Draft Pilot Project
Scope of Work

City of Miami Beach

Business Case Analysis for the City of Miami Beach Stormwater Resiliency Program

RFQ 2017-300-KB

September 20, 2018

ICF

1. PURPOSE AND VISION

The City of Miami Beach is seeking to understand and demonstrate the business case for resilience investments. This project will help the City pilot-test an approach on a limited geographic scope, starting with the First Street neighborhood, that could eventually be scaled up citywide.

To further focus the analysis, we propose to define the primary audience for this analysis as City decision-makers (including city managers and elected officials). Secondary audiences include the general public, community organizations, credit rating agencies, insurers, and others interested in the long-term resilience of Miami Beach.

The outcome of this project will be compelling, concise communication materials for City decision-makers articulating the business case for resilience investments, backed by a robust technical analysis incorporating integrated flood modeling and economic analysis. In addition, this project will produce a replicable methodology that can be scaled and used to support future decision-making. The economic analysis is designed to capture a wide range of the costs and benefits of resilience investments.

The scope of work below outlines a step-by-step approach to achieve these objectives, organized as follows:

- **Stage 1: Kick Off**
  - Task 1. User Engagement and Data Collection
- **Stage 2: Determine Effectiveness of Resilience Investments**
  - Task 2. Citywide SLR and Storm Surge Risk Modeling
  - Task 3. Integrated Flood Modeling (Neighborhood-scale)
  - Task 4. Determine Property Value Impacts
- **Stage 3: Build Business Case for Resilience Investments**
  - Task 5. Build Individual Property Business Case
  - Task 6. Build Neighborhood Business Case
  - Task 7. Build City-wide Business Case
- **Stage 4: Communicate Results**
  - Task 8. Communication Materials

2. SCOPE OF WORK

Stage 1: Kickoff

Task 1 User Engagement and Data Collection

Purpose

The purpose of this task is:

(1) To clearly define and document the audience for the business case analysis and their communication and analysis needs. This will ensure the subsequent analysis and all final communications products and deliverables are user-driven, and that the City and consultant team have a shared vision for the outcome of the project.
(2) To work with the City to collect necessary data for the business case analysis.

Approach

Step 1. Kickoff meeting.

The consultant team will convene a half-day, in-person kickoff meeting with diverse City staff to officially launch the project. The kickoff meeting will include:

- An overview of project goals and tasks
- Discussion of project audience
- Discussion of data needs
- Review of project communication protocols (we recommend biweekly 30-minute check-in calls)

During the discussion of the project audience, the consultant team will walk through a "Creative Brief," a template we regularly use to guide communication products and ensure a consistent vision for all team members. The Creative Brief includes questions such as:

- What are the goals of the materials?
- Who are the target audience(s)?
- What knowledge gaps do our target audience have?
- What metrics matter to our target audience?
- What is the decision-making or planning time horizon of our target audience?
- What key messages do we want to communicate?
- What defines effective communication for our audience?

The primary audience for this analysis is City decision-makers (including city managers and elected officials). Secondary audiences include the general public, community organizations, the business community, credit rating agencies, insurers, and others interested in the long-term resilience of Miami Beach. The Creative Brief and communication materials will be targeted toward the primary audience.

We also recommend including a walk-through of the study area to discuss planned improvements, adaptation options available, and potential vulnerabilities.

Following the kickoff meeting, the consultant team will provide notes for the City's review and confirmation. The notes from the meeting, including the Creative Brief defining the audience and their needs, will inform the ensuing analysis and communication materials.

Step 2. Data collection.

Prior to the kickoff meeting, the ICF team will develop a data needs list for the analyses in Tasks 2-4. During and following the kickoff meeting, the consultant team will work with the City to collect available data for the analysis. The table below provides an illustrative list of data needs that will be refined and augmented upon inception of the work.

Data Needed	Format	Relevant Task(s)
City-owned building data (GIS) (e.g., location, age, height, construction type, occupancy type, and replacement value)	GIS	2, 3, 4
Parcel-level attributes (GIS) (e.g., boundaries, age, height, construction type, occupancy type, and replacement value)	GIS	2, 3, 4
Updated roadway elevations, incorporating recent improvements	GIS	2

Property tax rate structures and revenues	GIS	2
Digital elevation model	GIS	2,3
Tourism revenues over time	Any	2, 4
ICPR model inputs for existing and proposed stormwater system improvements	ICPR3	3
Location and specifications of current stormwater infrastructure (drainage pipes, ditches, culverts, pumps, catchments, levees, seawalls, etc.), surveys, atlas of structures, geotech, etc.	GIS	3
Historical flood frequency	Any	4
Any information on impacts of past flooding (impacts = operational cost to respond, duration of business scool, road, or other important closures; congestion effects; resident complaints; etc.)	Any	4
AADT for roads in the City	GIS	4

The consultant team will document all data received, including the relevant point of contact in the city, applicable metadata, and other information to ensure transparency and replicability.

