Term Project: Site Suitability Analysis for
City of Austin Riparian Grow Zone Program
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Progression of a grow zone, Bartholomew Park (City of Austin)

Introduction and Goals:

Riparian zones are the areas that directly connect streams with the land adjacent to them. They include the stream banks, floodplain, and a small buffer beyond the floodplain. In this biome, a unique plant and animal habitat exists which provides ecosystem services to the stream environment. In urban settings, riparian zones have a particular importance as they can help mitigate the effect of fast moving storm water as runoff flows to streams. The diverse habitats are known to reduce erosion and promote bank stability as well as improve water quality through reducing sediment load and contaminate transport to the stream. They also can slow storm water down by increasing the rate and amount of infiltration of during events, as a healthy vegetative surface generally equate to less compact soils. In absorbing more water during events and slowly releasing it to the stream through vadose zone percolation rather than overland runoff, the stream is less flashy, base flow is sustained for longer periods between events, and water quality is improved after pasting through the filter-like subsurface. With these benefits, improving and restoring riparian zones in urban areas can have a significant positive affect on the quality and quantity of water in our creeks, prevent loss of land to bank erosion, and improve the diversity of plant and animal communities which are often reduced in urban environments. The City of Austin Watershed Protection Department has created a program called "Grow Zones" which aims to make these improvements through "no mow areas", or areas where city land is allowed to return to a natural state. An example of this progression can be seen in the photo above.

Given the positive benefits of creating grow zones, my project aims to find suitable sites where more of these riparian zones can be allowed to regenerate. I have selected five case study watersheds to look at the need for riparian restoration among differing categorical levels of urbanization (Figure 1). Two watersheds represent relatively undeveloped environments (Barton Creek and Bull Creek), two represent maximum development (Waller Creek and Shoal Creek), and one is near maximum development but is primarily residential (Boggy Creek). Looking at the spatial differences in these watersheds can help elucidate the priority-based need for restoration sites in urban areas, but can also be informative in recognizing the heterogeneity among creeks within similar development conditions.
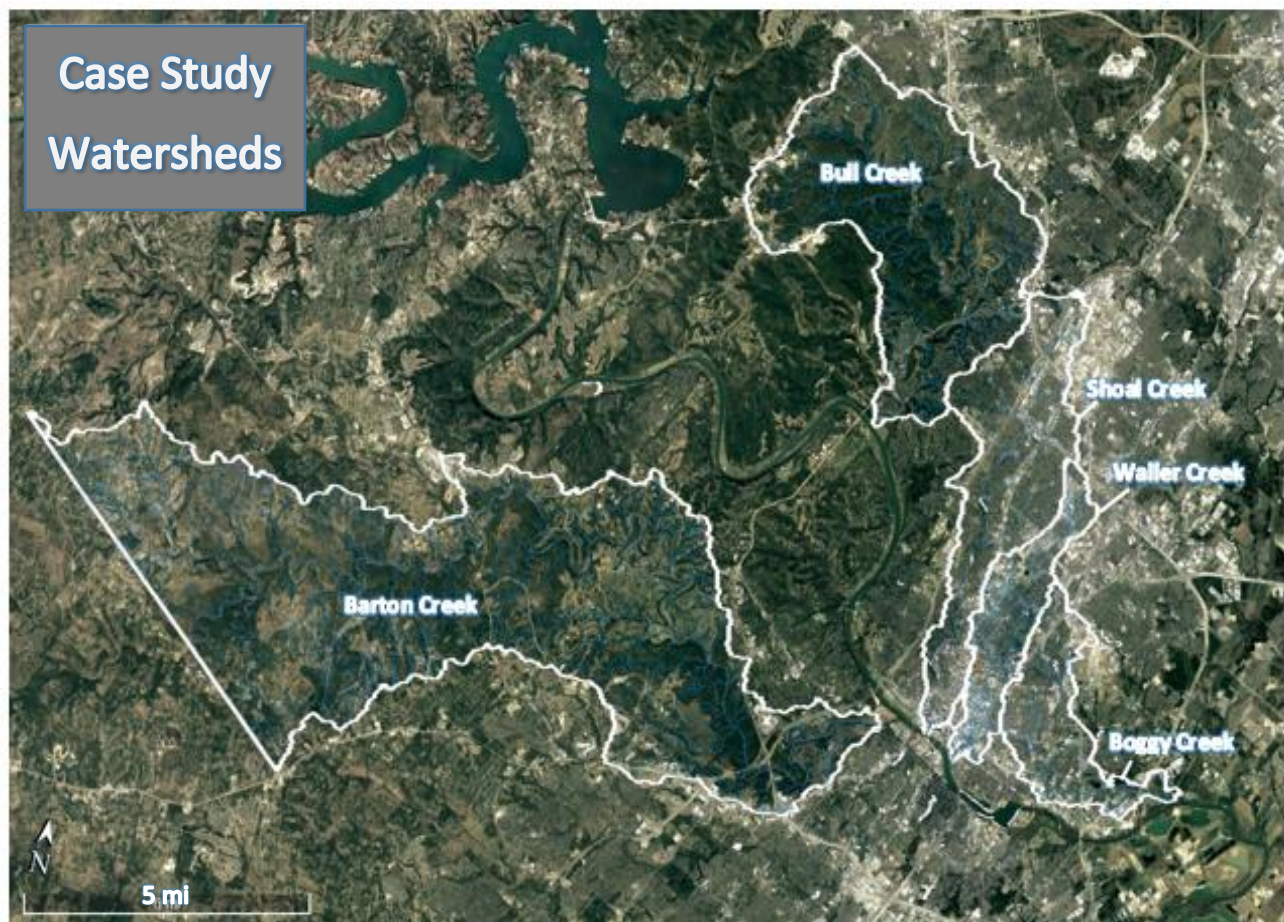

