

CHEROKEE BOULEVARD RE-IMAGINED

Identifying No. 17407



A re-imagined Cherokee Boulevard is a complete and green street: a vital artery in northwest Chattanooga with strong connections from adjacent neighborhoods with enhancing transit, walkability and bicycle infrastructure.

A reimagined Cherokee Boulevard will be the commercial heart of the neighborhood and the backbone for economic development, connectivity and environmental improvement – more than passage – clean, green and inviting place.

CHEROKEE BOULEVARD RE-IMAGINED

Entry #17407

INTRODUCTION

Chattanooga has extended an invitation to the design community to participate in a competition to provide a design solution on selected sites that employs the standards and methods specified in the Rainwater Management Guide. One of the sites offered is Cherokee Boulevard from Market Street to the tunnel. The City identified nine objectives in this program applicable to all of the selected sites. These are as follows:

1. Raise awareness about green infrastructure and the City of Chattanooga's new development requirements.
2. Garner community stewardship and enthusiasm for low-impact development (LID) and green infrastructure practices.
3. Promote innovation and present engaging, cost-effective strategies.
4. Catalyze private interest and spur property owners to invest in LID/green infrastructure retrofits.
5. Demonstrate cost effectiveness of LID green infrastructure alternatives.
6. Provide a hands-on learning experience in which design, construction and development professionals in the Chattanooga area will gain meaningful experience with LID methodologies that can be applied to everyday practices.
7. Demonstrate the economic, environmental and marketing benefits of green infrastructure.
8. Encourage greater use of sustainable development in the Chattanooga area.
9. Recognize the participants for creativity, innovation and application of sustainable site design.

The City has also defined specific spatial and rainwater management criteria applicable to Cherokee Boulevard. Spatial criteria recognized two distinct zones with criteria accordingly as follows. For the entire length of the street, assume that:

1. The design will be within the right-of-way (ROW) unless you identify opportunities for acquisition of additional areas
2. A center turn lane will remain when needed
3. Planted medians may be provided in the center turn lane where possible
4. Bike lanes will be provided in each direction
5. On-street parking will be provided where space permits
6. Curb extensions will be provided where appropriate, to maximize safety
7. From North Market Street to the Manning Street area, assume that two travel lanes will remain in each direction.
8. From the Manning Street area to the Stringers Ridge Tunnel, assume that one travel lane will remain in each direction.

City defined rainwater management criteria are as follows:

1. Selected practices should be designed to infiltrate, evapotranspire or harvest and reuse the first 0.9 inches of rain that falls within the project limits. Or, alternatively, design a system that will remove 80% TSS from a 2.1-inch, 24-hour design storm.

CHEROKEE BOULEVARD RE-IMAGINED

Entry #17407

2. Utilize LID site design techniques and green infrastructure features as the predominant stormwater infrastructure system
3. Use the methodology outlined in the Rainwater Management Guide.

Our design team has selected Cherokee Boulevard. This submittal represents our interpretation of the design challenge that addresses the City's objectives and criteria.

PLAN OBJECTIVES – A re-imagined Cherokee Boulevard

The City of Chattanooga has long since been on a transformative trajectory of its physical, social and environmental realm. Cherokee Boulevard presents an opportunity to continue with an important component of the transformation. While it may be that the primary objectives of the City in this design competition is to demonstrate the efficacy and utility of the new standards for rainwater management, the standards also require new approaches with more than a traditional engineering solution to rainwater volume management. Cherokee Boulevard provides an excellent case study for how to manage the rainwater as an integrated adaptation to this urban corridor. We believe that this requires an understanding of the complexity found in this unique area, and a solution that not only satisfies the City's stated objectives and criteria, but fits into the context of adopted plans and emerging development.

These objectives call for a **re-imagined** Cherokee Boulevard as a complete and green street: a vital artery in Northwest Chattanooga, with strong connections from adjacent neighborhoods with enhancing transit, walkability and bicycle infrastructure. A **re-imagined** Cherokee Boulevard is the commercial heart of the neighborhood and the backbone for economic development, connectivity and environmental improvement – more than passage – a clean, green and inviting place.

