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# Measuring the Social, Environmental, and Financial Impacts of Site Design

A Cost Benefit Approach to Decision Making for Houston Parks and Recreation Department



II Impact Infrastructure

Autocase

# PROJECT OVERVIEW

Two alternative visions for the usage of a natural space in Harris County

- Restoration to a natural habitat, with usage as an educational space and refuge
- Recreational complex with capacity for team sports, parking for park users, and a trail system into the forest

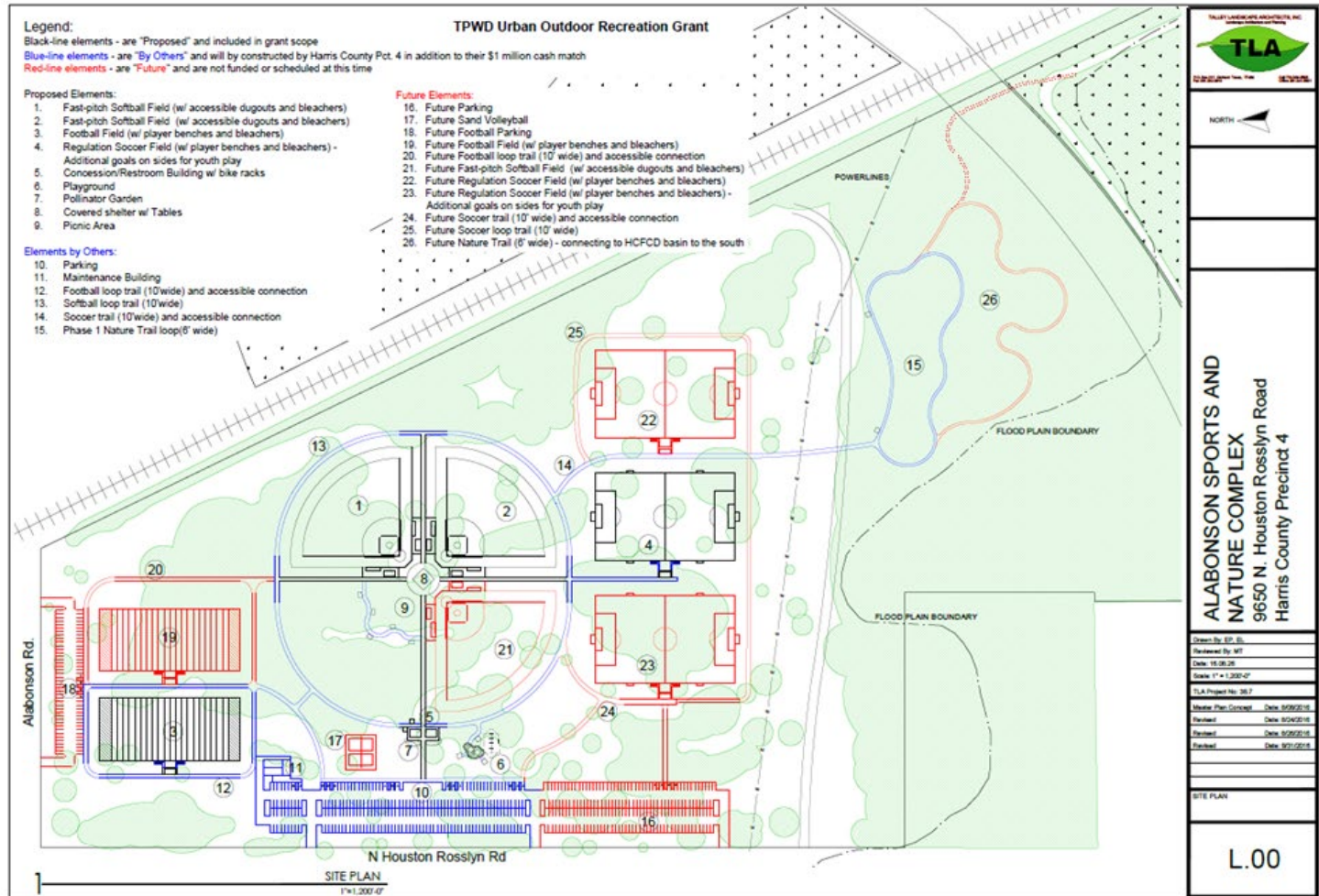
The as-is state of the site is a largely unused section of forest, dominated by invasive species