Figure 1. Case study watershed shape files overlain in Google Earth to show differing degree of development.

To complete the task of finding suitable sites for grow zones, I have developed a three-point criteria: (1) land must be on city owned, (2) it must be along a stream, and (3) it must be near a known erosional site. It is with these criteria in mind that the following data and analysis methods were employed.

Data Collection:

To comply with the three criteria set for site suitability, I have collected the data on city owned parks within Travis County, streams and watersheds within the county, and any erosional points that were noted by city workers; background files for the state and the county were also collected. All data were downloaded as shapefile using the City of Austin GIS/Map downloads website (https://data.austintexas.gov/browse) or the Texas Natural Resource Information System (TNRIS) (https://tnris.org/) website. Below is a list of all data downloads:

City of Austin

- City of Austin Parks Shapefile
- Erosion Site Points Shapefile
- Watersheds Shapefile
- Creek Lines Shapefile
- Grow Zones Shapefile (for validation)

TNRIS

- Texas State Shapefile
- Travis County Shapefile

Methods:

General methods used in this site suitability analysis for this project are shown in Figure 2. Each of the case study watersheds were handled using the same steps for the purposes of reproducibility. The first step was to project all of the files in to the same projection coordinate system. For this analysis, NAD 1983 (2011) State Plane Texas Central Zone was used as the State Plane coordinate systems are typically used by federal, state, and other municipal entities in their mapping needs. All the main files listed above in the data collection section were then clipped to the Travis County Shape file. The watersheds and streams clips were exported as KML files and brought into Google Earth to examine watersheds of different development intensity (Figure 1). From there, the 5 case study watersheds were chosen for exploration and site suitability analysis.

With Barton, Bull, Boggy, Waller, and Shoal creek watersheds chosen, the Buffer Analysis Tool was used to buffer the creek lines by 25 feet and erosion sites by 500 feet. The creeks and erosion site buffer files were then intersected with the City of Austin Parks file. This analysis yielded suitable sites for Grow Zones according to the criteria.