EXISTING CONDITIONS – Constraints/Opportunities

Cherokee Boulevard, as it evolved and currently exists, is a thoroughfare that serves primarily to convey automobiles. The existing street section from the Market Street intersection to the south to the Stringer's Ridge Tunnel to the north consists of two traffic lanes in each direction with a continuous turn lane, and while sidewalks do consistently line the street, they are secondary to the automobile lanes: narrow and designed to minimum standards. Many sites along the corridor have wide driveways that allow free automobile motion into the site along the entire length, meaning that pedestrians are left with an undefined zone, forced to walk through a parking lot or wide entry to cross the site.

The corridor becomes more "urban" as it approaches Market Street. Existing buildings have been sited to address the street and create a more compact section, complete with wide sidewalks, on-street parking and regular street trees, but moving north, this section quickly erodes to a scenario where buildings are sited to allow for parking in front and free flow automobile access into the site, to the detriment of a cohesive streetscape. Additionally, as Cherokee Boulevard runs in a southeast to northwest access, it impacts the primarily north/south grid of the surrounding neighborhood, creating unusual intersection conditions. Of note is the intersection of Cherokee Boulevard and Manning Street/Sommerville Avenue/Harper Street.

CHEROKEE BOULEVARD RE-IMAGINED

Entry #17407

DESIGN CONCEPT – A Complete Street

These existing conditions present an opportunity to transform Cherokee Boulevard. The redevelopment of the corridor has been re-imagined and designed to exceed the City's rainwater control standard, as well as better balance the needs of automobiles, pedestrians, bicyclists and transit users. This complete green street approach will better serve the community by providing for improved mobility, reduce downstream flooding, improve water quality and act as a catalyst for redevelopment. Importantly, the re-imagined street can serve as a template for other similar streets in Chattanooga.

Zone Adaptation

The Cherokee Boulevard corridor presents itself as three distinct sub-zones based upon existing patterns and opportunities for redevelopment. While there are differences between the three zones, the proposed design includes similar elements that create a consistent character and theme throughout the corridor.

Zone A: Acting as a gateway into Chattanooga, Zone A begins at the Stringer's Ridge Tunnel and runs to Gurley Street. Because of the topography of this zone, existing buildings are set back further from the street or non-existent. The adjacent wooded hillside drains along the ROW and is intercepted by a roadside drainage structure. The opportunity to remove a lane in each direction creates opportunity to balance mobility needs and capture storm water within the ROW. A continuous bike lane, wide sidewalks and central median are proposed. On-street parking is not necessary in this section because of limited development and opportunities in this zone. Enhanced tree lined bio-swales in the median, along with connected tree cells – serving also as protection for the walkways and bike lanes – are utilized to match the low-density character of the zone. These capture and control rainfall runoff from the street and ROW. In this zone, bicycle and pedestrian connectivity is linked to Stringers Ridge and the North Shore community. A bus stop with bike racks is proposed at the West Bell Avenue intersection to address the limited parking space for Stringer's Ridge.

Zone B: Zone B extends from Gurley Street to Manning Street, and is the area where most neighborhood redevelopment could occur. Central to this zone is an opportunity to remove one traffic lane in each direction, creating room to include limited on-street parking with one separated bike lane in each direction, widened and enhanced sidewalks and a central median, all of which will work in tandem to create a catalyst for reuse and redevelopment of the buildings, and create a system for managing rainwater. Multiple sites in Zone B have been identified as vacant or under-utilized and can be opportunities to jump-start redevelopment of the district. Mixed-use buildings that include ground-floor retail, residential or small office space, organized to line the street will create a transitional density between Cherokee Boulevard and the surrounding neighborhoods and will re-establish the street as the commercial heart of the district.

