Maui
Preliminary Sediment Budget

Rob Sloop, PE
Moffatt & Nichol

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Maui Preliminary Sediment Budget

- Littoral Cells in Study Regions
- Methodology
- Sediment Budget by Littoral Cell
- Summary
- Recommendations for Further Study

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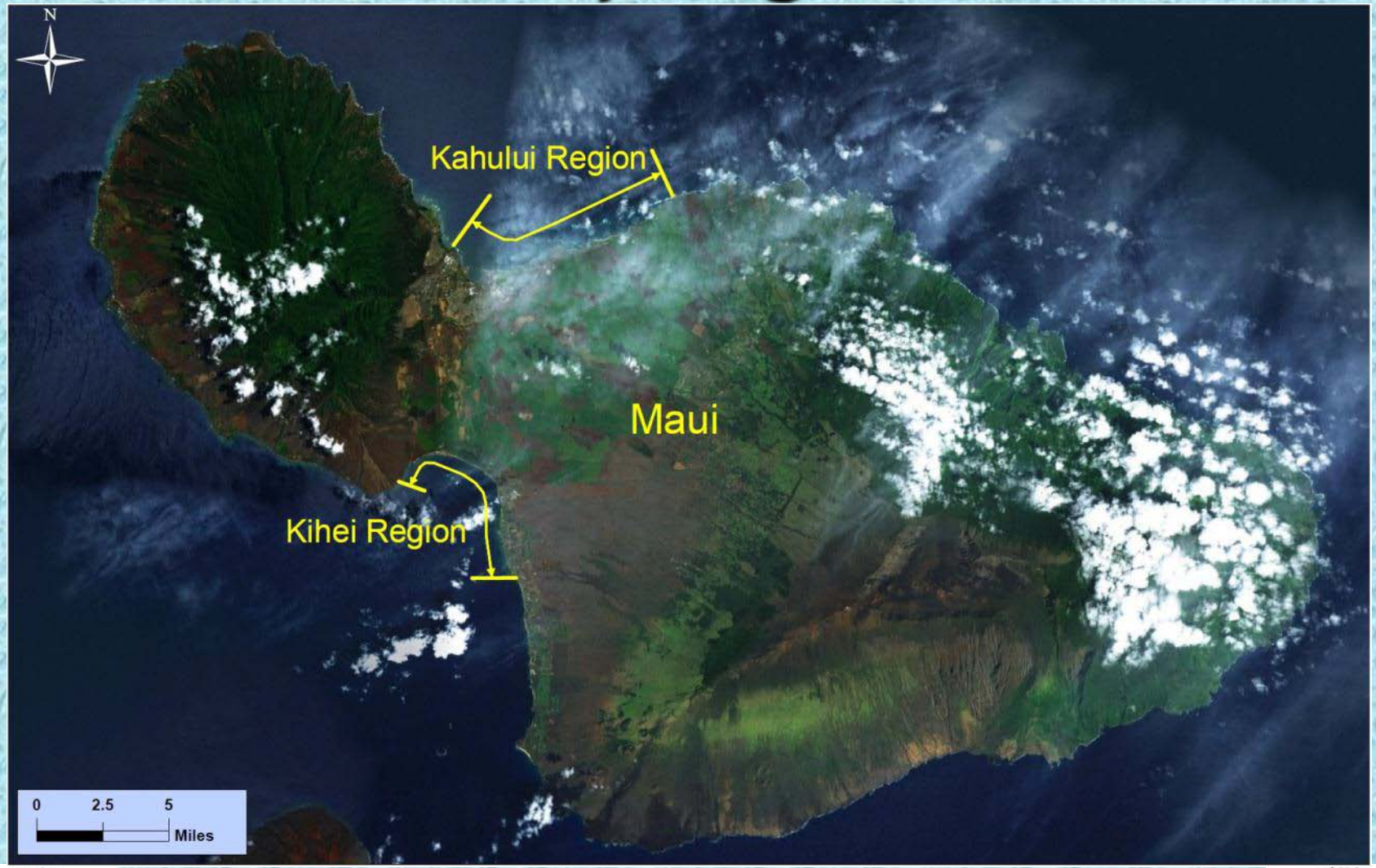
Study Regions