Project all Files:
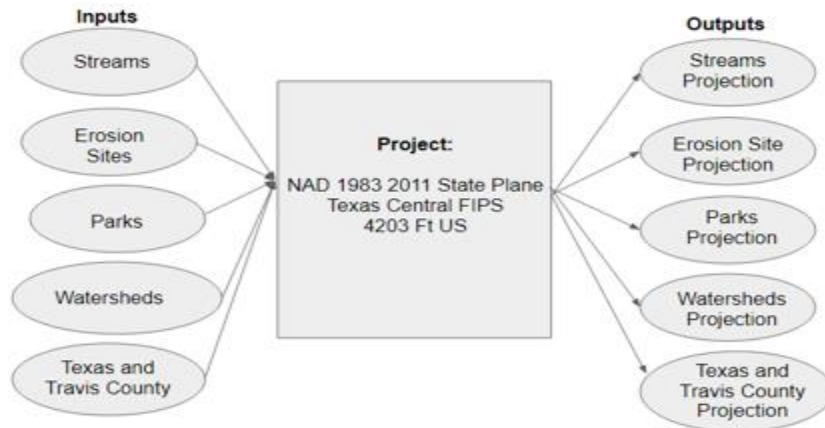
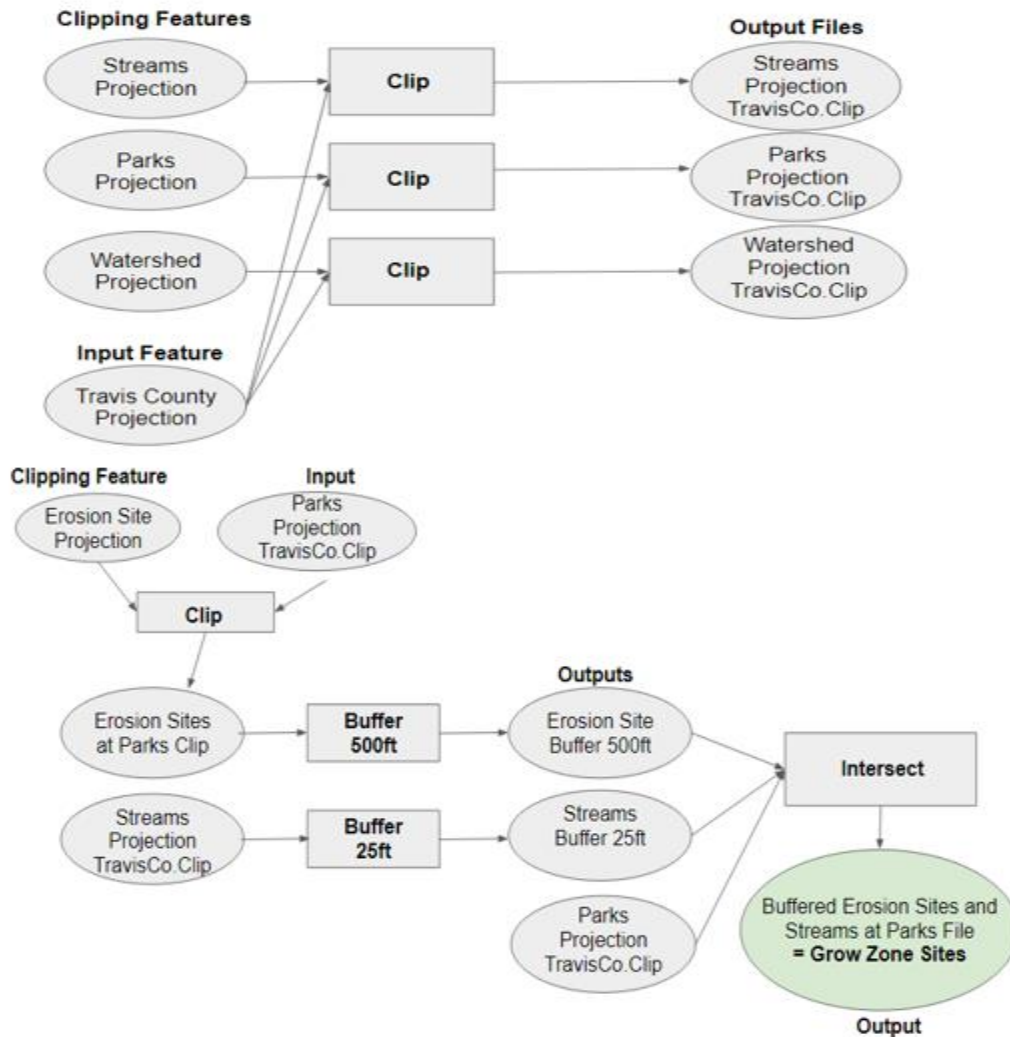**The following analysis was performed on each of the 5 case study watersheds**

Figure 2. Work flow diagram showing projection and analysis tools used to complete site suitability. Ovals denote files while squares denote functions or tools used. After the projections were complete, the 5 case study watersheds were exported as a separate shape file and all further functions were applied to those watersheds alone.

Results and validation Discussion:

The results of this analysis are polygon areas within 25 feet of a stream and 500 feet of a known erosion sites that coincide with Austin Parks. As Grow Zones are a current city project, my analysis can be validated with an existing Grow Zone shapefile distributed on the City of Austin GIS data website. The following pages will include maps of specially selected sites in all five case study watersheds, highlighting examples of priority areas within that watershed. The selection of priority sites shown in my analysis for riparian regeneration is based on the density and/or occurrence of erosion sites and area of coverage. A discussion of the sites my analysis has produced compared with the actual sites (provided they exist) will be given, including commentary on how the real world selection process differs from the simple model created here. Boggy Creek and Shoal Creek watershed analyses provide the most content in terms of restoration needs, they will be discussed first, followed by Waller Creek, and finally the two low-development watersheds. Road ways have been intentionally left out of the maps as the focus of the analysis is on water pathways; instead park names have been added to orient the reader to site specific locations within a watershed.