Zone C: Zone C, located between Manning Street and Market Street, is the most urban of the three zones. A significant amount of redevelopment has occurred in this zone, highlighted by mixed-use buildings that have been sited to address the street and create an urban form. On-street parking and new sidewalks, complete with street trees, have been utilized to create a pedestrian-friendly environment that transitions to the North Shore neighborhood. The street profile includes two drive lanes in each direction and a turn lane at intersections. Because of the urban form of this zone, and the requirement of keeping the drive lanes, green

CHEROKEE BOULEVARD RE-IMAGINED

Entry #17407

infrastructure opportunities are more limited than in other zones. Connected tree cells, pervious pavement (in bike lanes and walkways) and bio-swales in street corner bulb-outs will create a system to manage rainfall and provided much needed green space within the ROW. Additionally, there is an opportunity to utilize the existing parking lot at the intersection of Cherokee and Manufacturer's Road as a redevelopment parcel that includes a bio-swale. This will enhance the urban character of the zone while providing additional rainwater storage outside of the ROW.

Connections – Moccasin Bend, North Hills, Stringers Ridge: The design scheme strengthens Cherokee Boulevard as a main artery in northwest Chattanooga. As such, creating strong connections from adjacent neighborhoods to the corridor are important, as well as enhancing transit, walkability and bicycle infrastructure. A *re-imagined* Cherokee Boulevard will be the commercial spine of the neighborhood and a main linkage to the rest of the city.

Redevelopment of vacant or underutilized sites along the corridor will strengthen the character of the neighborhood, serve as a catalyst for new commercial development, and increase property values. Important to the success of this redevelopment is creating strong controls for how buildings are sited. All new construction should require buildings to be built to the ROW, forcing parking to be located in the rear of the site. This will support the walkability of the corridor and promote a new character for the district. Small shops and restaurants could focus upon the revitalized street, adding vitality to the corridor. Additionally, there is opportunity for residential or small office space to be located above ground-floor commercial buildings. Adding new residents and daily employees will create a diversity of end-users within the district and, along with existing neighborhood residents, support the local commercial businesses.

Traffic Management: Cherokee Boulevard, in its current configuration is designed for automobile speeds of 30 to 40 miles per hour. This scenario is not conducive to a walkable district. While automobile traffic needs to still adequately flow through the district, it should be slowed to allow for other types of mobility. By removing one lane in each direction from Manning to points north; narrowing existing travel lanes; adding medians, on-street parking and bike lanes, a sense of "compression" will be achieved to effectively slow automobile traffic and increase safety for pedestrians and cyclists. This balanced approach will serve to transform the character of Cherokee Boulevard.

Public Transportation: Transit is an important element to the design concept. Currently Cherokee Boulevard is underserved by CARTA, and as the population increases and the corridor becomes more of a destination, new transit facilities should be included. Dedicated bus stops within the ROW that connect Cherokee Boulevard to the transit system should be contemplated. Additionally, Stringers Ridge is an important regional open space that should have a stop to alleviate parking concerns in the area. A location for this stop is proposed at the W. Bell Avenue intersection.

CHEROKEE BOULEVARD RE-IMAGINED

Entry #17407

DESIGN ELEMENTS AND FEATURES

The proposed design plan integrates and incorporates a variety of strategies and practices to create a comprehensive solution with a common theme. The plan also tailors the design elements and features for each of the zones, as shown on our competition boards (illustrated below.)



Design elements and features include:

- Connected tree cells
- 54,880 square feet of pervious parking lanes/spaces
- 74,390 square feet of pervious sidewalks
- 76,480 square feet of pervious asphalt (colored) for Bike Lanes
- 28,128 square feet of a landscaped and tree lined bio-retention median
- 36 Street corner bulb-outs
- Street benches in selected locations
- Conservation green space in selected areas
- Dedicated bike lanes for the entire length
- Curb cut consolidation
- On-street parking in zones B and C

