

BENEFITS ANALYSIS:



BAYOU GREENWAYS -- A KEY TO A HEALTHY HOUSTON

August, 2011

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Marsh Darcy Partners, Inc.

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**BAYOU GREENWAYS --
A KEY TO A HEALTHY HOUSTON**

EXECUTIVE SUMMARY

The vision is now 100 years old, but the work is not complete. While Houston is behind the curve on creating a world-class park system, the good news is that the potential for bayous to emerge as the “backbone” of an outstanding system remains. The will to complete unleashing the latent potential of the bayous in the region seems stronger than ever, and is manifesting itself in the Bayou Greenway Initiative.

Bayous are the unique and distinctive natural asset of Houston, the Bayou City. And while our bayous have many well-used trails and parks, most of these trails are not connected to each other, and the bayous remain an under-utilized resource and amenity. Furthermore, the Houston area needs thousands of acres of new and equitably distributed parks. The Bayou Greenway Initiative proposes to complete the work of transforming ten of the major bayous in the greater Houston area to greenways of natural beauty, connectivity, recreation, habitat preservation, and increased functionality and cleanliness – all while addressing the deficit of equitably distributed green spaces. The estimated cost to acquire the proposed land to create the continuous greenways along the existing bayou corridors, and thread a single line of all-weather, continuous trail through those greenways is \$480 million. This program not only significantly increases the equitable distribution of greenspaces for the greater Houston area, but offers substantial increments of economic value.

The value proposition of the Initiative discussed in this report is remarkable. While only some of the benefits in this report could be measured reliably in dollar terms, the resulting totals are impressive. They demonstrate that there is unlikely to be any other investment in the greater Houston area that will have a significant impact on the quality of place, transform its park system, contribute to the health of Houstonians and the natural environment, and reposition the City for the 21st century – while also returning annual benefits conservatively valued at \$117 million a year.

The key benefits are increases in:

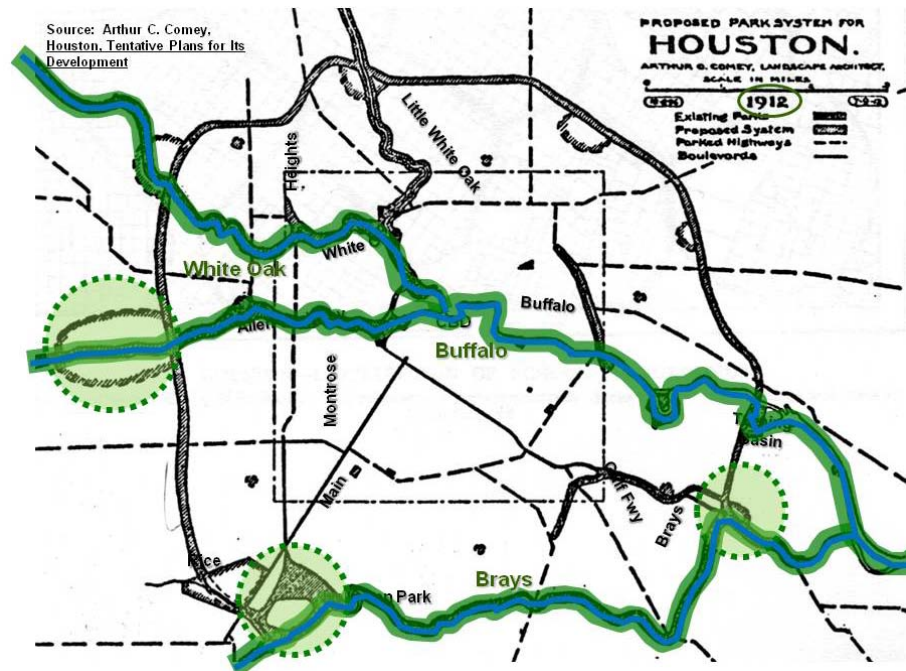
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|--|-----------------|
| 1. Houstonians’ physical and mental health
Bayou Greenways will create more equitably distributed parks and recreational amenities improving our physical and mental health. | \$ 77.1 million |
| 2. Houston’s environmental health
Bayou Greenways will transform the area’s image from a sprawling, automobile congested urban center to one that values its ecological capital, its clean air and clean water. | \$ 22.5 million |
| 3. Houston’s economic health
Bayou Greenways will contribute greatly to the quality of place, attracting and retaining knowledge workers, corporate offices, and retirees, and increasing property values to benefit the area’s tax base and individual homeowners. | \$ 17.5 million |
| Estimated total measurable annual benefits | \$117.1 million |

These figures are impressive, but the primary outcome of completing the Bayou Greenways could be to catapult Houston to one of the top cities in the nation in quality of place.

100-YEAR OLD VISION

In 1912, Arthur Comey, the author of Houston's first city master plan, observed "Houston is far behind other progressive cities in certain respects, notably in its park system, and should act at once to remedy these conditions." He went on to state: "the backbone of a park system for Houston will naturally be its bayous or creek valleys... [which] furnish opportunities for parks of unusual value within a comparative short distance of most of the residential areas." Almost one hundred years later, comparative metrics suggest that Comey's observations apply to contemporary Houston.