The analysis runs three comparisons:

- Recreation Case vs As-Is
- Restored Case vs As-Is
- Restored Case vs Recreation Case

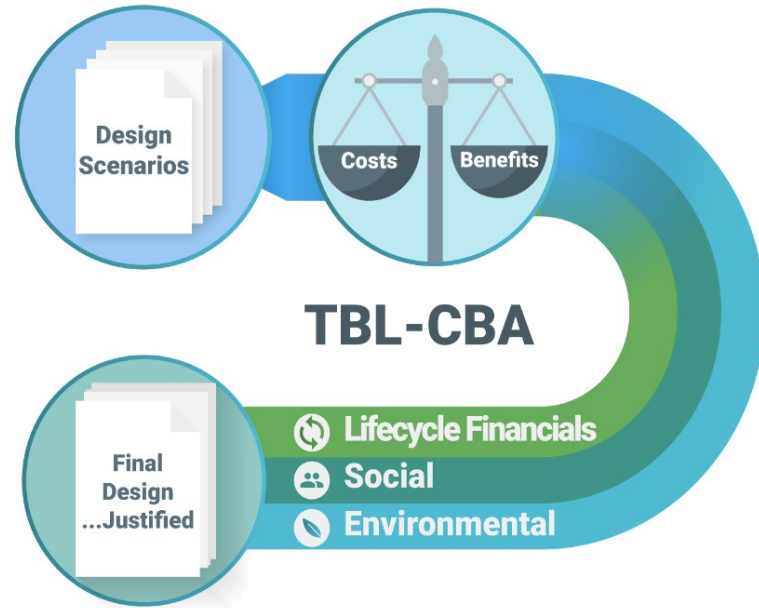
The aspects of these alternatives are sorted into three impact categories:

- Financial (i.e. capital expenditure, operations and maintenance)
- Social (i.e. recreational value, public health uplift)
- Environmental (i.e. air pollution reduction, biodiversity)



# ANALYSIS FRAMEWORK AND INPUTS

## COST BENEFIT ANALYSIS – TRIPLE BOTTOM LINE



- A fuller perspective on project performance and trade-offs made in the decision making process
- Framework that quantifies and monetizes project alternatives, producing a business case which facilitates both decision making and outreach

## KEY ANALYSIS INPUTS

### *GENERAL*

- 50 acre site
- 1 year construction, 50 year operations duration
- Houston specific values (i.e. climate, property value)