The focus area for Boggy Creek watershed is at Rosewood Park in east Austin (Fig. 3). At this site there are 13 known erosional points, making this urban park area a priority for riparian restoration. The city already implemented grow zones at this location, however, my analysis has yielded some spatial differences. The zones in my analysis are generally more narrow compared with those chosen by the city, and they also extend to areas which the city has not labeled as grow zones. Some of the reasons for differences in the sites are because of the size of Rosewood Park and the way in which it is recreationally used. The city seems to have been able to expand the typical 25 feet of buffer around the stream to a much greater distance in some portions of the park because there is sufficient park land to do so without inhibiting recreational use. In other areas where my analysis has yielded grow zones but the city does not have any specific designations, looking back to google earth imagery, this area is not actually being used for recreational purposes and is currently un-mowed now. Therefore, there would be no reason for the city to implement a grow zone as one is technically already occurring. To improve my results, finding data to constrain areas that are maintained (meaning mowed) verses unmaintained would be useful in improving accuracy.
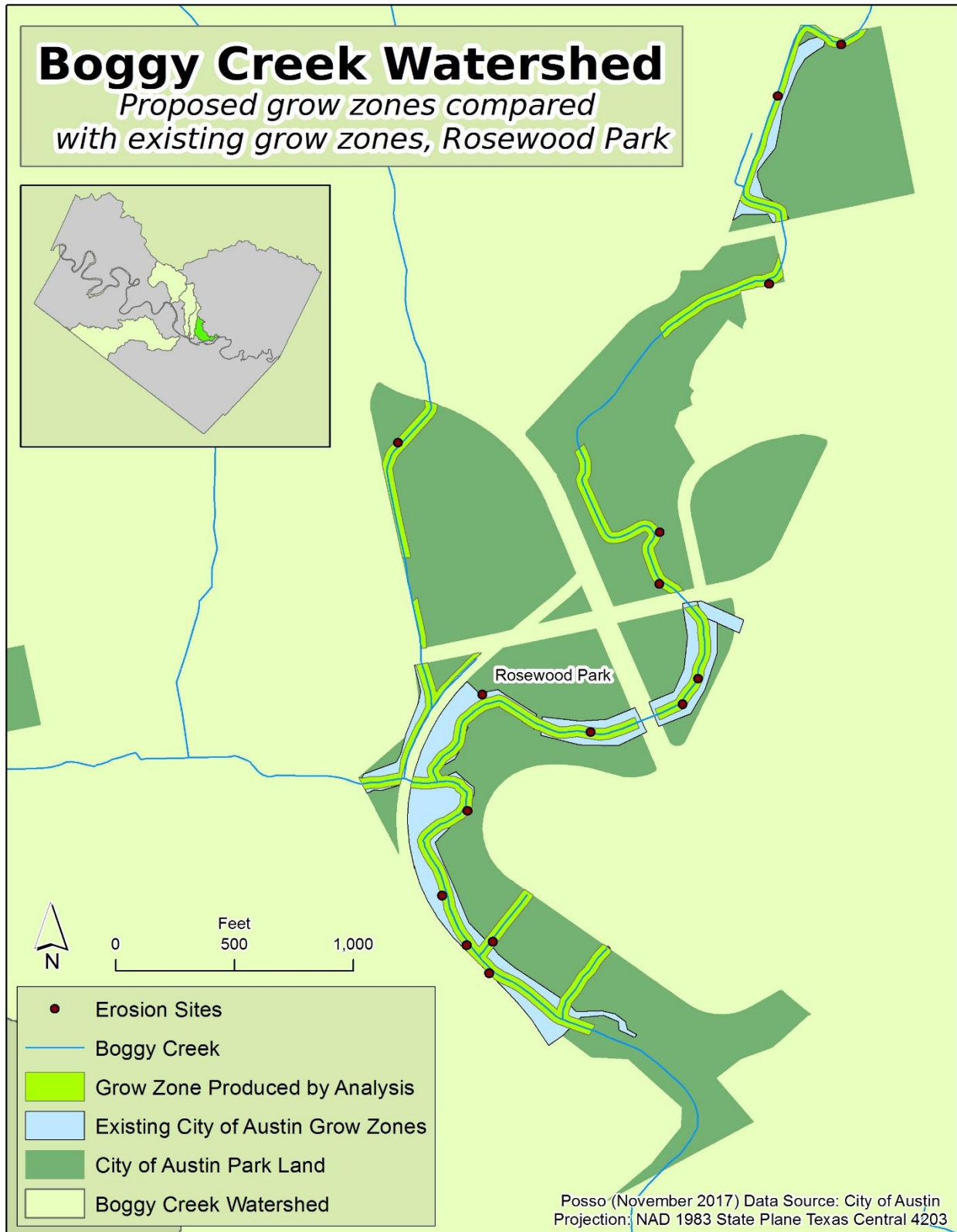
Figure 3. Site suitability analysis for Boggy Creek watershed at Rosewood Park. City of Austin grow zones (blue) represent and area of approximately 19 acres, whereas the proposed grow zones (green) are approximately 8 acres.