Today, the total area of parkland within the City of Houston boundaries is 39,357 acres. While this amount is significant, 55% of that acreage is accounted for by just 3 major parks on the edge of the city's boundaries. Recognizing the need to enhance equity and balance in Houston's park system and echoing Comey's conclusions, the 2007 Parks Master Plan recommends the addition of 1,500 new acres of greenways along Houston's bayous, and the addition of trails meandering through those greenways to enhance connectivity. The need for fair distribution and easy access to parklands within communities is also emphasized in The Center for Houston's Future 2009 report on "Counting on Quality of Place". That report notes that only 27% of Houston's population lives within a ¼ mile of a park.



So, we know we have some work to do to make our park system better and are returning back to our bayou corridors to address the equity and balance challenge while providing numerous other benefits discussed in this report. Bayous are the unique and distinctive natural asset of Houston, the Bayou City. And while our bayous have many well-used trails and parks, most of these trails are not connected to each other, and the bayous remain an under-utilized resource and amenity.

There are no great cities in the world that do not have a great park system. Houston's shortage in equity and balance inhibits the city's aspirations to be widely recognized as a "great city". In the past two decades, New York, Chicago, Baltimore, Seattle, San Antonio, Denver, Dallas, Pittsburgh, Atlanta, and many other American cities have invested hugely in equitable expansion, renovation and revitalization of their park systems, especially along waterways. To this point, Houston is behind the curve. However, the good news is that the potential for bayous to emerge as the "backbone" of an outstanding system remains. This potential can be reached with the implementation of the Bayou Greenway Initiative. It is extraordinary, perhaps unique among major U.S. cities, that an opportunity of this magnitude remains 100 years after it was proposed in Houston's first city plan.

BAYOU GREENWAYS INITIATIVE

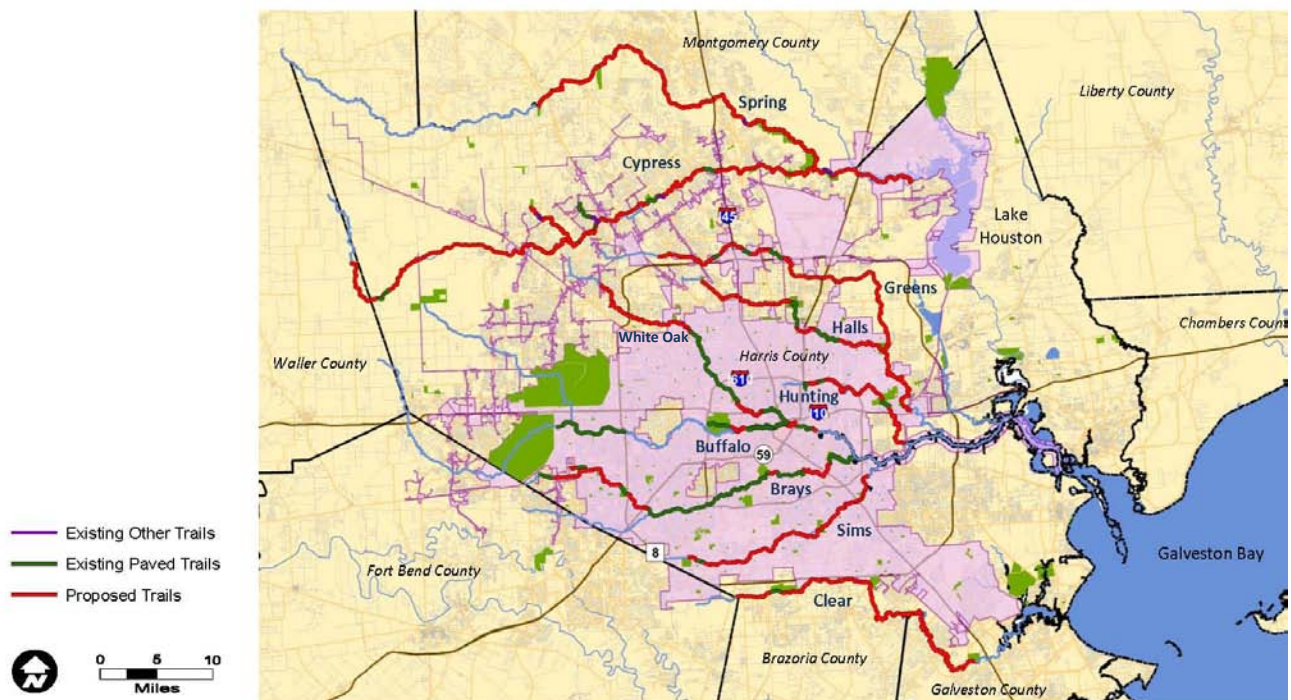
While Houston is the predominant population center and land owner in Harris County, the Bayou Greenways Initiative stretches beyond Houston's city limits to the boundaries of Harris County -- partly because the greater Houston area extends well into Harris County and partly because of the desire to include the full lengths of the major bayous that run through Houston.

The Harris County-wide Initiative contributes two assets to the physical landscape. First, it adds a total of 4,800 acres to the effective parks inventory -- 1,900 of those acres are in the City of Houston's boundaries and 2,900 in other parts of Harris County. This fulfills almost all of the new greenway needs identified in Houston's Parks Master Plan, and increases the amount of equitably distributed parkland throughout the greater Houston area, knitting together diverse communities, neighborhoods, employment centers and significant institutions. Second, it creates 300 miles of off-street, all-weather trails along ten of the major bayous in Harris County and the greater Houston area, linking numerous parks and creating perhaps the most extensive off-street trail system in any US city.