If any data are not available, the consultant team will provide a recommended alternate approach.

Roles and Responsibilities

ICF staff will lead Task 1, with support from Brizaga to develop and populate the Creative Brief. AIR, Kimley-Horn, and FAU will provide input to the data needs wish list.

City staff will participate in the kickoff meeting and provide requested data if available.

Outcomes

- Kickoff meeting notes
- Creative Brief documenting analysis objective, audience, and audience needs
- Compiled dataset of available City data to inform business case analysis
- Data tracking spreadsheet

Stage 2: Determine Effectiveness of Resilience Investments

Task 2 Citywide Sea Level Rise and Storm Surge Risk Modeling

Purpose

- Provide risk-based estimates of flood risk city-wide with and without sea level rise
- Provide critical input to subsequent tasks and business case analysis, including:
    - Storm surge risks and boundary conditions for neighborhood-level integrated flood modeling (Task 3)
    - How flood risk varies across the city to inform property value analysis (Task 4)
    - Expected losses and private property damage from flooding (for Tasks 4-7)

This is a one-time, up-front analysis, applicable to future projects.

Approach

AIR will incorporate available City-specific data on building age, height, and other characteristics, and roadway elevations and run the AIR tropical cyclone model to estimate expected losses from tropical cyclones.

The model will be run for two scenarios, to inform the cost of inaction to sea level rise:

- Baseline conditions
- Climate change conditions – elevated sea level (a specific scenario to be finalized with the City, but as a starting point we recommend the 2050 Compact projections) and more intense storms (simulated using AIR's "warm ocean" storm catalog)

For each scenario, the model will output average annual loss and expected loss at different probabilities of storm occurrence (up to the 1-in-100,000 year event), in addition to maps and exhibits summarizing the modeling and results. The "cost of inaction" represents the difference between the two scenarios.

Roles and Responsibilities

AIR will lead this task.

Outcomes

- Excel spreadsheets and maps/shapefiles containing loss information.
- Storm surge extent and depth for specific storm scenarios, for input into the ICPR modeling in Task 3.

These output will be used as input for subsequent tasks.

Task 3 Integrated Flood Modeling (Neighborhood-Scale)

Purpose

- Use an integrated flood model to determine the effectiveness of different resilience strategies to reduce flood risk. The model would integrate groundwater, stormwater, and coastal conditions, consistent with the Urban Land Institute's recommendations.
- Pilot-test an approach/model configuration that could be scaled city-wide
- Provide critical input to the business case analyses of resilience investments (Tasks 5-7)

Approach

For a single neighborhood to be selected with the City (e.g., First Street), the ICF team will use the Interconnected Pond Routing (ICPR) stormwater model, version 4, to model extent and depth of flooding, incorporating improvements the City has already made into its baseline.

To pilot-test the model, we propose the following parameters and assumptions:

- Preliminary limits of the modeled area will be between 1st Street and South Pointe Drive, west of Washington Avenue to the western coastline.
- The ICPR4 model will be run for up to four design storm events that represent a combination of rainfall, sea level rise, storm surge, and tide stage. These design scenarios will be selected and confirmed in coordination with the City. Preliminary scenario are:

Scenario Name	Rainfall	Sea Level Rise	Storm Surge	Tide Phasing
5-year	5 year 24 hour	20” (2050, USACE High)	None	Max*
10-year	10 year 24 hour	20” (2050, USACE High)	None	Max
25-year	25 year 72 hour	20” (2050, USACE High)	Yes (to be extracted from Task 2)	Max
Cat 2 storm	TBD	20” (2050, USACE High)	Yes (to be extracted from Task 2)	Max

*Meaning as he modeling will take a conservative approach and assume that the timing of precipitation occurs at the time of the tide cycle that would maximize flooding

- For the four design storms, Kimley-Horn will model outcomes under three investment scenarios:
    - No investment (i.e., baseline conditions)
    - Public infrastructure investment (i.e., planning stormwater improvements)
    - Private infrastructure investment (e.g. raising finished floor elevation or moving valuable property – exact strategies to be determined on site visit)
- Kimley-Horn will map the resulting flood depths for the 12 scenarios. For flood depths that intersect a building footprint, the maximum flood depth will be noted for the associated building. This information will be provided to the City for their use, as well as as input to the business case.