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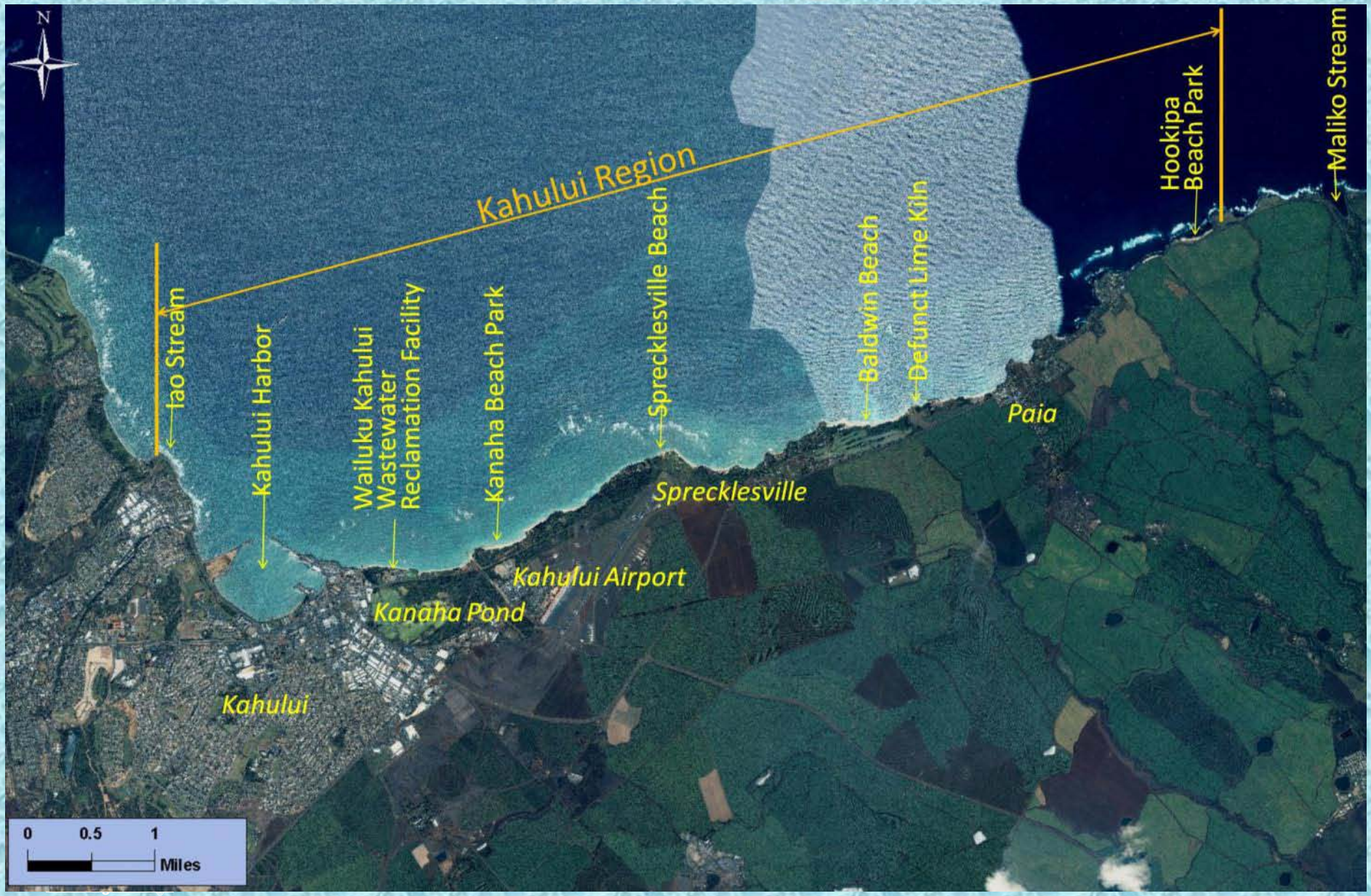