More specifically, the Initiative proposes the completion of a linear park system adjacent to ten of the major bayous in Harris County. It includes the acquisition of property along at least one side of each of the bayous, the construction of at least one line of continuous, all-weather, shared-use trail, and the addition of over 50 parcels of greenspaces along the greenways, ranging in size from under 2 acres to over 350 acres. These properties would be designated for use as parkland and natural areas, but in most cases could also be used for storm water detention and would result in water quality enhancement. This greenway trail system would connect 77 existing public parks, and substantially enhance the small but heavily used bayou trails already in place.

The initial estimate for implementing the Bayou Greenway Trail Initiative over the next 10 years is \$480 million. This is a substantial amount, but it is significantly smaller than that spent for capital improvements on parks by some of Houston's peer cities over the past decade, and is a highly effective way to fulfill the 20-year needs identified in Houston's 2007 Parks Master Plan.

Figure 1
The Bayou Greenways Plan



CHANGE IN PARKLAND USE

In the 1980s, the ways in which people used parks changed. Prior to that time much park use took place in the center of parks and was characterized by such activities as informal games, sitting and relaxing, and picnicking. In recent decades, activities requiring linear rather than “block” spaces have prevailed. Use tends to be concentrated on the periphery of parks or on trails through them as exemplified by walking, jogging, biking, rollerblading and skateboarding. Thus, investment in bayou greenways and recreational trails is consistent with prevailing contemporary recreational interests.

Over half of current Harris County residents live within 1.5 miles of the proposed Bayou Greenway system further strengthening the case that implementation of this plan would result in an equitable distribution of parkland that would be impossible to achieve both physically and financially if the traditional model of a neighborhood-centric park system was pursued.

*52% of Harris
County residents
live within 1.5 miles
of a bayou corridor.*

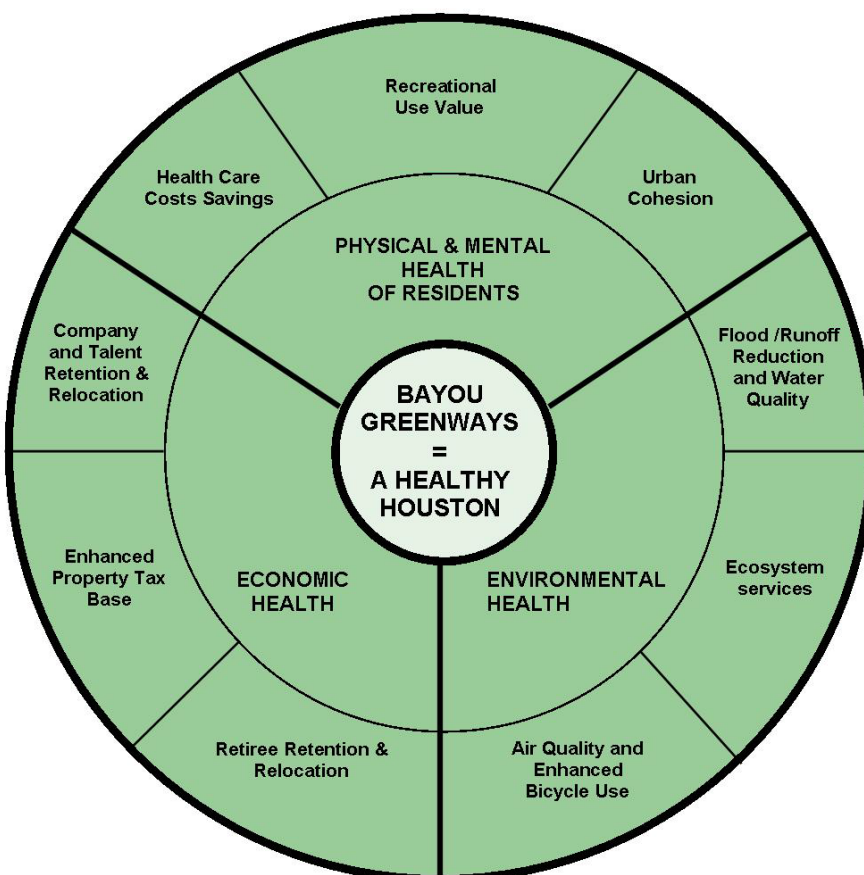
An excellent park system that builds upon a city’s natural treasures makes for a healthy city in many ways.

CONTRIBUTIONS TO A HEALTHY HOUSTON

Implementation of the Bayou Greenways Initiative will make a highly visible and tangible contribution to Houston's economic health, environmental health, and the physical and mental health of its residents. The balance of this report discusses the incremental benefits to be derived and where possible, illustrates the dollar value associated with them.

Even though a dollar value could not be attributed to all benefits discussed (due to the lack of reliable measurement data), those that were assessed a dollar value demonstrate that there is unlikely to be any other investment in the greater Houston area that could transform the City's image and national reputation, and keep on returning annual benefits conservatively valued over \$117 million a year. It must be noted however, that even the values assessed are based on a relatively embryonic science of measuring benefits and should be viewed as illustrative rather than definitive. Please refer to the APPENDIX for additional information on the benefit assessment.

*Figure 2
Prospectus for a Healthy Houston – an annual value of \$117 million*



The benefits associated with the Initiative emanate from a wide variety of sources. The primary benefits in each of the three domains to which the Initiative will contribute are shown in the outer ring of Figure 2. They constitute the key benefits Houston will receive from implementing the Initiative and demonstrate why the Initiative should be recognized as an investment in the city's future, rather than a current cost.