Shoal Creek watershed has 26 erosional sites in a very short segment of the creek, these also coincide with Pease Park and the highly trafficked Shoal Creek Greenbelt, making this site a particularly suitable priority for riparian restoration. The proposed grow zones are really well validated with the existing COA grow zones at this location (Fig. 4). The locations and areas of the grow zones proposed by my analysis match nearly exactly in all areas of the upper most reach of the map. The degree of agreement is like due to recreational use of the park in these locations, because there are designated trails that would not interfere with the amount of land the city choses to use on restoration, the criteria of a 25 foot stream buffer worked really well for this location.
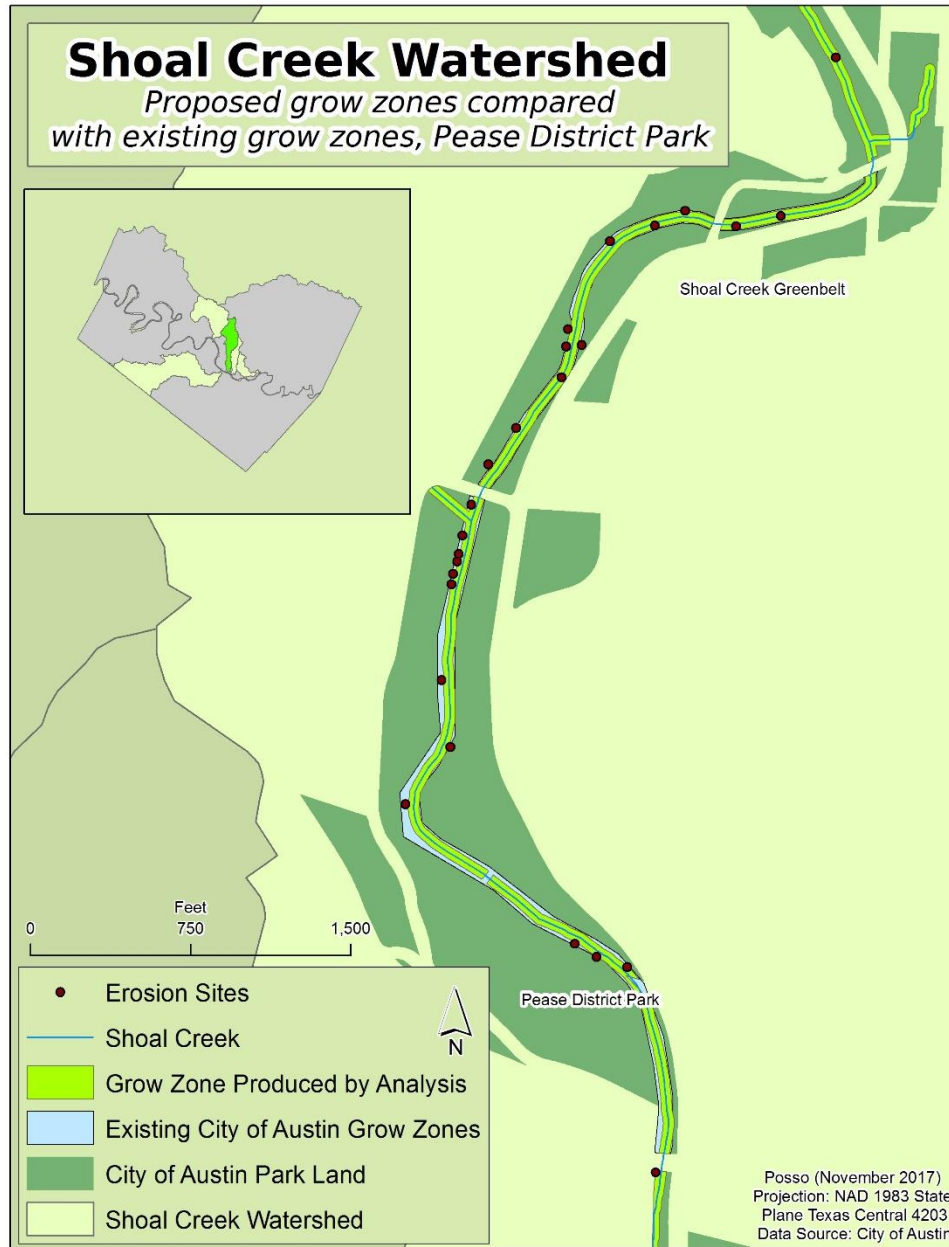

Figure 4. Shoal Creek watershed at Pease District Pak and the Shoal Creek Greenbelt. Proposed and existing grow zones show good agreement.