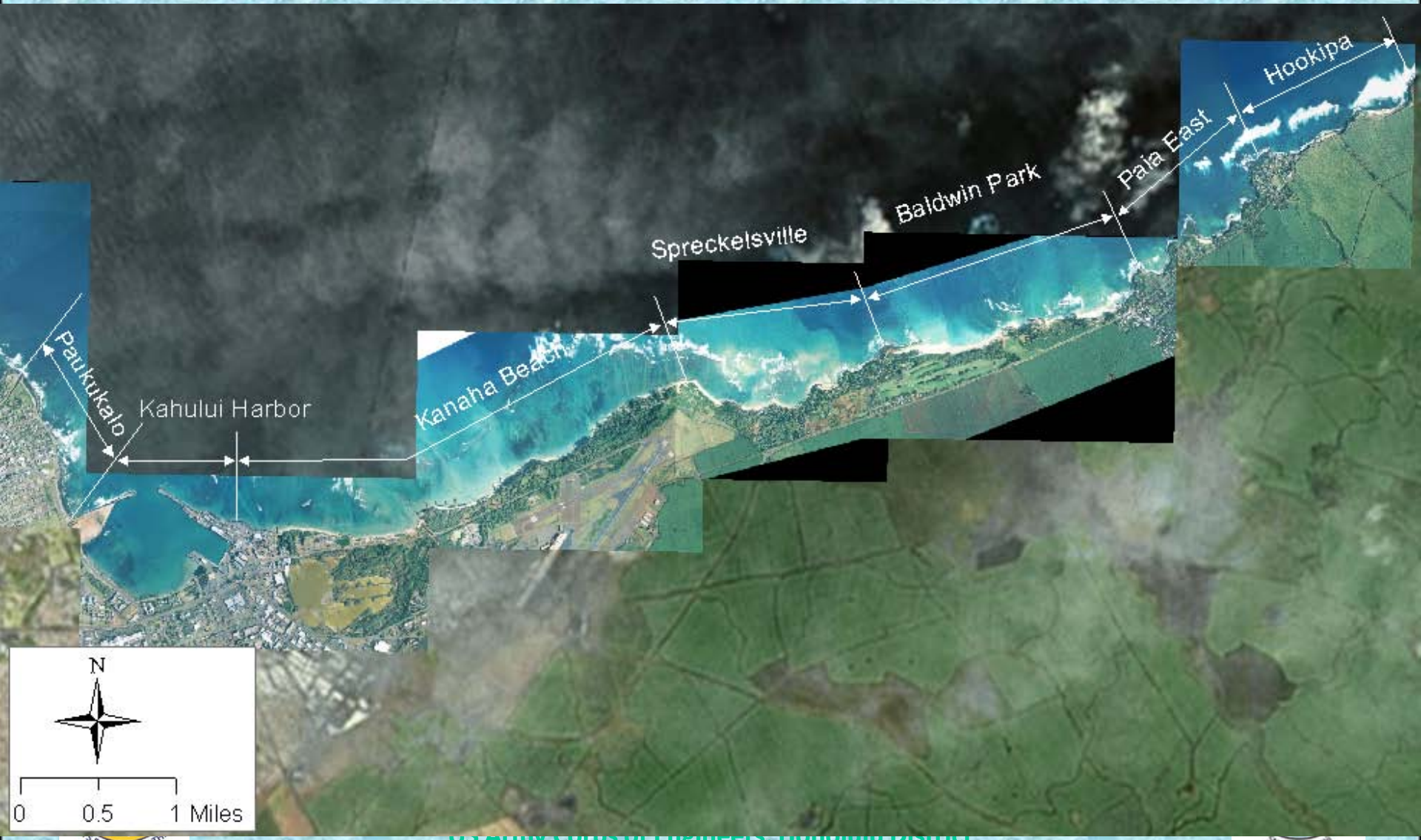
Kahului Region