While it facilitates discussion to categorize the benefits into three domains, it should be noted that they are not mutually exclusive. For example, all the environmental and physical & mental health benefits contribute to Houston's economic health. Similarly, if the city is economically and environmentally healthy, this contributes to residents' physical & mental health.

1. PHYSICAL AND MENTAL HEALTH OF RESIDENTS

Recreational Use Value

Because linear parkways such as Bayou Greenways have multiple access points, it is not feasible to charge a fee to use them. Thus, economic value is based on a surrogate measure that asks people using the trails how much they would be willing to pay if a fee was charged.

In addition to the recreational benefit illustrated in the adjacent box, there is an “availability value” to the greenways. Just as there are many residents with no children in a local school system who nevertheless support the investment of tax revenues in schools, so are there likely to be some residents who have no desire to currently use the bayou greenways, but who still place an economic value on their availability. They may value having the option of using them in the future or, more altruistically, derive satisfaction from “doing the right thing” by making them available to others or providing opportunities for future generations. Since no empirical study measuring the availability value was found in the literature, a quantitative estimate for availability value was not offered.

*Illustrating the recreational value of the Bayou Greenways -- To estimate the aggregate recreational use value of the system, the surrogate measure used was the per person value of \$4.70 per day based on Corps of Engineers FY 2011 Unit Day Values for Recreation. Applying the value to the projected number of new trail users suggested the economic annual value for recreational use is approximately **\$63 million**.*

In order to establish local values for this measure, a “contingency evaluation study” may be conducted by Texas A&M graduate students during the 2011-2012 academic year.

Health Cost Savings

The landmark Surgeon General’s report in 1996 was unequivocal in concluding that the health of Americans “could be substantially improved by incorporating moderate amounts of physical activity in their daily lives.” Specifically, a lack of physical activity is consistently shown in the scientific literature to contribute to cardiovascular and cerebrovascular disease, hypertension, type-two diabetes, colon cancer, osteoporosis, osteoarthritis and rheumatoid arthritis, obesity, and depression and anxiety. Studies have demonstrated that costs associated with obesity and inactivity account for a large portion of health care costs.

Proximity to parks and trails has been consistently linked to increased physical activity. With the equitable distribution to be provided with the proposed Bayou Greenways, it would be reasonable to conclude that there will be increased physical activity associated with proximity to the greenways.



Photo: F. Carter Smith

Illustrating the health benefit value of the Bayou Greenways -- The Trust for Public Land commissioned a review of the scientific literature reporting on the reduction in health care costs associated with physical exercise. This concluded that a value of \$351 was the average annual cost difference in 2010 dollars between those who exercise and those who do not. For persons 65 and older, this value was doubled to \$702 because seniors typically incur two or more times the medical care costs of younger adults. When the values were multiplied by the number of projected users of the Bayou Greenways, the annual health benefits were estimated at approximately \$13.9 million

Urban Cohesion

Houston is a mosaic of diverse neighborhoods -- often divided by major thoroughfares, freeways, or railroad tracks. Travelling by car, we are physically and socially isolated, and once we arrive at our destination, we are focused on the task at hand. Park-like environments encourage people to relax, encourage informal social interaction, and provide shared experiences. Completing the Bayou Greenways, will extend that park experience for miles at a time – connecting factories to open fields along Sims Bayou, the Ship Channel to the Medical Center along Brays Bayou, and the piney woods of Lake Houston to the open prairies of Waller County along Cypress Creek. Greenways will connect historic neighborhoods to new suburbs, grade schools to universities, offices to open spaces, and people to each other. This shared experience and sense of place will help us appreciate that we are part of a larger urban and natural community.

2. ENVIRONMENTAL HEALTH

Air Quality and Increased Bicycle Use

In the latter half of the 20th century, the brownish haze that frequently embraced Houston was viewed by much of the city's leadership as the inevitable consequence of, and an acceptable trade-off for, the city's booming business economy. That perspective changed as the 21st century commenced.

In the year 2000, *USA Today* ran a story with the headline "Houston (cough)... we have a problem (cough)", while the *Los Angeles Times* was celebrating the news that Houston had surpassed L.A. as the city with the worst air quality. An American Forests report concluded:

"Houston's 16 percent decline in tree cover over the past three decades has cost the city \$38 million in annual air pollution removal services." Professor Stephen Kleinberg of Rice University, who has tracked the Houston economy for 30 years, observed: "Everyone began to realize Houston had no chance of making it in the new economy if the perception was that it was not just flat and hot, but also ugly and dangerously polluted."



Traffic's role in generating air pollution is well-documented. For example, as much as 50% of ground level ozone pollution is a result of motor vehicle exhaust. This both triggers asthma attacks and causes asthma, which is the number one reason children visit an emergency room and miss school. Since the formation of ozone from volatile organic compounds and nitrogen dioxide is accelerated by sunlight and high temperatures, Houston is especially susceptible to it.

The stories in the national media and the automobile-dominated culture of Houston were anathema to a city's leadership that was trying to recruit the high-end businesses of the new economy and the knowledge workers needed to nurture and service them.

The shift to improve the city's health in the past decade has been palpable. It has included building a large segment of Brays Greenway, refurbishing Hermann Park, committing to plant a million trees, converting half the city's light-duty automotive fleet to hybrid vehicles, defeating Texas utilities' attempts to build eight new coal-fired power plants that could have had a devastating effect on the city's air quality, and petitioning the federal Environmental Protection Agency to strengthen emission standards for oil refineries and petrochemical factories.