Roles and Responsibilities

Kimley-Horn will lead this task.

The City will provide necessary input data and verify modeling assumptions.

Outcomes

- Maps showing inundation under four storm and three investment scenarios.

Task 4 Determine Property Value Impacts

Purpose

- Conduct a Miami-Beach specific analysis to capture the effects flood risk and public infrastructure investments on property values. The analysis is intended to capture the many unique features of the Miami Beach real estate market, including universally high flood risk (compared to other cities), high market value, high number of foreign investors, and land use and development restrictions.
- This information will inform the business case for the variety of resilience investment scenarios under Tasks 5-7.

This is a one-time, up-front analysis, applicable to future projects.

Approach

As a major component of the benefits of resilience investments, the ICF team will develop a model to estimate the impacts of flood reduction and public infrastructure investments on property values. Broadly speaking, there are two options for conducting this analysis:

- Use benefit transfer from existing studies or
- Develop a City-specific hedonic pricing model.

We propose to conduct a City-specific analysis of how flood risk affects housing price, controlling for other neighborhood characteristics. This analysis will use housing sales data from the areas of interest and develop hedonic pricing models. The hedonic pricing models will allow estimation of changes in property values from changes in flood risk to the property or nearby roads. The main advantage of using City-specific models is the ability to specify independent variables that would target flood mitigation strategies considered by the City (e.g., reducing flood risk to roads or installing other infrastructure). A benefit transfer approach will rely on existing models and may not be able to support detailed analysis of City's investments impacts on property values. For example, if we use a benefit transfer approach we may not be able to account for benefits associated with changes in flood risk to roads or proximity to seawall or other infrastructure designed to reduce flood risk.

The hedonic pricing analysis would involve analyzing data on housing and land sales, major floods, GIS data on environmental amenities, and tax data from the City which we combine with data of hazard zones.

- **Housing sales and parcel characteristics data.** Based on our initial investigation, the relevant housing sales and parcel characteristics data are available from ParcelQuest in a GIS shapefile format and from CoreLogic. Raw (uncleaned) data are also available the City of Miami Beach. Based on our prior experience, cleaning and linking raw data with spatial datasets can be labor intensive, depending on the state of the raw data. Because the cost of purchasing sales data for can be substantial, we will discuss options with the City for defining the geographic scope of the study.
- **Community-specific characteristics.** These data are readily available from the Census Bureau (e.g., median income, senior population, poverty status, race composition, travel time to work, school district designations), various GIS data layers (e.g., coastal access points), FBI crime reporting statistics, and local data (e.g., school district test scores from the Florida Department of Education).
- **Flood hazard areas.** ICF will work with the City to define differential levels of flood hazard within the City (e.g., locations with a 1% vs 2% vs 5% vs 10% vs 25% vs 50% annual chance of flooding). This may be based on existing information from the City if available or from the output of the AIR Tropical Cyclone model.

We propose to rely on a Difference in Difference (DiD) hedonic price model and separately estimate the effect of flooding on housing prices. The treatment group is composed of housing sales in flood-prone areas during 2007 through 2017. The control group in the first estimation includes houses or land with relatively low flood hazard for Miami Beach. We will use data of housing or land transactions before and after the floods for both flood-prone and non-flood-prone locations.

To estimate changes in property values resulting from the city's investments we will use the estimated equation and the results of the tropical cyclone model to re-assign hazard factors to properties located in the study area.

Roles and Responsibilities

ICF will lead this analysis, with support from FAU.

Outcomes

- Data on how reduced flood risk and public investment increases property values (e.g., for X% decrease in flood risk, property value increases Y%), to be applied in Tasks 5-6 to the flood risk reductions determined from the integrated flood modeling.

Stage 3: Build Business Case for Resilience Investments

Task 5 Build Business Case for Individual Property Owners

Purpose

- Demonstrate the value of public and private infrastructure investments to individual homeowners in Miami Beach.

Approach

To aid its citizens in managing flood risk, including the increasing risk due to sea level rise, the City aims to provide residents with adaptation options to reduce or mitigate their personal flood risk. We propose to develop sample adaptation options that include specific flood mitigation and adaptation options that residents may select based upon the extent of flooding that could be anticipated. We will utilize base-level water level calculations under various sea level rise and weather scenarios, such as those and coordinate amongst the team.

For example, this business case would demonstrate the costs and benefits to the property owner of several adaptation strategies for a hypothetical home that was located in the First Street neighborhood, with benefits in terms of:

- Flooding reduction (e.g., frequency)
- Reduced property damage
- Enhanced property value
- Reduced insurance premium

Benefits will be captured for both public investment and private investment scenarios. For example, this would include the public stormwater improvements modeled under Task 3, as well as a range of low to high cost adaptation strategies (e.g., from French Drains to home elevation).

