Operation C.L.E.A.N.

CAPACITY ENHANCEMENT
WITH
LANDSCAPE MODIFICATION
USING AN
ECOLOGICAL APPROACH
FOR
ABSORBTION
AND
NATURAL RECHARGE

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Abstract

The University of Tennessee at Chattanooga is a metropolitan campus located in the heart of downtown Chattanooga and is home to more than 11,000 students and growing. This urban landscape nestled at the foot of several surrounding mountains and bounded by the Tennessee River is susceptible to significant flooding and water pollution. These common problems stem from Chattanooga's combined sewer system and the substantial amount of surface runoff generated by stormwater volume that cannot directly infiltrate into the extensive concrete and asphalt regions of the city campus. We thereby propose Operation **CLEAN**: **C**apacity enhancement with **L**andscape modification using an **E**cological approach for **A**bsorption and **N**atural recharge around the Engineering, Mathematics, and Computer Science (EMCS) building on campus. Features of Operation CLEAN green infrastructure (GI) interventions such as downspout disconnections, permeable pavement, underground cisterns, and retention areas integrated with real time sensor enabled operations. With active student and community engagement, Operation CLEAN will implement an outdoor environmental lab highlighting the innovative green design elements of the project complete with educational signs, a cost-friendly source of water for irrigating the greenhouse, and a retention basin complemented with picnic tables, benches, and native plant species. Overall, Operation CLEAN meets the current stormwater control regulations set by the City of Chattanooga for new developments while pushing towards an inspiring future of innovative green infrastructure for stormwater management and water pollution mitigation

Objectives

Objective 1: Reduce stormwater runoff entering combined sewer systems using an **ecological approach.**
Objective 2: Promote water sustainability through green infrastructure implementation and education to clean and reuse stormwater through **absorption** and **natural recharge**.
Objective 3: Revitalize aesthetics through **landscape modification** while reintroducing native plant species and advocating a multitude of social benefits such as encouraged community involvement, enhanced student gathering areas, and overall improved physical and mental wellbeing.
Objective 4: Demonstrate potential use of advanced technology for effectively managing water volume and discharges from urban **capacity enhancement** units such that urban flooding can be mitigated and water pollution is minimized.

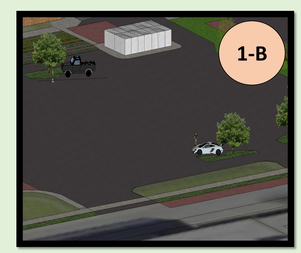
Results

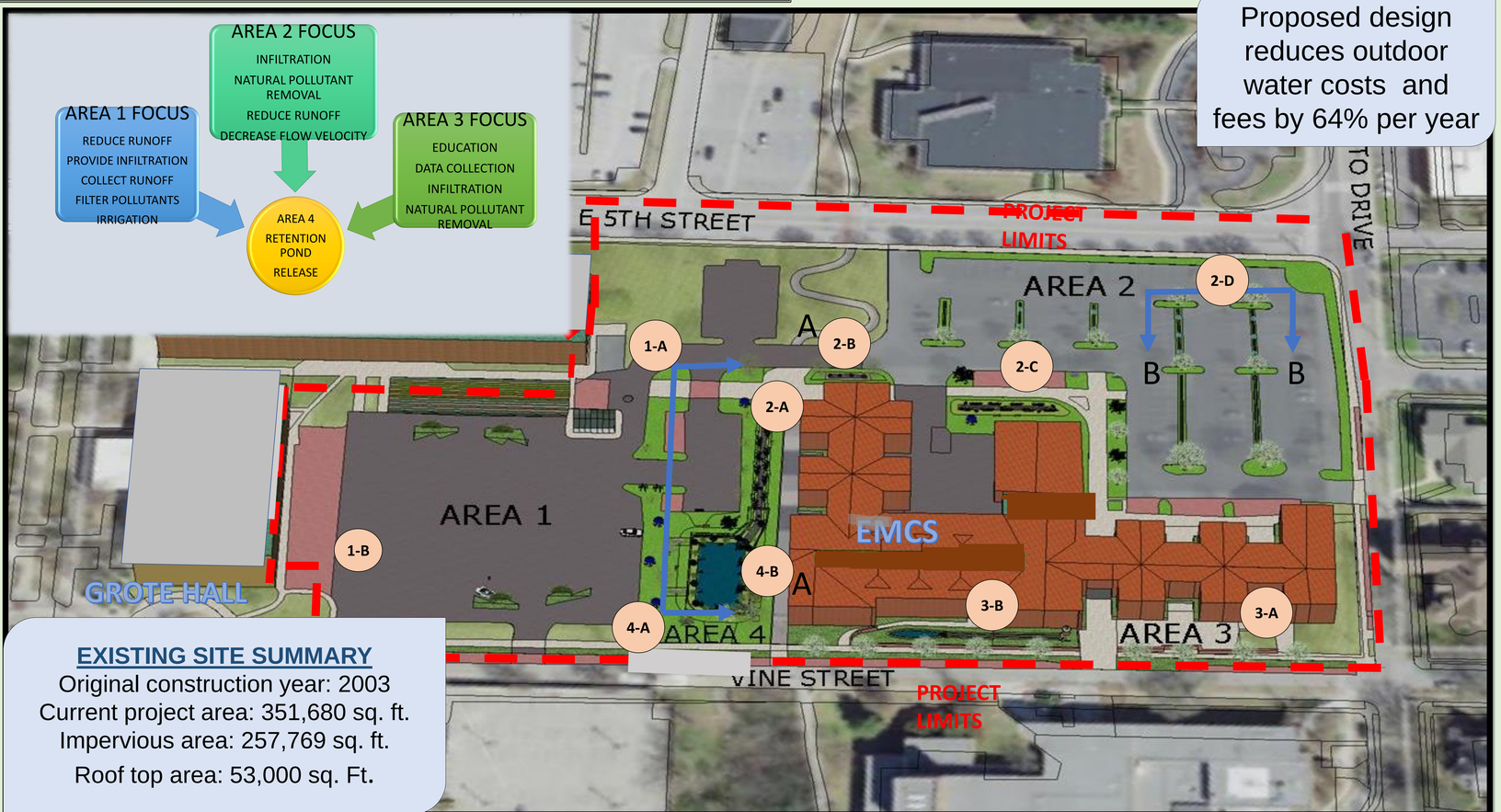
FLOW RATE $Q_{10YR\ STORM}$	STAY ON VOLUME	TIME OF CONCENTRATION
REDUCTION	IMPROVEMENT	INCREASED
14.4 %	27%	24%
IMPERVIOUS AREA	IRRIGATION	WATER QUALITY FEE COMBINED SEWER
REDUCTION	COST SAVINGS	REDUCTION
53%	$3,600 PER YR	53%