The Bayou Greenways Initiative could be the definitive image of an environmentally transforming Houston. It is an opportunity to ameliorate Houston's image as a sprawling, automobile congested city by intentionally reinventing itself as a city with the most comprehensive off-street trail system in the nation – a potentially iconic position.

A reduction in vehicle miles travelled will likely be a primary outcome of the Bayou Greenway trails, as a greater number of commuters shift to bicycles. The proportion of the population commuting by bicycle is likely to increase annually as the Bayou Greenways develop because both trail access to desired destinations will expand and the option of commuting by bicycle will become more embedded in the public's consciousness.

Illustrating the increase in bicycle use – At the current rate of 0.38% we estimate the number of bicycle commuters to increase annually by 325 riders. That would put us on par with cities like Chicago. If we can hit Portland's percentage of commuters at 5.81% our annual increase would jump to 4,963

Today, vehicles are equipped with high efficiency catalytic converters which eliminate 95 percent of the pollution produced during normal driving. Most pollution is now emitted in the first few minutes of driving, before the catalytic converter has warmed up. This means that the most effective strategy to reduce pollution from emissions of volatile organic compounds, nitrogen oxides, sulphur dioxide and carbon dioxide is to reduce the number of trips – especially short trips -- taken by automobile. The benefits associated with a shift to bicycle commuting emanate not only from the reduction in air pollution *per se*, but also from vehicle operating cost savings, and the concomitant benefit of fewer vehicle crashes.

Illustrating part of the benefit associated with increased bicycle use – Based on:

- \$31.75/pound to acquire emission reduction credits per H-GAC;
- IRS rate of \$0.51/mile for reduced miles; and
- \$21,464/crash reduction per H-GAC, the annual benefit of reduced air pollution, vehicle operating savings, and reduced crashes is estimated at \$4.2 million/year.

Flood/Runoff Reduction and Water Quality

In recent decades, there have been multiple instances of flooding in Houston during and after heavy rainfalls. This is testimony that the efficient and effective drainage system created by nature, to which the bayous are central, has been over-burdened. The acquisition of 4,800 acres of additional green space proposed to complete the Bayou Greenways will contribute to preventing the occurrence of this flooding. Developing the Initiative will reduce flooding by maintaining and increasing absorptive vegetative ground cover on the new properties to be acquired for the Greenways, and making these lands available for joint parkland/water detention use. It will also provide ongoing opportunities to leverage the enormous value provided by the Harris County Flood Control District's existing storm water management programs. Valuing the flood reduction and water quality benefits can be approached in a couple of different ways – the value of proactive land acquisition, and the value of reduced runoff.

Illustrating the value of proactive land acquisition for flood reduction– by acquiring floodplain land, that can double as detention, at an average cost of \$0.80/sf, we can prevent or reduce downstream flooding, thus reducing the need for potential future FEMA buyouts at an average cost of \$3.98/sf. Based on the potential detention area within the newly acquired acreage, the total cost savings in buyouts may be as high as \$142 million.

Illustrating the value of filtered runoff for water quality-- Maintaining and increasing porous ground cover which filters runoff (such as native grasses) over 70% of the newly acquired Greenway properties could filter 2 billion gallons of runoff annually (based on annual rainfall). Valued at \$0.00065/gallon of reduced treatment cost, the total annual savings is calculated at \$1.3 million.



Ecosystem Services

Ecosystem services provided by the bayous and adjacent green spaces are a central part of Houston's "nature capital". These capital assets are under-appreciated because residents do not pay for them, so their valuable roles are not part of the collective consciousness. However, they provide a stream of economic benefits such as local habitat preservation, detoxification, increased biodiversity, migratory habitat enhancement, increased aesthetics, increased cultural and scientific activities, and carbon sequestration. If these assets are degraded, then the city will have to invest in expensive mechanical systems to perform the services which it currently gets at no cost. Alternatively, if these assets are improved and increased, the city will enjoy the benefit and commensurate value.



Courtesy:
Jim Robertson

Illustrating the ecosystem value -- The proposed Bayou Greenway system will preserve the benefits of the existing riparian corridors, and add 4,800 acres of additional green space in these watersheds for an additional value to the ecosystem services. The acquired land will be comprised of freshwater wetlands, riparian buffers, forested lands and grassy open space. The value of ecosystem services of this increment is estimated at \$16.6 million/year.

3. ECONOMIC HEALTH

Impact on Business Development

The strength of Houston's future economy will be determined primarily by the city's ability to expand the number of "high end" jobs, especially in the high technology, research & development, company headquarters, and information & knowledge based sectors. These are the engines that stimulate the creation of lower paid jobs, and the housing and retail that follow jobs. There is fierce competition among cities to nurture and attract these businesses. Essentially, they are "information factories" whose viability and vitality is dependent on their ability to attract and retain highly educated knowledge workers.

Knowledge workers are highly compensated, but of equal importance to them is the quality of life in a city. For many people, once they obtain a threshold of income, improvements in quality of lifestyle become more important than increases in salary. In a focus group with state business leaders that the author facilitated, a vice-president of Dell Corporation in Austin, one of the country's largest computer manufacturers observed: "People

working in high-tech companies are used to there being a high quality of life in the metropolitan areas in which they live. When we at Dell go and recruit in those areas, we have to be able to demonstrate to them that the quality of life in Austin is at least comparable or they won't come. It's about what's the community like where I'm going to live."

