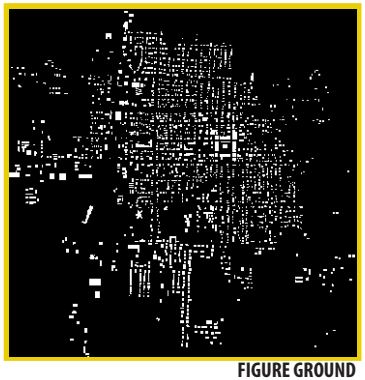

FIGURE GROUND

REST AREA \FIG_DTPRL_74_1\

Fueling Station & Charging Station

- These will be located on the west side of the highway.
- The Charging Station: Will display the sustainable side of Butler.
- On the site the fueling station and charging must be separated.
- There must a small store on the site which will have restrooms, and service desk.
- Paved drive for the parking areas and fueling station area.
- A trolley stop should also be on site
- There will be softscape and hardscape at the site of the retail area.
- This area is located west of highway north of Fort Scott.
- This is to further connect both sides of Butler and to attract more individuals.

- Provide land for businesses to build on.
- Seating outside the business
- Landscape: Softscape need to be place along the perimeter (reference to street guides in Fort Scott Corridor)
- Lighting: Add lighting along the street for safety. The light needs to be cohesive with the downtown lights.

OUTCOME

Butler is a community that has a long and important history. By implementing features within the park that celebrate the regional history these parks could strengthen the community's identity. By creating a prominent gateway landmark that celebrate the history of the area and values of the Butler Community, we believe that the number of visitors to town will increase along with the economic vitality.

FUELING STATION \FIG_DTPRL_75_1\

CHARGING STATION \FIG_DTPRL_75_2\

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PARK
\FIG_DTPRL_76_1\

GATEWAY
\FIG_DTPRL_76_2\

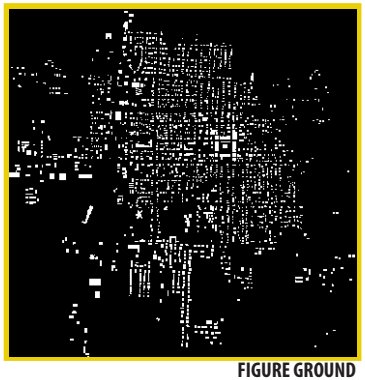
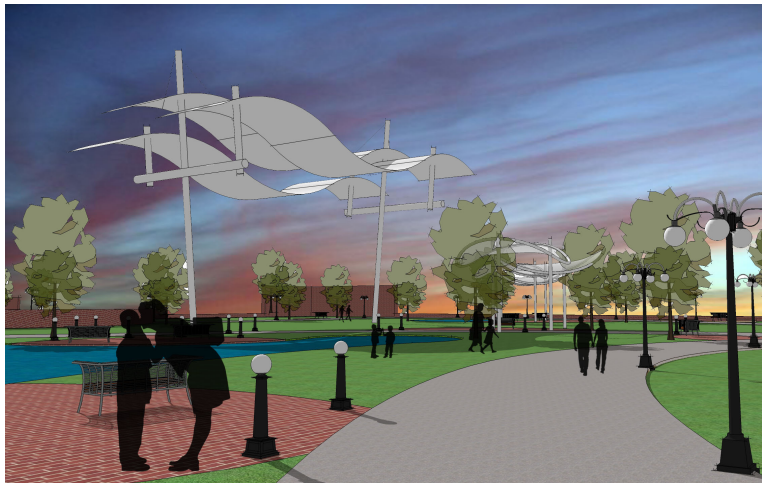


FIGURE GROUND

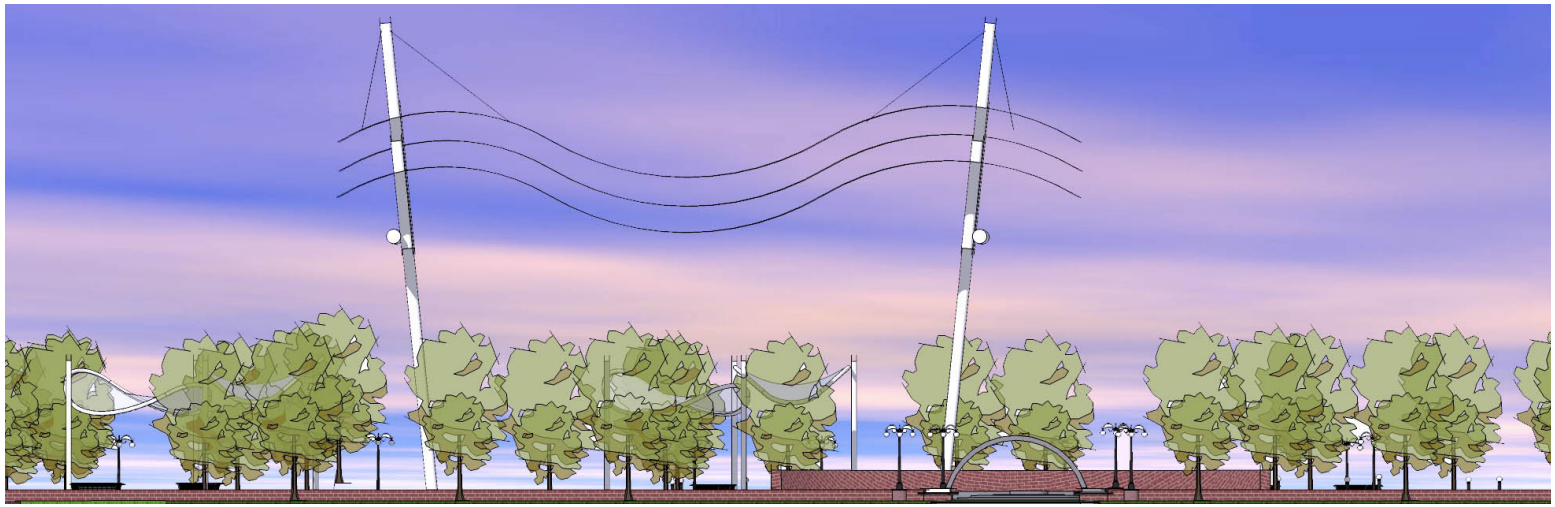
GATEWAY PARK PERSPECTIVE \FIG_DTPRL_76_3\

Water fountains and ponds can be used to create an inviting environment in the park. It should be designed so that it is appealing to all age groups.



GATEWAY PARK PERSPECTIVE \FIG_DTPRL_76_4\

There must be sufficient grassy areas within the park because there are numerous activities that can be done within the park such as exercising, walking dogs or relaxing.



PARK SECTION \FIG_DTPRL_76_5\

If the park is designed with a large monument it can be used as a landmark that would help bring identity to Butler.