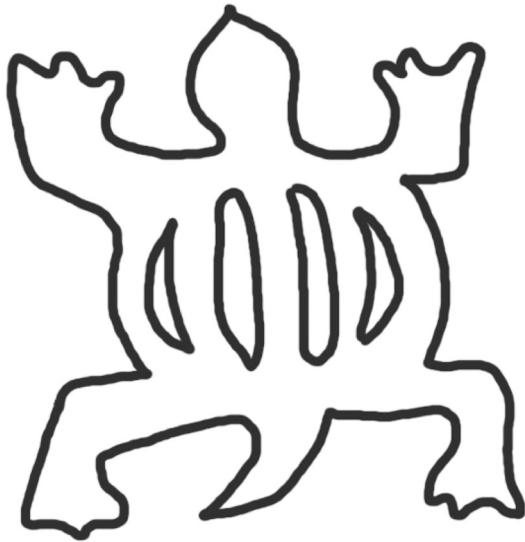
CHEROKEE BOULEVARD RE-IMAGINED

Entry #17407

- Continuation of existing street lighting for the entire length, approximately 175 new lights.
- Continuation of existing underground electrical and communication utilities
- Improved and extended transit stops to serve the entire length with a key stop at Stringer's Ridge

Some of the tailored strategies and practices include:

- Art to invoke the Cherokee heritage to be expressed on a median monument at the beginning of Zone A. A specific design for this work can be done in participation with local artists. One idea is to incorporate a subtle traditional Cherokee symbol for transformation or adaptation to signify the ongoing adaptation that will occur as the **re-imagined** boulevard comes to life. Initial research has suggested the following symbol:



Cherokee symbol for "adaptation."

- This symbol could also be included selectively in the cross walks as tribute to Cherokee heritage and to further brand Cherokee Boulevard.
- Additional, locally produced art could be displayed at the bus stop shelters. Chattanooga enjoys a growing and active local art community. Their participation can serve to engage the public and bring supportive attention to the transformation of Cherokee Boulevard. The design team recommends that these be mosaics or tile work, as mosaics are seldom boring to the eye, no matter how many times they are viewed.
- While the presentation board shows a common rain barrel, these could be designed as a combination planter and rain barrel.
- The design provides 490 trees located in the medians and connected tree cells. Specific species are recommended for each of the zones. These are as follows:

Zone A (tunnel to Gurley Street: 1,945 LF)

Water Hickory (*Carya aquatica*), River Birch (*Betula Nigra*), Redbud (*Cercis Canadensis*)

CHEROKEE BOULEVARD RE-IMAGINED

Entry #17407

Zone B (Gurley Street to Manning Street: 1,500 LF)

Black Gum (*Nyssa sylvatica*), Overcup Oak (*Quercus lyrata*), Nuttall Oak (*Quercus nuttalli*)

Zone C (Manning Street to Market Street: 1,930 LF)

Sweetgum (fruitless) (*Liquidambar styraciflua*), Red Maple (*Acer rubrum*), Shumard Oak (*Quercus shumardii*)

- Additionally, the design includes 270 trees in the suggested redevelopment areas consist with the zone

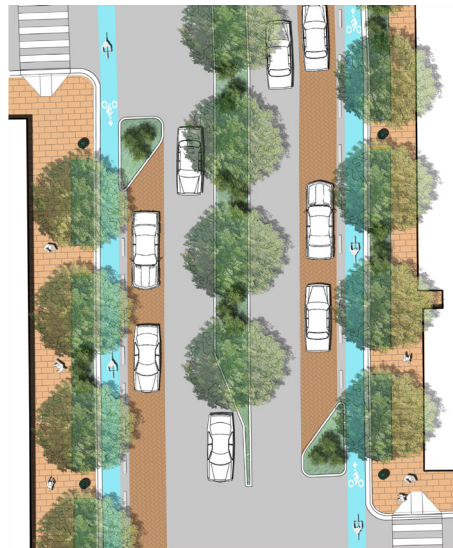
The design also features:

- Bike share stations and bike racks at selected transit stops
- Trash/recycling cans at each intersection
- A transit stop to serve Stringer's Ridge and local businesses and residents.