No matter how quality of life is defined, park and trail opportunities are a major component of it. The environment they provide is a key element in creating the quality of place that knowledge workers seek. Houston is disadvantaged when compared to many of its peer cities in quality of place. Implementation of the Initiative could have a transformational impact on perceptions of Houston's quality of place among knowledge workers.



Courtesy: HCFC

Impact on Retiree Decisions

There are Growing numbers of Retirees who are Active Monied People In Excellent Shape – GRAMPIES. Attracting and retaining these affluent retirees is increasingly recognized as a new clean growth industry in America today.

Retirees do not require the economic incentive packages that are invariably needed to lubricate business relocations. Further, they are positive taxpayers in that they use fewer services than they pay for through taxes, e.g. they pay school taxes but do not send children there. They transfer significant assets into local investments and banking institutions, but do not compete in the job market.

After proximity to family and friends, the primary criterion considered by GRAMPIES in deciding where they want to spend their retirement years, is proximity to amenities. While for the older elderly, the key amenities are the availability of health care and associated support services, for the younger elderly, the central role of recreational opportunities is consistently reiterated. This is exemplified in the growing number of specialized retirement settlements such as Sun City, Leisure World and The Villages that emphasize the array of opportunities they provide for engaging in recreational activities.

An extensive off-street trail system meandering through riparian zones of rich habitat and convenient linear parks along the network of bayous in the greater Houston area, would be a major attraction for GRAMPIES. The Bayou Greenways system would provide an appealing “hook” for promotional efforts targeting this group.

Illustrating the potential impact of GRAMPIES – for every 100 retired households that move to the greater Houston area in a year -- each with an annual income of \$50,000 -- their impact is similar to that of a new business spending \$5 million annually in the city.



Enhanced Property Tax Base

The real estate market consistently demonstrates that many people are willing to pay a larger amount for property located close to a greenway with trails than for a home that does not offer this amenity. In effect, this represents a “capitalization” of the bayou greenways into increased property values of proximate land owners.

The positive economic impact of parks on proximate property was a primary political rationale for cities investing tax revenue in them in the latter half of the nineteenth century – the formative years of urban parks in the U.S. *Ipsa facto* evidence of this impact in recent times is provided by the analogous investment of private developers in constructing approximately 1,000 golf courses in the past two decades for the explicit purpose of creating premiums for lot sales in their residential developments.

In contemporary Houston, the following table shows the increase in per square foot of assessed valuations on adjacent properties that accompanied the development of Discovery Green – a new park in downtown Houston. The total cost was \$122 million. Land for it was acquired in 2004 and design commenced in 2005. Tax assessments increased by over 50% during the period from announcement to completion of Discovery Green.

Table 1.
Changes in Assessed Property Values Adjacent to Discovery Green

Year	Mean Average Value	Change from Previous Year	Median Value	Change from Previous Year
2008	\$133.08	14%	\$125.23	24%
2007	\$116.77	14%	\$101.20	31%
2006	\$102.68	17%	\$77.28	106%
2005	\$87.87	N/A	\$37.53	N/A

Most of the proximate value is likely to occur within 600 feet (approximately three blocks) of a park or greenway. The magnitude of the premium varies widely for residential properties because it is influenced by such factors as the supply of parks in the area and ownership/rental status. As a result, we included a conservative increase in residential properties values' for the 600-foot band width at approximately 5%. We omitted including any increase in commercial properties values since very limited data exists on the influence of parks or greenways on commercial properties, because rental prices tend to be proprietary.

Although the premium accrues to individual property owners, the city as a whole benefits because the tax rates levied on these premiums by the city, county, school districts and other special districts, result in these entities collecting more tax revenues.

Illustrating the potential impact of the Bayou Greenways in enhancing the property tax -- When the 5% premium was applied to the Harris County Appraisal District valuations within the 600 foot band width of the new additions to the Bayou Greenway system, the aggregate increase in property tax values to home owners was estimated to be \$155,689,000. If annualized at 7% over 30 years, the annual value of the increase is \$12.5 million. In addition, based on the historical property tax rates in Houston of approximately 2% of property value, the annual residential property tax premium accruing to taxing entities is likely to increase by \$3.1 million.



THE BOTTOM LINE

The science of assessing an annual value to all the benefits to be derived from completing the Bayou Greenways in the greater Houston area is embryonic; so, the dollar estimates in this report are subject to a potentially substantial margin of error. Nevertheless, we can comfortably conclude that the values illustrate a compelling case for the Bayou Greenways. Two main points emerge from this report:

1. Multiple benefits emanate from the completion of the Bayou Greenways, and they stem from a wide variety of different sources.
2. The magnitude of the benefits is so great that while substantial changes in the assumptions that undergird the illustrative estimates, and/or future refinements in the methodologies may result in changes to them, they are unlikely to affect the overall conclusion that investing in the Bayou Greenways plan will leverage massive gains for the residents the greater Houston area.

In conclusion, there is unlikely to be any other \$480 million investment the greater Houston area could make that would generate such an extraordinary annual return in:

Houstonians' physical and mental health \$ 77.1 million

Bayou Greenways will create more equitably distributed parks and recreational amenities increasing our physical and mental health.

Houston's environmental health \$ 22.5 million

Bayou Greenways will transform the area's image from a sprawling, automobile congested urban center to one that values its ecological capital, its clean air and clean water.