Waller creek watershed exists in a highly urbanized area, yet the city has no existing grow zones within this watershed. The reason for this is likely due to the fact that all areas are either channelized with bedrock or concrete, not publically owned, or does not show specific need based on in-person field assessment. My analysis has produced the stream segment below at Eastwood Park as a potential location, however no grow zone exists. In viewing the area on google maps, the riparian area adjacent through the creek is unmaintained and left as a wooded area within the park. Again, the results in this watershed show the need for an additional criteria reflecting maintained areas, and perhaps even areas that have undergone channelization would be useful. With data on this topic, my analysis would yield more accurate results.
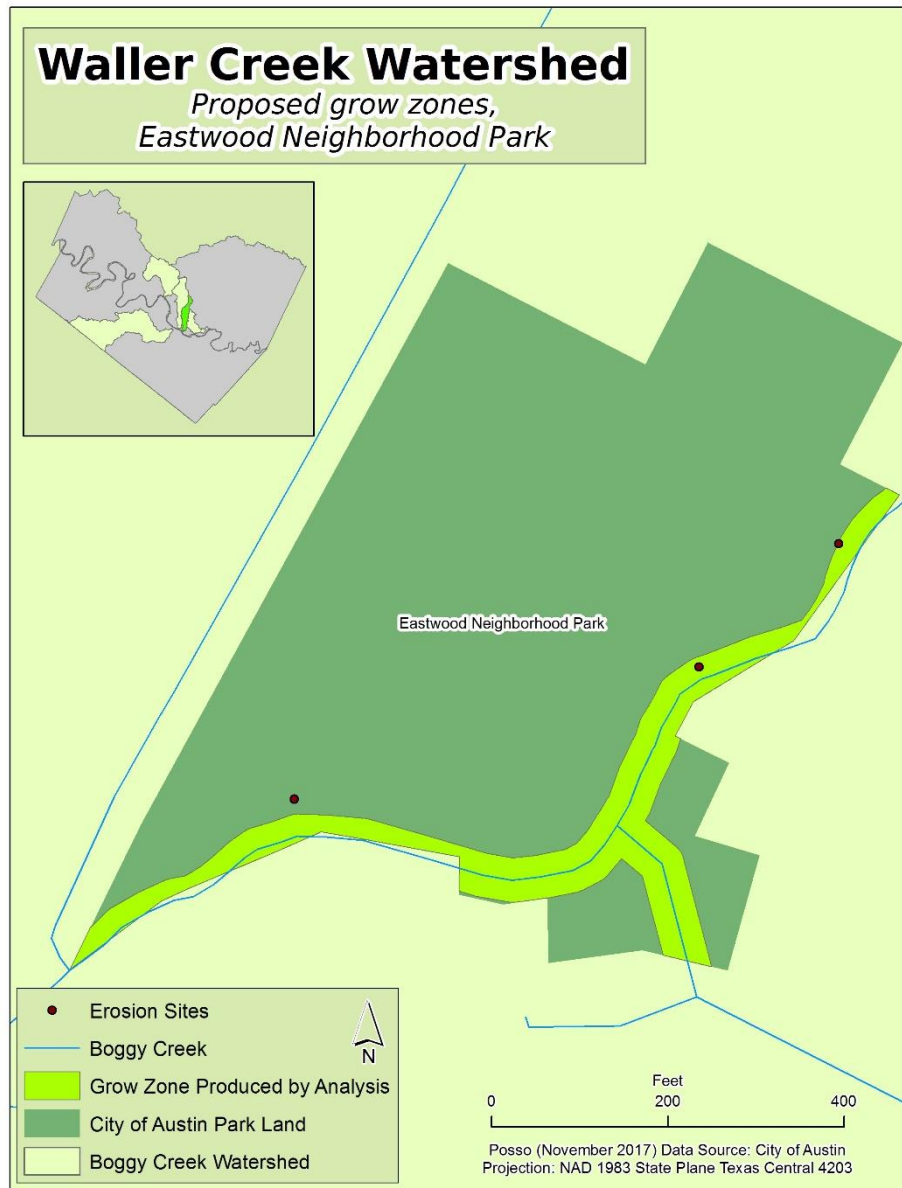

Figure 5. Waller Creek watershed at Eastwood Park. With the highest density of erosional sites in this watershed, there exists no COA grow zone due to the way which the riparian zone is currently maintained.

