Stormwater Green Infrastructure (LID) Management
for the Edwards Aquifer Region of South Central Texas

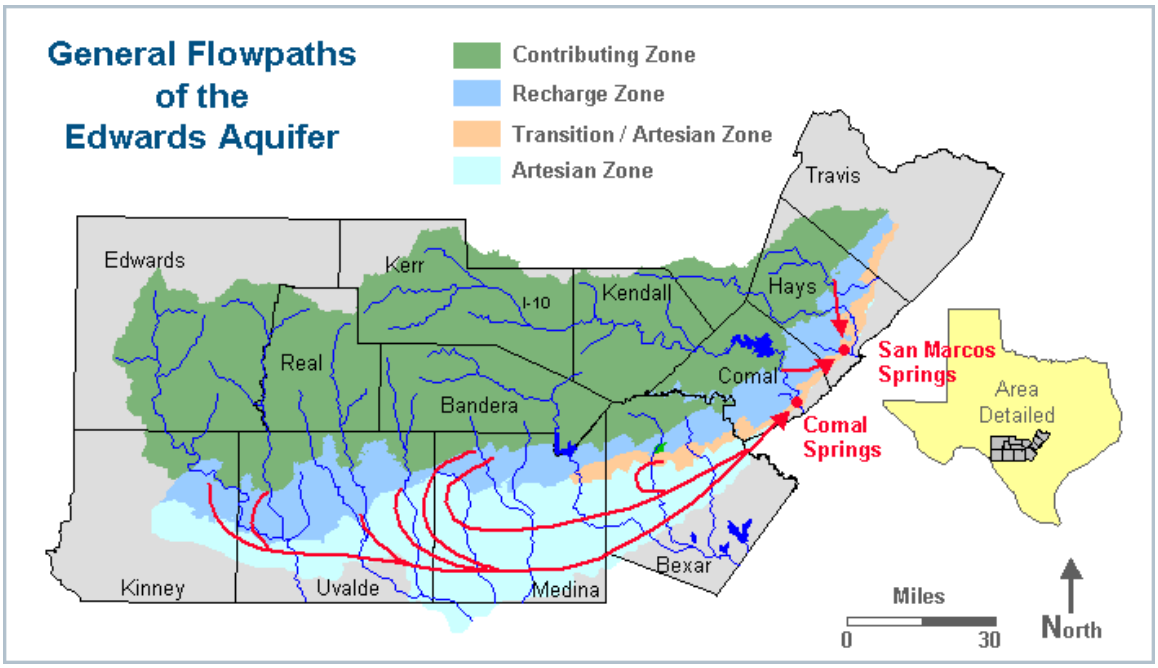

Figure 1: Groundwater Flow in Edwards Aquifer (Eckhardt 2009)

Karst regions have special issues for green infrastructure

- Stormwater runoff carries pollutants from impervious roadways and parking lots, which enter aquifer quickly through porous karst.
- Stormwater in urbanizing karst regions tends to concentrate water, eroding and destabilizing limestone bedrock.
- Green infrastructure can minimize impacts of stormwater runoff by using green space and vegetative techniques to slow and disperse water flow.
- Investigation of subsurface geology and avoidance of known sinkhole areas important if considering use of infiltration

Benefits of green infrastructure for Edwards Aquifer region

- Improved water quality flow to streams and reduced erosion
- Replenishes groundwater and spring flow
- Reduces desertification impacts of buildings and impervious surfaces
- Site scale green infrastructure provides local community amenities, integration with natural setting
- Increases habitat for wildlife and endangered species
- Used in concert with traditional infrastructure, can reduce system costs

Edwards Aquifer Zones will determine choice of green infrastructure technique

- Contributing Zone: Hilly upland plateau with thin soil, streams and seeps that contribute overland flow to aquifer
    - Overall practice is to preserve natural water balance and runoff conditions

- Conservation of open space to restrict development from sensitive lands
- Sinkhole areas and major faults prioritized for conservation
- Brush management for cedar, Ashe juniper removal to maintain natural live oak-grassland savannah ecosystem
- Maintain vegetative buffers around sinkholes and seeps that lead to springs
- Maintain streamside buffers for healthy water quality in creeks

- Recharge Zone: Area immediately south / southeast of Contributing Zone with exposed rock fractures leading directly to aquifer water table; topography is steep sided canyonlands with many rock outcrops, natural springs under artesian pressure
  - Most critical area for water quality protection since surface water drains directly to aquifer; area contains water table zone of aquifer
  - Protect slopes to reduce potential for erosion and aquifer sedimentation
  - Restrict impervious surfaces to reduce chance for pollutants to reach aquifer
  - Use green infrastructure to treat impervious runoff prior to infiltration
  - Utilize green infrastructure to maintain natural water balance, stabilize rainfall fluctuations and spring flows

- Transition Zone: Area south / southeast of Recharge Zone with outcrops contributing some surface water to aquifer
  - Use green infrastructure techniques to maintain water quality and recharge

- Artesian Zone: Area south of Transition Zone where water is confined by deep layers of bedrock, limestone is saturated and there is no water table
  - Water accessed through deep wells; under pressure; water quality and aquifer depth monitored through wells

Infiltration-based LID techniques appropriate for Edwards region

- Infiltration-based techniques can be used with a liner or underdrain.
  - Liners hold water for water quality or use by plants.
  - Underdrains convey filtered water to surface streams or springs
  - Both techniques can be used together or separately
- Bioretention: Lined, permanent pools with sediment forebays and shallow marsh edges that decrease runoff, improve water quality, provide habitat for aquatic species
- Biofilters: Planters with subsurface drainage that receive and treat water from impervious surfaces such as streets, rooftops prior to releasing it to streams
- Seepage pits: Stone pits, sometimes covered by soil and vegetation, that allow water to drain slowly to the aquifer water table
- Infiltration trenches: Shallow trenches that capture sheet flow from impervious surfaces and allow it to drain more slowly into the water table
- Vegetative swales: Shallow planted linear trenches that slow concentrated flows prior to releasing them downstream or to the aquifer.
- Buffer strip: Strip of natural vegetation along a streambank that filters water from pastures, maintaining stream water quality
- Pervious pavement: Grass or stone pavers or pavements made of special mixes of asphalt or concrete that allow water to permeate to subsurface recharge beds

Non-infiltration based LID techniques for Edwards Aquifer region:

- Cisterns: Storage tanks for rainwater, can be above or below ground, common in Texas
- Rain barrels: Household-sized drums supplied from roofs via downspout disconnections
- Curb cuts and street edge planters: Pavement runoff diverted to linear planters; overflow directed to stormwater system
- Rain gardens: Small planted areas with rock underdrains designed to disperse and filter water from micro-watersheds, such as roofs
- Green roofs: Vegetated roofs designed to capture most common storms (usually 1-2 inches of rain); used mainly in urban settings to reduce runoff peaks and volumes.
- Tree trenches: Continuous trenches with permeable paving that allow tree roots space to expand under paved areas; usually designed with underdrainage connected to system

Case Studies/Examples

- TBD

References

- Texas Commission on Environmental Quality.Complying with the Edwards Aquifer Rules: Technical Guidance on Best Management Practices. TCEQ. July 2005. http://www.tceq.state.tx.us/publications
- Eckhardt, Gregg. Introduction to the Edwards Aquifer, website http://www.edwardsaquifer.net/intro.html.
- Hewes, Will. Using Infrastructure in Karst Regions. American Rivers website http://www.americanrivers.org
- LID Standard Details and Specifications Technical Guidelines. Low Impact Development Center, website http://www.lowimpactdevelopment.org/ewri_sds.htm. 2005.