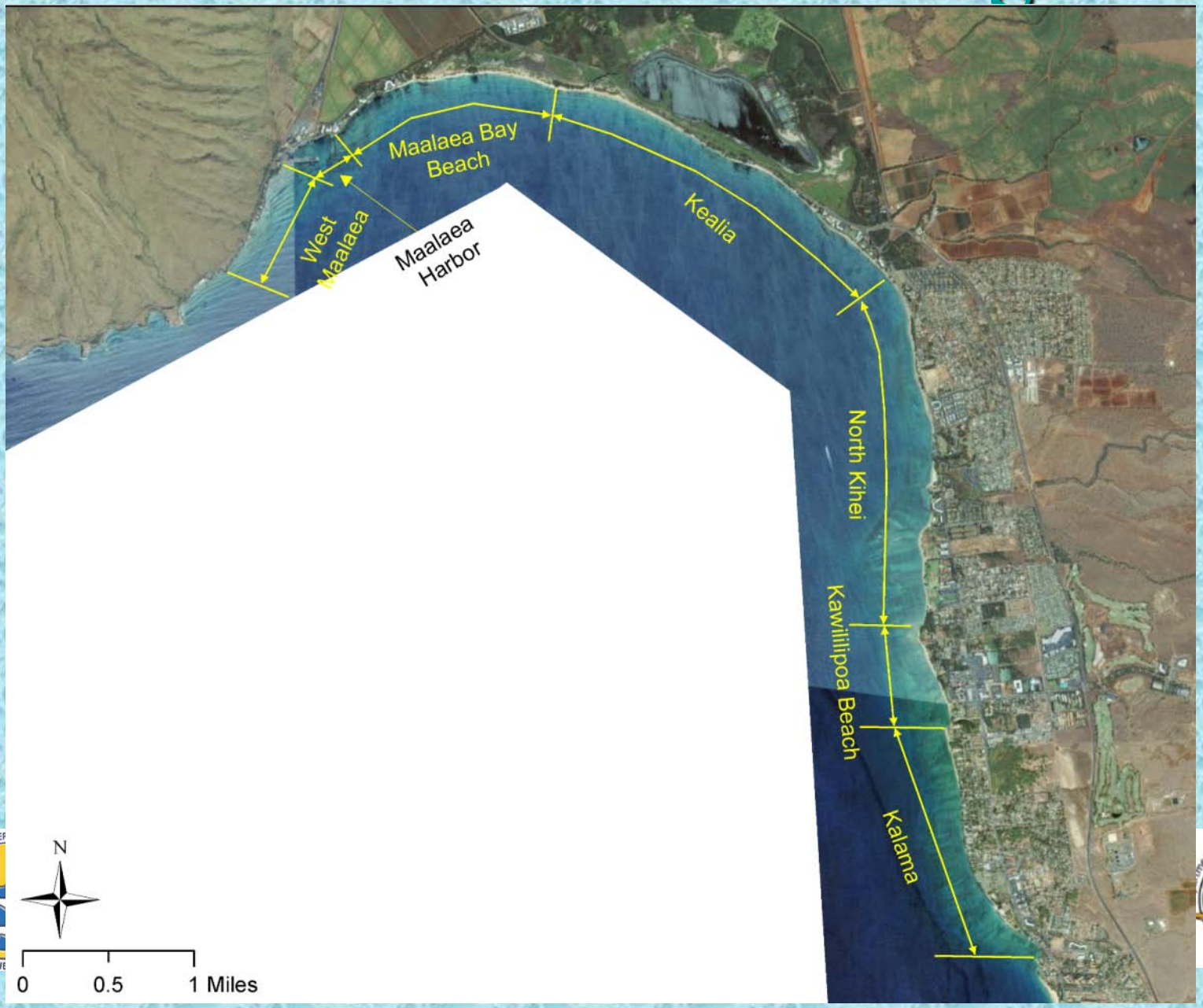


Littoral Cells in Kahului Region



Kihei Region

Littoral Cells in Kihei Region



Methodology

- **Historical Beach Volumes For Each Littoral Cell**
  - Beach volume defined as beach between stable backbeach line and mobile shoreward toe line
  - Calculated beach widths for each available historic shoreline (from UH erosion maps)