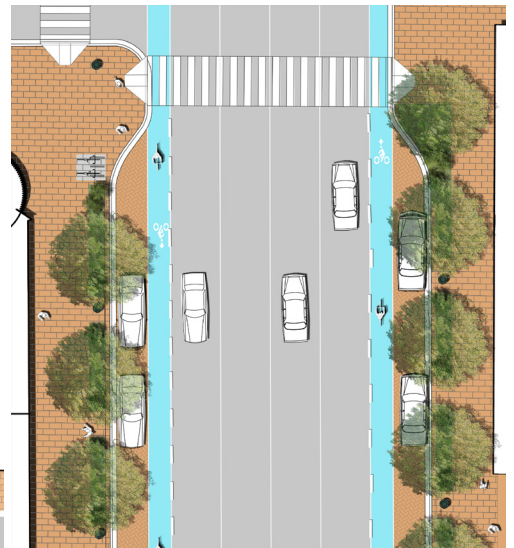
Street designs tailored to each Zone are depicted below:



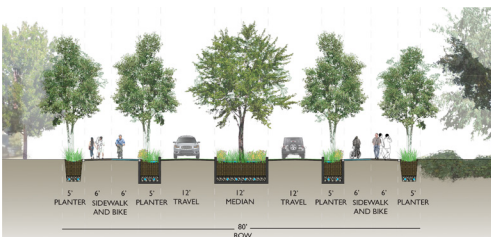
ENLARGED PLAN - ZONE A



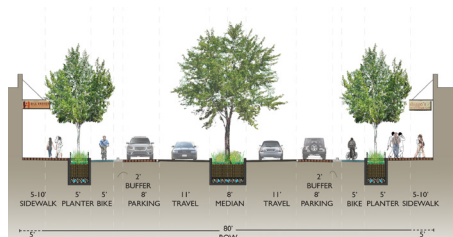
ENLARGED PLAN - ZONE B



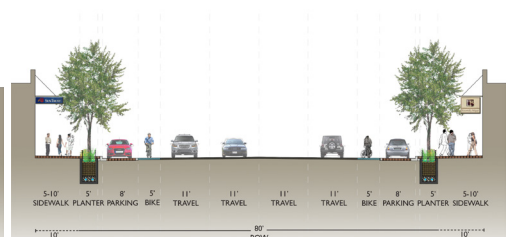
ENLARGED PLAN - ZONE C



STREET SECTION - ZONE A



STREET SECTION - ZONE B



STREET SECTION - ZONE C

RAINWATER MANAGEMENT

The City has specified that the selected practices should be designed to infiltrate, evapotranspire or harvest and reuse the first 0.9 inches of rain that falls within the project limits.

CHEROKEE BOULEVARD RE-IMAGINED

Entry #17407

The City's rainwater management criteria for this project site follow the specifications found in the Rainwater Management Guide (RMG). More specifically, Cherokee Boulevard has been designated as a "redevelopment" project. Redevelopment projects have a primary standard of 0.9 inch rainfall retention, defined as "stay on-volume" (SOV). If this primary standard is not met, then the design must capture and slow release through a bio-detention/filtration structure (green infrastructure), the water quality volume (WQv) of 2.1 inch rainfall less the SOV achieved. The manual further specifies that redevelopment project sites within ½ mile of a transit stop (bus stop) have a reduced SOV of 0.8 inch rainfall volume. The Cherokee Boulevard project currently, and as proposed, qualifies for the 0.8 inch SOV standard.

The applicable standards also require control and management of storm events up to the 24-hour, 100-year storm event. For this project site, the City has specified peak rate control of up to the 24-hour, 25-year storm event (5.1 inch rainfall).

The RMG provides for a relatively simple procedure and an LID spreadsheet design tool to locate and size various BMPs. The spreadsheet also provides a simple procedure to calculate, using the TR-55 methodology, to determine a curve number (CN) for the proposed design. A comparison of pre-development and post-development CNs for each of the storm events up to the 100-year event provides an indication that corresponding peak rates are also controlled.

The spreadsheet LID tool in the RMG is used to calculate rainfall volume managed and determine attenuation of peak flows to less than the pre-design condition. Given that the pre-design condition is mostly impervious, post-design peak discharge rates and volumes will be lower. More extensive modeling is not necessary for purposes of concept-level design. Detailed design and construction plans could utilize more detailed models to quantify pollutant load reductions, as well as infiltration rates and evapotranspiration based on base soils and geotechnical analysis.