Roles and Responsibilities

Brizaga will lead this task. AIR will advise on impacts to reduced property damage and insurance premiums. ICF will provide information on enhanced property value (applying findings from Task 4).

The City will provide available data on the cost of the proposed resilience investments.

Outcome

- Summary of the costs and benefits of different investment strategies (see example below).

	5 year 24 hour	10 year 24 hour	25 year 72 hour	Category 2 Hurricane	Total
Investment scenario 1: Public Infrastructure Investment					
Cost (to property owner)					
- Up front (e.g., capital)					
- Ongoing (e.g., O&M)					
Benefits					
- Flooding reduction					
- Reduced property damage					
- Enhanced property value					
- Reduced insurance premiums					
Investment scenario 2: Low Cost Private Infrastructure Investment (e.g., French Drain)					
Cost					
- Up front (e.g., capital)					
- Ongoing (e.g., O&M)					
Benefits					
- Flooding reduction					
- Reduced property damage					
- Reduced property value loss					
- Reduced insurance premiums					
Investment scenario 3: Moderate Cost Private Infrastructure Investment (e.g., Elevate)					
Cost					
- Up front (e.g., capital)					
- Ongoing (e.g., O&M)					
Benefits					
- Flooding reduction					
- Reduced property damage					
- Reduced property value loss					
- Reduced insurance premiums					
Investment scenario 4: High Cost Private Infrastructure Investment (e.g., Reconstruct)					
Cost					
- Up front (e.g., capital)					
- Ongoing (e.g., O&M)					
Benefits					
- Flooding reduction					
- Reduced property damage					
- Reduced property value loss					

- Reduced insurance premiums					

Task 6 Build Business Case for Neighborhood-Level Investments

Purpose

- Quantify the return on investment for the resiliency investments modeled in Task 3, incorporating multiple dimensions of economic impact.

Approach

Using the best available data, the ICF team will quantify and, where needed, qualitatively describe the monetary and non-monetary benefits of the proposed neighborhood resilience investments. Quantified benefits will be limited to the study area. Benefits to the rest of the City from these investments will also be qualitatively characterized. We will also broadly characterize the benefits to the particular neighborhood from potential resilience investments that are made outside that neighborhood. As additional neighborhoods and investments are modeled, a more comprehensive and integrated picture of cumulative benefits and system relationships will emerge.

This business case analysis will address a broad range of potential benefits, such as:

- Reduced property damage (e.g., estimated based on flood depth for individual structures and relevant depth-damage functions)
- Reduced property value loss (e.g., applying relationships from hedonic modeling developed under Task 2)
- Enhanced property tax revenues
- Enhanced tourism revenues (based on potential impacts to hotel capacity, rental property, and retail space)
- Reduced insurance premiums
- Reduced city operational costs
- Reduced traffic-related disruptions
- Reduced business closures

The monetary benefits will be compared against the investment cost to determine a benefit-cost ratio and investment payback period.

Roles and Responsibilities

ICF will lead this task. AIR will advise on impacts to insurance premiums. FAU will advise on investigating tourism and operational costs, and neighborhood sense of place.

The City will provide available data on the cost of the proposed resilience investments.

Outcomes

- Summary of the costs and benefits of different investment strategies (see example below).

Scenario	**5-year**	**10-year**	**25-year**	**Cat 2**	**Total**
Investment scenario 1: Public Infrastructure Investment (compared to no investment)					
Cost					
- Up front (e.g., capital)					
- Ongoing (e.g., O&M)					

Benefits					
- Flooding reduction					
- Reduced property damage					
- Enhanced property value					
- Enhanced property tax revenues					
- Reduced insurance premiums					
- Enhanced tourism revenues					
- Reduced city operational costs					
- Reduced traffic-related disruptions					
- Reduced business closures					
Investment scenario 2: Private Infrastructure Investment (compared to no investment)					
Cost					
- Up front (e.g., capital)					
- Ongoing (e.g., O&M)					
Benefits					
- Flooding reduction					
- Reduced property damage					
- Enhanced property value					
- Enhanced property tax revenues					
- Reduced insurance premiums					
- Enhanced tourism revenues					
- Reduced city operational costs					
- Reduced traffic-related disruptions					
- Reduced business closures					

Task 7 Build Business Case for City-wide Investments

Purpose

- Determine a high-level business case for citywide investments, extrapolating from findings from earlier tasks
- Identify citywide "cost of inaction," and, correspondingly, appropriate level of investment

Approach

Based on the results from previous tasks, the ICF team will calculate and summarize a city-wide cost of inaction to sea level rise in order to characterize appropriate level of investment. We will also draw from the neighborhood-scale findings to communicate the potential benefits and effectiveness if similar measures (with assumed similar effectiveness until more detailed modeling occurs) were applied citywide.