  - Calculated beach area for each available historic shoreline (multiplied average beach width X cell shoreline length)
  - Calculated beach volume by multiplying beach area (SF) X 0.40 CY sand per SF of beach (UH/USGS beach profiles)
  - Produced graphs of relative beach volume over time.

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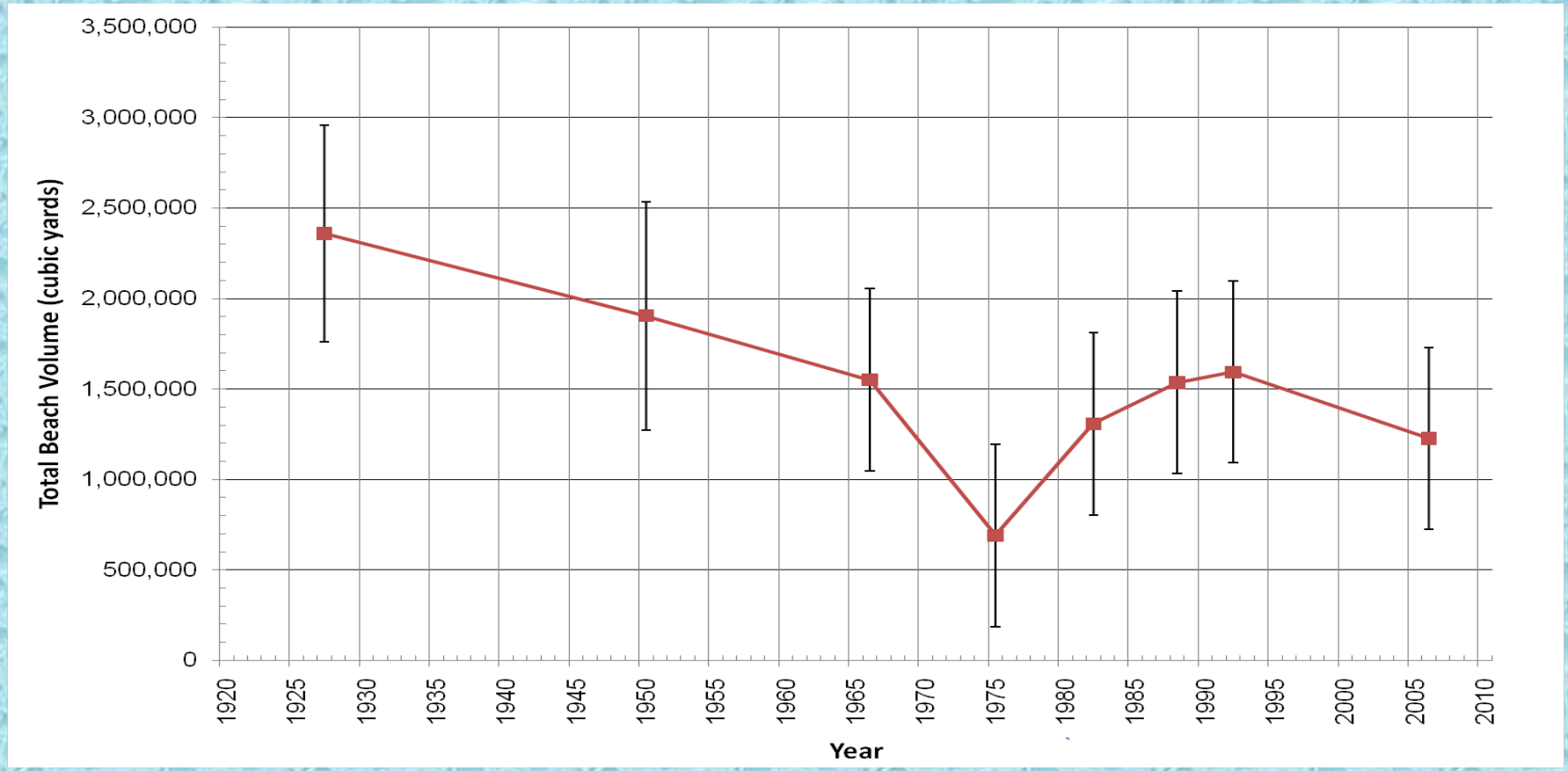
Methodology (cont.)
Example – Beach Volume Graph