The site suitability for Bull Creek watershed yielded a grow zone proximal to an area of an existing COA grow zone, however they do not align. Based on knowledge of this park and google earth imagery, the city of Austin chose to create grow zones further away from the main channel as the areas from my analysis are frequently used for recreational activities like swimming and picnics. The area upstream of the COA grow zones, for which my analysis has yielded possible grow zones sites, is an unmaintained area and therefore would not require an explicit implantation of a grow zone.
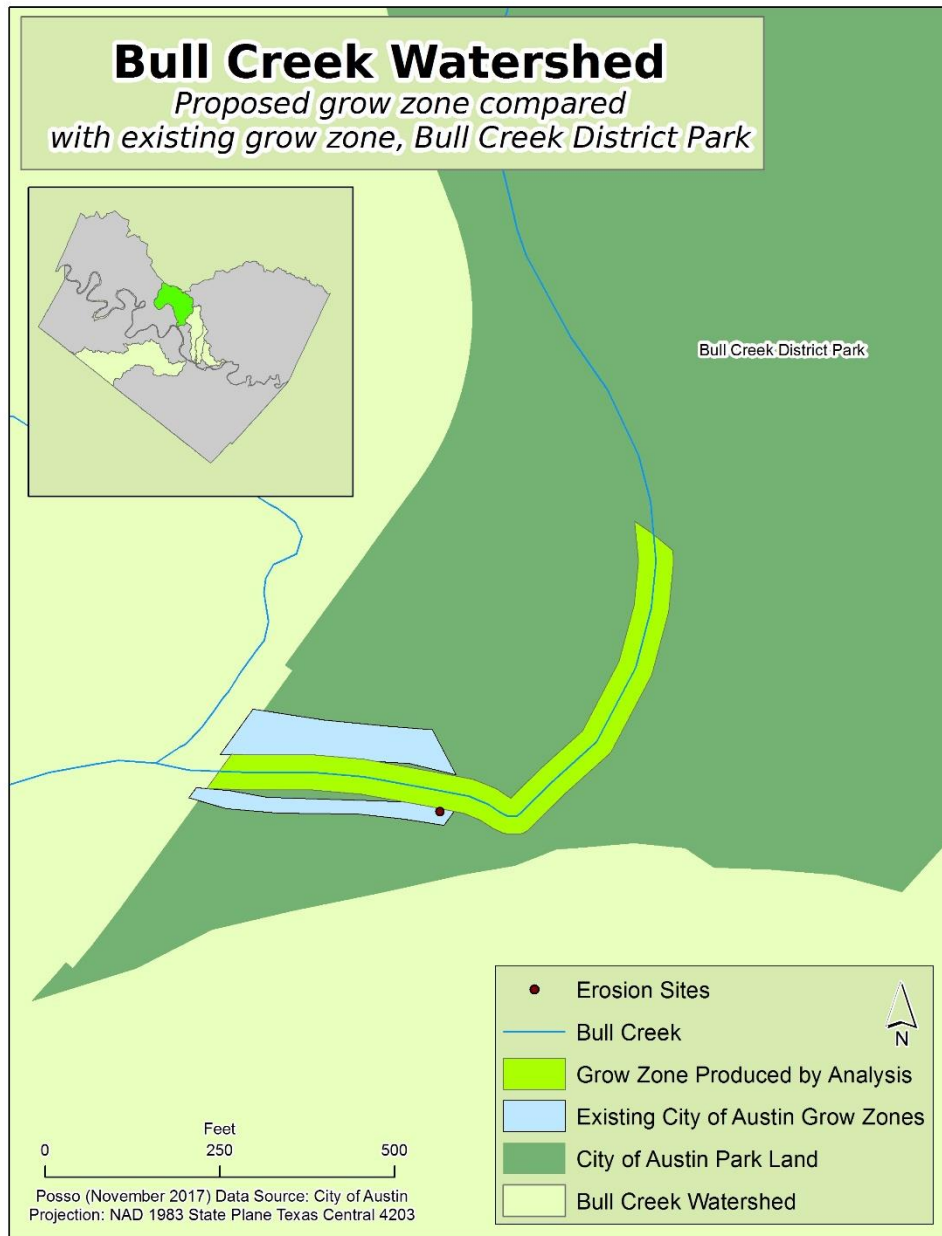

Figure 6. Proposed grow zones compared with existing COA grow zones in Bull Creek watershed.