Houston's economic health \$ 17.5 million

Bayou Greenways will contribute greatly to "the quality of place", attracting and retaining knowledge workers, corporate offices, and retirees, and increasing property values to benefit the area's tax base and individual homeowners.

Estimated total measurable annual benefits \$117.1 million



APPENDIX:

BENEFITS SUMMARY AND METHODOLOGY

Marsh Darcy Partners, Inc.

SCOPE

The Bayou Greenway Initiative is a collaborative, multi-year effort, encompassing almost 4,800 acres, of which approximately 1,600 acres would be used for a linear trail system with the remainder being strategically located green space. More than 245 new miles of shared-use trails will be added to the 55 miles of existing bayou trails, for a total cost of approximately \$480 million. When completed, over 52% of Harris County residents will be within 1.5 miles of the Bayou Greenway system and the annualized benefits (in 2011 dollars) to the region based on moderate usage projections is \$117.1 million.

The analysis is based on the creation of a linear greenway and shared use trail linking existing and proposed parkland along one side of each of the ten major bayous in or bordering Harris County: Brays Bayou, Buffalo Bayou, Clear Creek, Cypress Creek, Greens Bayou, Halls Bayou, Hunting Bayou, Sims Bayou, Spring Creek, and White Oak Bayou.

The analysis values benefits by aggregating multiple financial models and usage predictions developed by Marsh Darcy Partners, Inc., based on similar studies performed by other regional and national academic, governmental, for-profit and not-for-profit institutions. This Marsh Darcy Partners (MDP) Model estimates the annual dollar value of the benefits that are expected to accrue to the region and individual users of the Bayou Greenway system, with full benefits in place once the entirety of the greenway is complete. The MDP model also predicts the number of new users as a function of the existing user base for health, recreation, commuting, etc, with the usage factor decreasing with distance from the bayou greenway. Since the science is not exact, the model worked with a range of values from low to high. The moderate value was used to support the text in the report.

ANNUAL BENEFITS SUMMARY

	Low	Moderate	High
Physical & Mental Health of Residents			
Recreational Use Value ¹	\$ 52,800,000	\$ 63,200,000	\$ 82,500,000
Health Care Costs Savings ²	\$ 11,700,000	\$ 13,900,000	\$ 18,000,000
Urban Cohesion ³			
Subtotal	\$ 64,500,000	\$ 77,100,000	\$ 100,500,000
Environmental Health			
Air Quality & Enhanced Bicycle Use ⁴	\$ 4,200,000	\$ 4,200,000	\$ 4,200,000
Flood/Runoff Reduction & Water Quality ⁵	\$ 1,700,000	\$ 1,700,000	\$ 1,700,000
Ecosystem Services ⁶	\$ 16,600,000	\$ 16,600,000	\$ 16,600,000
Subtotal	\$ 22,500,000	\$ 22,500,000	\$ 22,500,000
Economic Health			
Enhanced Property Tax Base ⁷	\$ 12,500,000	\$ 12,500,000	\$ 12,500,000
Retiree Retention & Relocation ⁸	\$ 5,000,000	\$ 5,000,000	\$ 5,000,000
Company & Talent Retention & Relocation ⁹			
Subtotal	\$ 17,500,000	\$ 17,500,000	\$ 17,500,000
Total Measurable Benefits	\$ 104,500,000	\$ 117,100,000	\$ 140,500,000
Population along 10 bayou greenways ¹⁰	1.9 million	(52% of Harris County residents)	

NOTES

The benefits listed in this analysis are based on population and/or acreage. The population estimate includes residents within a 1.5 mile band on both sides of each bayou. Residents' use of the greenway is assumed to decline as the distance of their home from the greenway increases. The acreage estimate is based on 2010 Harris County Appraisal District (HCAD) information and mapped in a GIS format, supplemented with data obtained from other publically available information sources.

The recreational and health benefits, as well as the air quality and enhanced bicycle values are based on an estimate of the additional number of residents who will use the greenway system after it is completed. Adapted from methodology in the National Cooperative Highway Research Program Report *Guidelines for Analysis of Investments in Bicycle Facilities*, supplemented with data from the National Household Transportation Survey, and an evaluation of bicycle and pedestrian facilities completed by the Texas Transportation Institute (1999), a low, moderate and high range of users were projected.

1. **Recreational Use Value** - The Recreational Use Value benefit measures the value a percentage of the population living near the Bayou Greenway system will obtain by using the trails and adjacent green space on a periodic basis for enjoyable activities such as walking, running, biking, and picnicking and nature appreciation. This benefit is based on a guideline used to establish the value of recreational activities included in US Army Corp of Engineers (USACE) projects nationally, and is adjusted based on the urban environment, climate and topography and access, and based on moderate usage, for an average of \$4.70/use.
2. **Health Care Cost Savings** – This benefit is based on the consistent findings that exercising several times per week improves general health and results in lower overall health care costs. Proximity to outdoor exercise options is an incentive to use, and having the bayou greenways nearby will result in a percentage of nearby residents using the facilities. The savings are generated by a moderate number of users, based on a study commissioned by the Trust for Public Land, indexed to Houston-area costs and calculated on the basis of estimated age and population living nearby. The estimated reduced annual health care cost is \$338.72/person for those under 65, and \$677.43 for those 65 and older.
3. **Urban Cohesion** – Although a reliable method for measuring this benefit is not available, recent studies indicate that parks and green space can serve as community gathering spaces, encouraging interaction between users, creating opportunities for shared experiences and strengthening neighborhood ties. The continuous greenways adjacent to the bayous will form natural linkages under and around the streets, bridges and highways which frequently divide neighbors and neighborhoods. The wide, all-weather trails that are integral to the bayou greenway plan will make it easier to travel between the diverse communities along the greenways enabling Houstonians and visitors to expand and enrich their community experiences.
4. **Air Quality & Enhanced Bicycle Use** – The numbers of greenway users is based on a study by the National Cooperative Highway Research Program and supplemented by data from a Texas Transportation Institute report on trail usage. The total number of users is the basis for calculating vehicle operating cost savings, crash reduction benefits and improved air quality benefits.