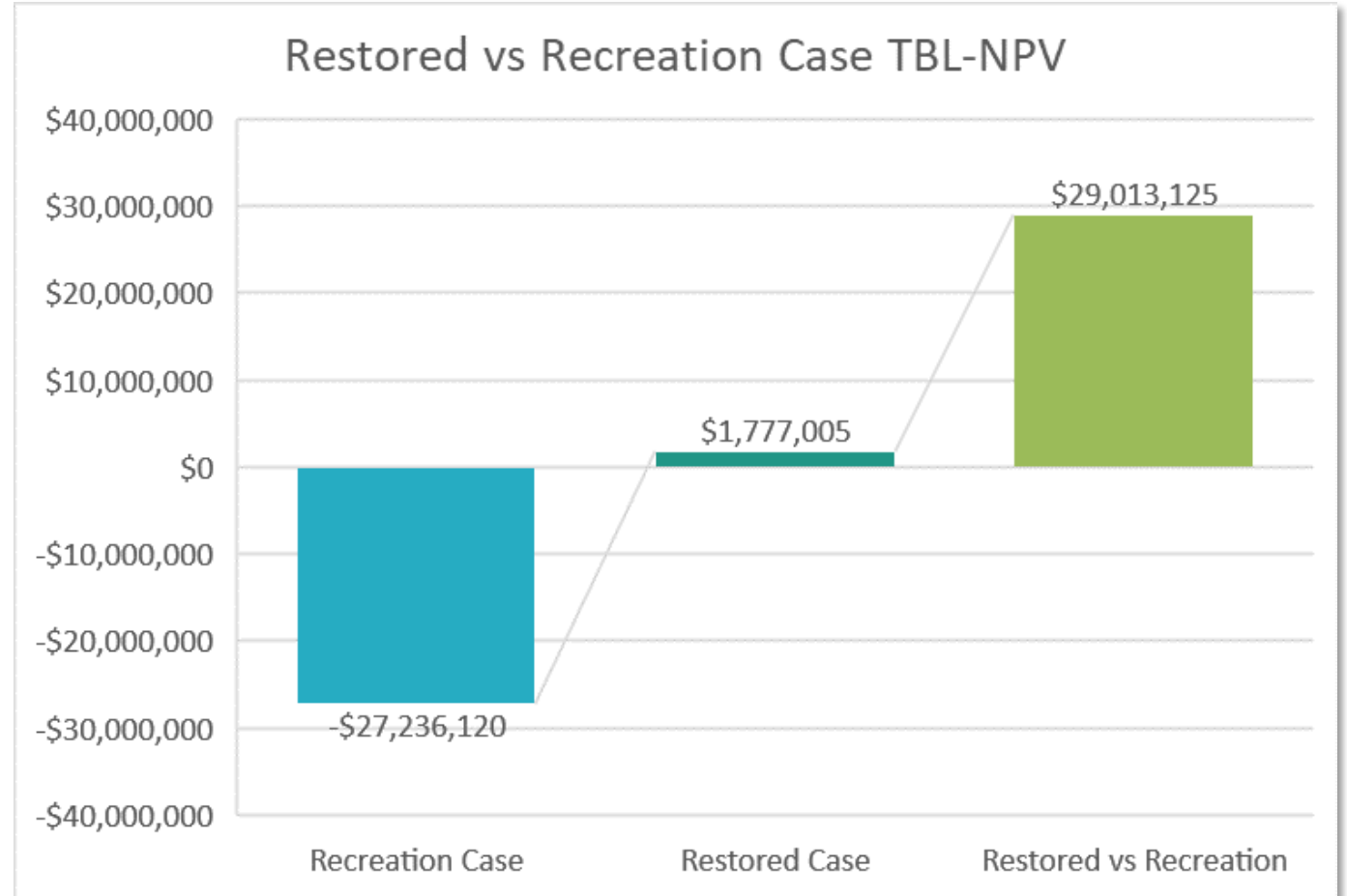
### *SPECIFIC*

- Changes in natural features
- Soil type/infiltration rate changes
- Ground cover and tree count variations
- Visitation uses, frequencies and durations
- Capital expenditure and operations and maintenance differences overtime

# ANALYSIS OUTCOMES - HIGH LEVEL COMPARISON

## Total value comparison across all three TBL categories

- Large negative value in the Recreation Case analysis
- Positive return on investment for the Restored Case
- Massive difference between the two alternatives