Barton Creek watershed is fairly protected from urbanization, so erosional issues are not as prominent in the area. The one park that had more than one known erosional site was at Zilker Metro Park. Being that this park is an extremely popular recreational location and is somewhat of an iconic symbol to the city, it is unlikely that useable park land would be chosen for restoration unless there was a clear need for it. However, if the need should become more apparent, this sites yielded by my analysis would be a good recommendation.
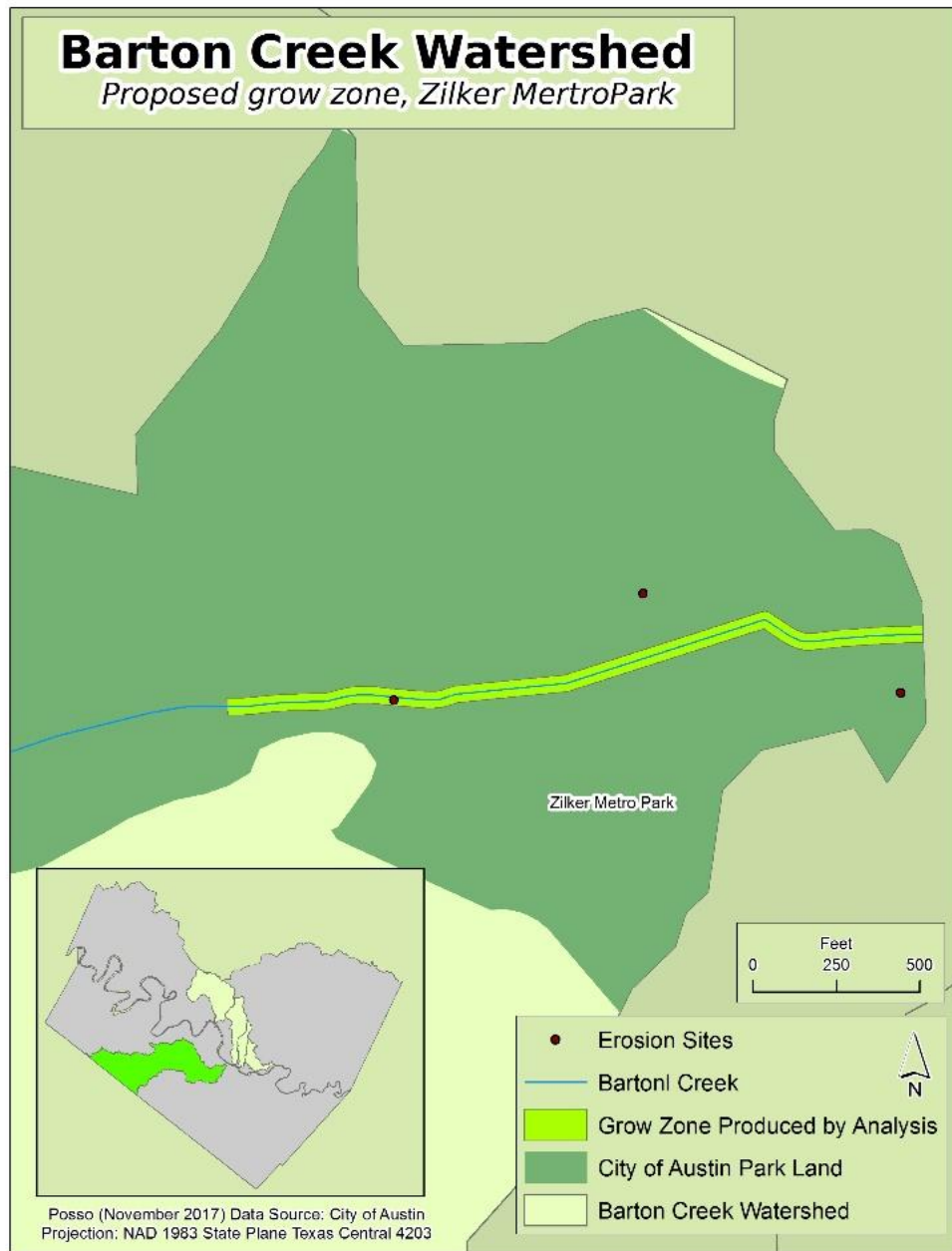

Figure 7. Potential grow zone sites at Zilker Metro Park of Barton Creek watershed

Conclusion

The degree of development in each of the case study watersheds has an influence of the need for riparian zone restoration. These can be seen in figures 3-7, as the most developed watersheds have the highest density of erosion sites and the therefore the highest need for some kind of mitigation, such as grow zones. The analysis provides suitable sites to implement grow zones based on available land space and indicators shown by erosion. My model has been visually validated by comparison with existing grow zones, and results in reasonable locations for further implementation. From the comparative analysis, additional criteria needed to improve my model would be data regarding currently maintained areas and how parklands are used for recreation spatially within the park. Having completed this analysis, my data can be presented to the City of Austin for suggestions on criteria and future locations in fully urban watersheds.

Sources and References:

http://desktop.arcgis.com/en/arcmap/latest/map/projections/state-plane-coordinate-system.htm