This analysis will include items such as:

- Quantified change in expected losses (from Task 2)
    - Note: the extent of the losses will depend on available data. AIR can model losses to residential and commercial property without additional information from the City. Losses to public structures can be included if required data on public buildings is provided, as outlined under Task 1 (e.g. building footprint and replacement cost)
- Quantified impacts on property values (from Task 4)

- Quantified impacts on City tax base/tax revenues (based on change in property values and property tax rate)
- Quantified impacts to tourism-related tax revenues (assuming sufficient data are available on property types to identify how much hotel capacity, rental property, and retail space would be impacted. We will also review any available data from the City on changes in the hotel occupancy rates and business closures due to flood events in recent years in the study area, existing literature on economic impacts of flood damages on tourism revenues).

In addition to these quantified impacts, the project team will outline qualitative, non-monetized components of the cost of inaction, such as additional impacts to tourism, businesses, transportation services, and sense of place.

Roles and Responsibilities

ICF will lead this task, with support from all team members.

The City will provide input to the specific time frame and sea level rise scenario assumptions for the Tropical Storm model. In addition, the City will provide available data on property tax rates, tourism revenues, etc.

Outcomes

- Summary of the business case for city-wide investments, based on cost of inaction and initial results of neighborhood and property-level resilience investment findings. For example:

Stage 4: Communicate Results

Task 8 Communicate Results

Purpose

- Develop concise communication materials to share the results of the business case analysis with the target audience in a compelling, understandable, and visual format.

Approach

The ICF team will develop communication materials (beyond the technical memoranda described previously) to clearly convey the findings of the business case analysis for the primary and secondary audiences defined in Task 1. These communication materials may include infographics, fact sheets, or digital materials including interactive maps.

In addition to the physical communication materials, we propose to:

- Hold a city staff workshop to share the results and educate staff on the methodology and final outcome to ensure consistent messaging.
- Present the results to the City Commission, if desired.

These communication materials will convey the cost of inaction and the economic tradeoffs of the three investment scenarios.

Roles and Responsibilities

Brizaga will lead this task, with support from ICF.

Outcomes

- Visually compelling, concise materials to communicate findings to key audience

3. ILLUSTRATIVE SCHEDULE

	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Task 1 – User Engagement and Data Collection												
Task 2 – Citywide Sea Level Rise and Storm Surge Modeling												
Task 3 – Integrated Flood Modeling (Neighborhood-scale)												
Task 4 – Determine Property Value Impacts												
Task 5 – Build Business Case for Individual Property Owners												
Task 6 – Build Business Case for Neighborhood-Scale Investments												
Task 7 – Build Business Case for Citywide Investments												
Task 8 – Communicate Results												

4. BEYOND THE PILOT PROJECT

Upon completion of the pilot project, the ICF team will work with the City to refine the approach and identify priorities to enhance the analysis. This could include:

- **Scale up the analysis**, such as by expanding the geographic scope of the integrated flood modeling, number and type of resiliency investments modeled, or depth of economic analysis.
- **Develop an interactive decision-support tool** to help City managers and decision-makers readily compare resilience investment scenarios and understand the return on investment over time.

5. PRICE

Task	**Cost**
Task 1 – User Engagement and Data Collection	$15,000
Task 2 – Citywide Sea Level Rise and Storm Surge Modeling	$50,000

Task 3 – Integrated Flood Modeling (Neighborhood-scale)	$110,000
Task 4 – Determine Property Value Impacts	$100,000
Task 5 – Build Business Case for Individual Property Owners	$10,000
Task 6 – Build Business Case for Neighborhood-Scale Investments	$75,000
Task 7 – Build Business Case for Citywide Investments	$15,000
Task 8 – Communicate Results	$20,000
Total	**$395,000**

*These costs represent rough order of magnitude estimates, to be refined and finalized following confirmation of approach and scale with the City.

Please note that ICF's proposal as presented herein reflects ICF's non-binding estimation of effort required for this opportunity. ICF looks forward to working with the City of Miami Beach to determine a mutually agreed upon scope and level of effort for this task. ICF's proposal is also predicated upon the full execution of the agreement between ICF and the City of Miami Beach for "Business Case Analysis of the City of Miami Beach Stormwater resiliency Program.