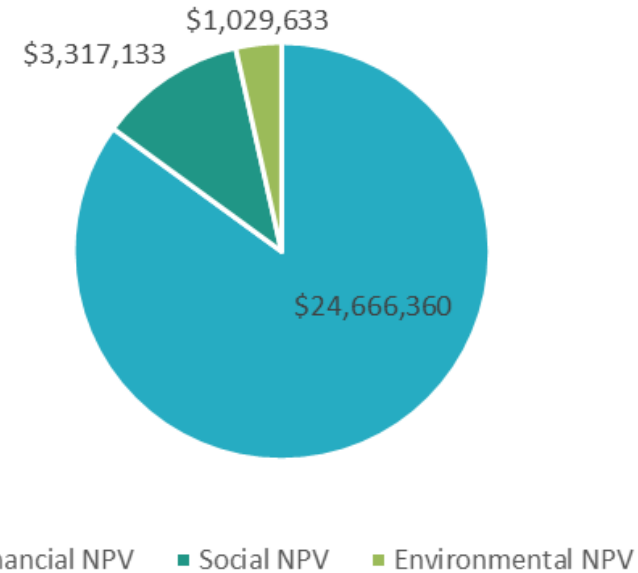


# ANALYSIS OUTCOMES - IMPACT TYPE COMPARISON

## Impact Category Breakdown

- Recreation Case value driven by large financial outlay necessary for implementation
- Recreation case negative across all three impact types
- Small financial outlay in the Restored Case offset by positive social and environmental returns
- Positive return on investment in Restored Case demonstrated through TBL lens
- Comparison between Restored and Recreation alternatives driven by difference in financial considerations

Comparative Performance by Impact Category



	Recreation Case	Restored Case	Restored vs Recreation
Financial NPV	-\$25,888,253	-\$1,221,894	\$24,666,360
Social NPV	-\$764,650	\$2,552,482	\$3,317,133
Environmental NPV	-\$583,216	\$446,416	\$1,029,633
<b>Triple Bottom Line</b>	<b>-\$27,236,120</b>	<b>\$1,777,005</b>	<b>\$29,013,125</b>

# ANALYSIS OUTCOMES - DETAILED RESULTS

## Recreation Case

- Recreation case has high capital expenditure and O&M through operations
- Large increase in ambient temperature leading to large negative effect on Urban Heat Island

## Naturalized Case

- Social benefits of Naturalized case offset financial costs
- Uplift across all four environmental categories

## Comparison of Cases

- Replacement cost a serious consideration
- Big difference in educational opportunity, carbon sequestration, and Biodiversity

		Recreation Case	Naturalized Case	Natural vs Recreation	
	Impact Type	Cost/Benefit	Expected Value	Expected Value	
	Financial	Capital Expenditure	\$10,273,048	\$1,188,134	\$9,084,914
	Financial	Operations and Maintenance	\$9,769,630	\$33,760	\$9,735,871
	Financial	Replacement Cost	\$5,845,575	\$0	\$5,845,575
	Social	Property Value	\$559,300	\$575,638	\$16,338
	Social	Heat Island Effect	\$2,188,071	\$67,495	\$2,255,566
	Social	Recreational Value	\$609,178	\$557,075	\$52,103
	Social	Education	\$149,293	\$779,028	\$629,735
	Social	Flood Risk	\$98,623	\$162,398	\$261,021
	Social	Public Health	\$204,272	\$410,199	\$205,927
	Social	Environmental Awareness	\$0	\$648	\$648
	Environmental	Carbon Reduction by Vegetation	\$452,173	\$29,257	\$481,430
	Environmental	Air Pollution Reduced by Vegetation	\$108,553	\$40,989	\$149,542
	Environmental	Biodiversity	\$0	\$341,755	\$341,755
	Environmental	Water Quality	\$22,491	\$34,415	\$56,906
	<b>Financial NPV</b>		<b>\$25,888,253</b>	<b>\$1,221,894</b>	<b>\$24,666,360</b>
	<b>Social NPV</b>		<b>\$764,650</b>	<b>\$2,552,482</b>	<b>\$3,317,133</b>
	<b>Environmental NPV</b>		<b>\$583,216</b>	<b>\$446,416</b>	<b>\$1,029,633</b>
	<b>Triple Bottom Line NPV</b>		<b>\$27,236,120</b>	<b>\$1,777,005</b>	<b>\$29,013,125</b>

# CONCLUSIONS AND DISCUSSION

## Summary of Findings

- The smaller capital outlay initially and over time in the Restored Case is a major driver of the overall difference in return
- The Restored Case provides both social and environmental benefits across above and beyond the state of the site as-is
- Major drivers of the difference beyond the financial considerations are urban heat island impacts, educational opportunity, carbon sequestration, and biodiversity
- Massive difference in project performance across all three categories, with the Recreational Case being negative across all the impact categories which results in a negative return on investment overall

Category	Recreation Case	Restored Case	Comparison
Return on Investment Ratio (TBL)	-0.05	2.45	2.5
Net Present Value per Acre	\$544,722.40	\$35,540.10	\$580,262.50