The *Vehicle Operating* cost savings benefits are an estimate of the value of the reduction in vehicle miles traveled because of an increase in short trips (errands) and commutes (work) by bicycle. Average trip and commute length is per the Houston-Galveston Area Council (H-GAC), and the value of each reduced mile is per the IRS mileage reimbursement rate of \$0.51/mile. In addition to new commuters, an additional percentage of the population will make a short trip by bike, instead of by car.

The *Crash Reduction* benefit of using bikes instead of cars for the trips above also results in fewer car accidents. Based on Houston-Galveston Area Council statistics, the reduction in vehicle miles traveled would result in 13 fewer car crashes per year, resulting in savings of \$21,464 /per car crash.

The *Air Quality* benefits estimate the value of VOC, NOx, and CO2 emissions reductions as a result of fewer miles travelled by car. The value is the purchase price of emissions reduction credits (per ton) paid by H-GAC. Also contributing to enhanced *air quality* is the carbon sequestration benefit resulting from the permanent conservation of almost 4,800 acres of green spaces along the bayou corridors.

The calculation is based on an estimate of the amount of carbon taken up by an average acre of land in a year and the floor value of Carbon per the California Emissions Market.

- 5. Flood/Runoff Reduction & Water Quality Benefits** -- These benefits result from maintaining existing open space, thereby reducing flooding, and maintaining existing wetlands that filter runoff before it reaches the bayous.

The Runoff Reduction benefit is realized by maintaining soil porosity and tree cover on more than 3,200 acres to be used for park, detention and/or water quality purposes. If developed, an average of 47% of the land would be covered with impervious surface, based on data from H-GAC and the City of Houston. This cover would generate an additional 1,914,726,544 gallons of runoff per year. The City of Houston processes a combination of storm water and sewage at one of its three wet-weather treatment facilities. By preventing additional runoff as a result of new development, monies are saved that may otherwise be spent on storm water treatment.

In addition, a *Water Quality* benefit will be achieved by adding approximately 1,056 acres of wetlands and grasslands, at an average value of \$522/acre, as calculated by Dr. Robert Costanza of Portland State University.

- 6. Ecosystem Services** - Valuation of Ecosystem Services benefits is a statistically valid method for quantifying a range of benefits that are typically not traded on financial markets. Of the various ecosystems that have been valued, three exist in the Bayou Greenway system – grasslands, riparian corridors and freshwater wetlands. Generally, the value is derived from the land's ability to provide benefits such as pollution control, detoxification, wildlife nurseries, migratory habitat, and educational and scientific activities, among others. The value ranges from \$94 to \$10,708 per acre.
- 7. Enhanced Property Tax Base** - This calculation is based on research showing that residential property within approximately three blocks, or 600 feet, of a greenway or park is valued higher than those further away. In order to avoid any overlap, only the first value was included in the annual estimates:
 - \$12.5 million -- an “initial premium” of \$155,689,000 (5% of the assessed property value), realized when the greenway or park is built, annualized at 7% over a 30 year term -- base values are per HCAD, premium estimates are per Dr. John Crompton, Texas A&M University.
 - \$3.1 million -- an “annual premium”, which is the “initial premium” times the historical property tax rate in Houston of 2% per year, accruing to the taxing entities.

While the value of commercial properties may be increased due to proximity to a greenway system, no increase is included in these totals.

- 8. Retiree Retention & Relocation** – This calculation is based on the assumption that 100 more GRAMPIES (Growing numbers of Retirees who are Active Monied People In Excellent Shape) with an average annual income of \$50,000 may move to the greater Houston area when greenways are complete.
- 9. Company & Talent Retention & Relocation** – Although studies have attempted to value the benefit that public amenities have on economic development, the number of factors involved in attracting and retaining knowledge workers and corporations are too complex to be parsed by amenity type. However, other cities recognized as having a high-level of knowledge workers, such as Austin, Portland and Minneapolis, all have more than double the miles of off-street shared-use trails than Houston. With no reliable measurement data available, a specific monetary value was not assessed for this category.
- 10. Population Estimates** -- are based on the number of single and multi-family parcels located within the jurisdictional boundaries of the City or the County, and within 1.5 miles of each bayou. Land use data is per HCAD (April, 2010). Residents per household are per U.S. Census Bureau (2010) occupancy and vacancy rates.

GENERAL NOTES

In undertaking an analysis of this scale, a series of assumptions were developed and then tested for general accuracy. Examples include field counts of trail users, local Census data used to estimate residential occupancy rates, Houston-Galveston-Brazoria Consumer Price Index to calibrate to 2010 values, etc. As noted before, all estimates have been annualized in 2011 dollars.

When possible, assumptions and methodologies were discussed with and reviewed by leading public and private sector experts (Baylor College of Medicine, Rice University, Texas A&M University, Houston-Galveston Area Council, and Harris County Flood Control District), as well as community stakeholders.

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