Legend – Sub Drainage Catchment Areas

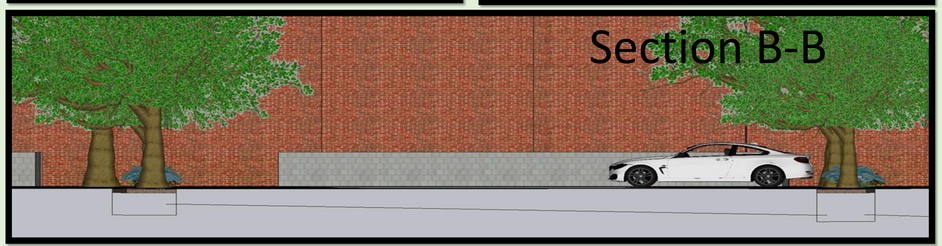
1-A PROPOSED CISTERN LOCATION USING SENSOR TECHNOLOGY TO COLLECT RUNOFF FOR IRRIGATION
1-B POROUS ASPHALT PAVING AND PERVIOUS PAVERS WITH DEPRESSED ISLANDS
2-A BIOSWALE COLLECTING DISCONNECTED DOWNSPOUT RAINWATER
2-B SMALL RAINGARDEN COLLECTING PARKING AND ROOF RUNOFF
2-C RAIN GARDEN AND OUTDOOR STUDY AREA
2-D SMALL RAIN GARDEN PARKING DIVIDERS FOR IMPERVIOUS RUNOFF
3-A OUTDOOR LAB: ROOF TOP WEATHERSTATION, CISTERN CONNECTED TO DOWNSPOUT DISCONNECTION, SMALL BIOSWALE, MINIATURE POND AND WATER QUALITY TESTING STATION CONNECTED TO SENSOR TECHNOLOGY TO ALLOW OVERFLOW RELEASED TO AREA 4.
3-B PATIO WITH PERVIOUS PAVERS DRAINING TO OUTDOOR LAB
4-A LARGE BIO-RENTION POND FOR COLLECTION OF ALL SUB-AREAS THAT ALLOWS FOR INFILTRATION, PARTICLE SETTLING AND POLLUTANT COLLECTION BEFORE RELEASE INTO COMBINED SEWER SYSTEM
4-B SITTING AREA WITH SAFETY FENCE AND RETENTION BASIN SUBGRADE FOR INFILTRATION

Proposed Site Design





Proposed design reduces outdoor water costs and fees by 64% per year



EXISTING SITE SUMMARY
Original construction year: 2003
Current project area: 351,680 sq. ft.
Impervious area: 257,769 sq. ft.
Roof top area: 53,000 sq. Ft.