Drainage from Cherokee Boulevard is intercepted in the ROW via a curb and gutter system. Offsite drainage is captured and intercepted either at the gutter, or directed away from the street. For purposes of this concept-level plan, the drainage runoff from the street ROW will be distributed and managed by the various BMPs that are distributed along the entire length of the street. The concept plan assumes that detailed design will provide a balanced distribution and capture of rainfall runoff in this linear project. As shown on the next page, the capacity and design of the proposed system is more than sufficient to handle expected variations in flow volumes along the street.

The redesign of Cherokee Boulevard is a concept-level plan. If the proposed plan is to be pursued further, detailed design, field surveys, geotechnical and soils analysis, TDOT approvals, CARTA participation, as well as extensive public participation, would be necessary.

The proposed design achieves a total BMP capture volume of more than 188,000 cubic feet of water. This is equivalent to the complete capture of the 10-year storm event and the 25-year event if infiltration is factored in. For comparison, the computed SOV from a 0.8-inch rainfall from the existing site is computed as 29,602 cubic feet and 10,671 in the proposed design. The significant reduction in impervious areas (from 454,948

CHEROKEE BOULEVARD RE-IMAGINED

Entry #17407

square feet to 164,000 square feet), coupled with green infrastructure practices, yields a huge impact on volume and peak rate control.¹ Volume management data for the project site determined was using the LID spreadsheet tool and is presented below. While not shown on the charts, the 490 trees in the street ROW provide 4,900 cubic feet of SOV, of which 2,668 (25% of 10,671) may be credited toward SOV.

BMP Type	Runoff Storage Type	Mid-height Area (ft ²)	Depth of Storage (ft)	Storage Capacity (%)	Storage Volume (ft ³)	BMP Surface Area (ft ²)	BMP Capture Volume (ft ³)
Bioretention	Surface	28,128	1	100%	28,128	28,128	45,005
Medians	Soil	28,128	3	20%	16,877		
	Stone	0	0	0%	0		
Infiltration Bed	Surface	57,070	1	100%	57,070	57,070	102,726
Row Through Tree Trenches	Soil	57,070	3	20%	34,242		
	Stone	57,070	0.5	40%	11,414		
Self-Managing Pervious Pavement	Surface	74,390	0	0%	0	74,390	14,878
Side Walks	Soil	0	0	0%	0		
	Stone	74,390	0.5	40%	14,878		
Self-Managing Pervious Pavement	Surface	54,880	0	0%	0	54,880	10,976
Parking Lanes	Soil	0	0	0%	0		
	Stone	54,880	0.5	40%	10,976		
Self-Managing Pervious Pavement	Surface	76,480	0	0%	0	76,480	15,296
Bike Lanes	Soil	0	0	0%	0		
	Stone	76,480	0.5	40%	15,296		
TOTAL							188,881

Peak rate control data for the project site was also determined was using the LID spreadsheet tool and is presented at the top of the next page.

¹Rv values for both existing conditions and the proposed design use the “large impervious area” values. The Rv values for “small impervious areas” may be applicable to the proposed final detailed design. These will further reduce the runoff volume.

CHEROKEE BOULEVARD RE-IMAGINED

Entry #17407

Rainfall	Area (ft ²)	Weighted CN	Storm Frequency	Rainfall (in)	S	Q (in)	BMP Capture Volume (ft ³)	Infiltration Volume (12 hrs) (ft ³)	Total BMP Volume Reduction (ft ³)	Q minus Total Volume Reduction (in)	Adjusted CN
SOV=0.8	454,948	98	2	3.70	0.20	3.47	29,602	14,801	44,403	2.29	86
			5	4.80		3.09				87	
			10	5.10		3.69				87	
			25	6.00		4.89				88	
			100	7.40		5.99				88	
WQv = 2.1	454,948	98	2	3.70	0.20	3.47	78,820	0	78,820	1.39	74
			5	4.80		2.19				77	
			10	5.10		2.75				78	
			25	6.00		3.65				79	
			100	7.40		5.05				80	
Capture Volume	454,948	98	2	3.70	0.20	3.47	188,851	0	188,851	-1.82	N.A.
			5	4.80		-0.72				N.A.	
			10	5.10		-0.12				N.A.	
			25	6.00		0.75				45	
			100	7.40		2.15				55	

The significant volume capture of the proposed design completely captures the 10–year storm event without any allowance for infiltration. The CN for the 25-year event becomes equivalent to that of a meadow or pasture in good soils, and is likely better than the pre-development condition of the area. The proposed design also exceeds the WQv capture and treatment for the 80% TSS removal.

COSTS, FUNDING, AND BENEFITS

Planning Level Cost Estimate

A planning level cost estimate for the project has been developed using the TDOT cost estimating tool for linear projects. The total estimated cost is as follows:

Total Estimated Project Cost: \$7,400,000
Subtotal of Construction: \$4,730,000
Mobilization: \$208,000
Utilities: \$850,000

Plus:

- 10% Preliminary Engineering
- 10% Construction Engineering and Inspection
- 15% Contingency

Some assumptions in the estimate are:

- Traffic signals on Market at Cherokee/Frazier and Cherokee at Manufacturers will be modified. The traffic signal at Manning will be updated with decorative mast-arm poles to match.
- Drainage costs were included given the location of the existing catch basins relative to the proposed curb line.

CHEROKEE BOULEVARD RE-IMAGINED

Entry #17407

- Trees priced at \$900 each
- \$9/SF for tree trenches
- Utility relocation includes overhead utilities only

We emphasize that this is a planning-level cost estimate, and that further design detail would refine the estimate.

Project Funding

The project will require an investment by the City to activate redevelopment and investment by the private sector. Examples from other cities, along with Chattanooga's own experience with public-private partnerships, has demonstrated this to be viable and effective. The proposed design also suggests some property acquisition targets that may serve to jump start the redevelopment and revitalization.

The City's investment in this project could be financed through at least two mechanisms: tax increment financing (TIF), and the sale of SOV credits.

With TIF the City could create a special district for a set period of time and retire the debt with the incrementally increased tax revenue.

The SOV credits created by the City's investment could also be used to retire the debt. The marketable SOV credit system is expected to be rolled out in the next few months. These credits have a potential value of up to \$45 per-cubic-foot of SOV. Developers could buy these to offset SOV requirements on their project sites. Given that the City has some regulatory latitude in this regard, the City may choose to define and treat the capture volume/and or SOV achieved by the project, such that the \$45 per-cubic-foot market value has the potential to cover the entire debt. This debt repayment option is a unique opportunity for the City of Chattanooga that, at the same time, provides incentives and regulatory relief to the development community in the district, as well as throughout the City.

Benefits

A **re-imagined** Cherokee Boulevard is more than an infrastructure upgrade, and therefore provides greater community benefits. Traditional stormwater projects that focus upon conveying water and draining it as quickly as possible only provide one service – moving water. While this is important to the functionality of a community, it is a limited benefit. This design proposal presents an opportunity to completely restructure and elevate Cherokee Boulevard's role within the district. Utilizing a green infrastructure approach to stormwater management will not only provide a more sustainable means of handling stormwater run-off, but in addition, the required green space will transform the character of the corridor, creating a centerpiece to the neighborhood and a catalyst for redevelopment. By coupling green infrastructure with a complete street approach to mobility, Cherokee Boulevard will become a true connector of the urban fabric, providing for pedestrians, bicyclists and transit users. This approach promotes environmental and economic sustainability, as well as community health and wellness.

CHEROKEE BOULEVARD RE-IMAGINED

Entry #17407

The following images show the transformative change adapted to the existing street context.



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By taking a holistic approach to stormwater management, Cherokee Boulevard will become a transformative corridor, one that will change how the community engages with the urban environment. The value created by a transformed Cherokee Boulevard will provide a significant return on the investment that will be realized in not only economic terms, but also in social and environmental benefits. Clearly, this project will continue to advance Chattanooga on its remarkable transformative journey.