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Methodology (cont.)

- **Beach Volume Change Rate**
  - Selected time periods of interest based on line graphs and historical events within each littoral cell
  - Calculated change rates for each time period and over complete period of record
    - Rate calculated using regression analysis / least squares fit, factors in seasonal variations and other uncertainties.
    - Rate corrected for any historic beach nourishment
- **Sand Pathways**
  - Some sand sources and sinks identified
  - Sediment transport directions not defined/quantified

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Example – Beach Volume Change Rate History

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Sediment Budget by Littoral Cell – Kahului Region

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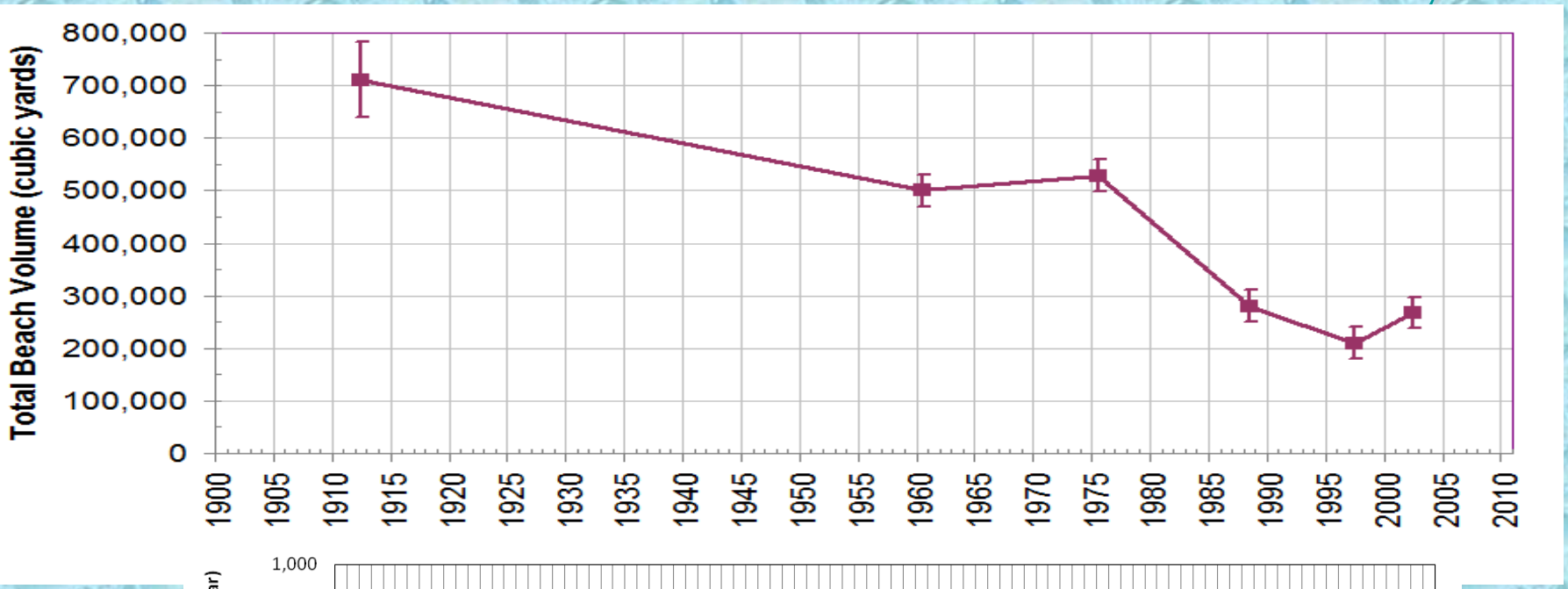
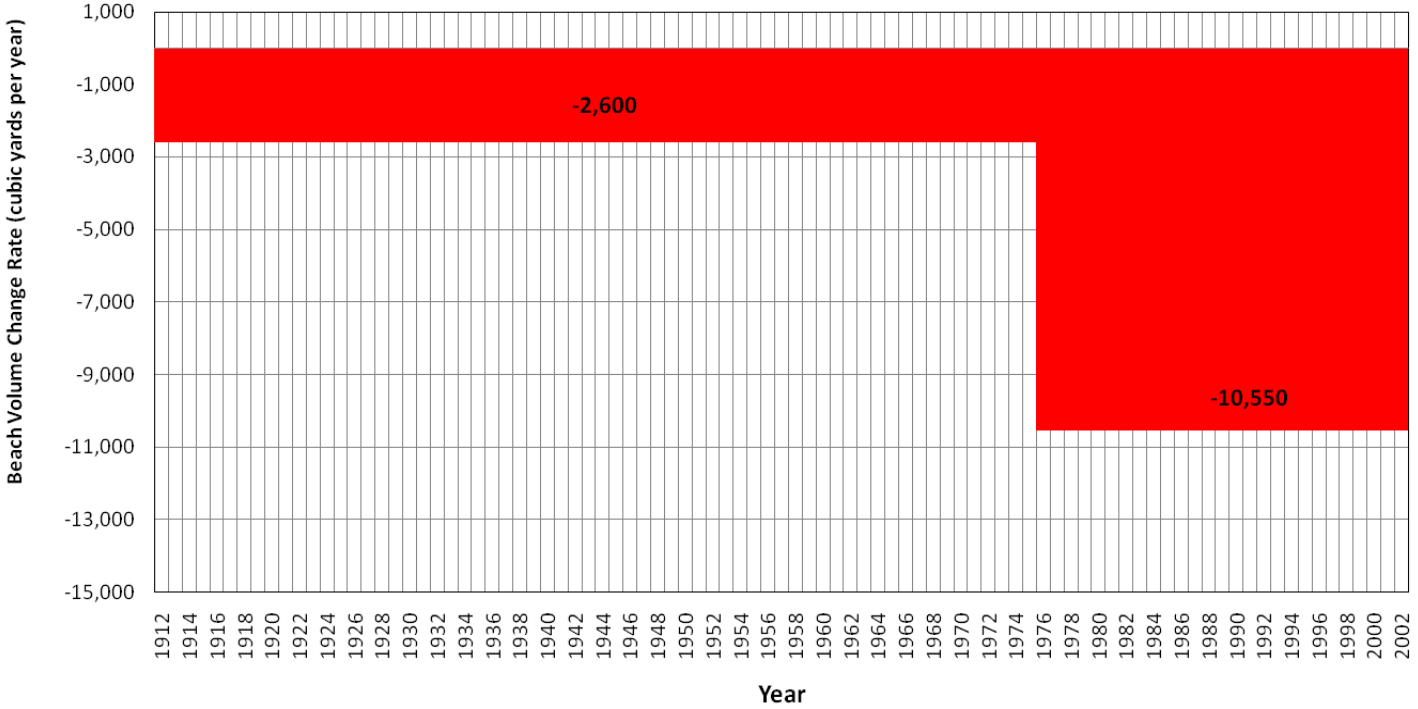
Kanaha Beach Cell – Shoreline Features

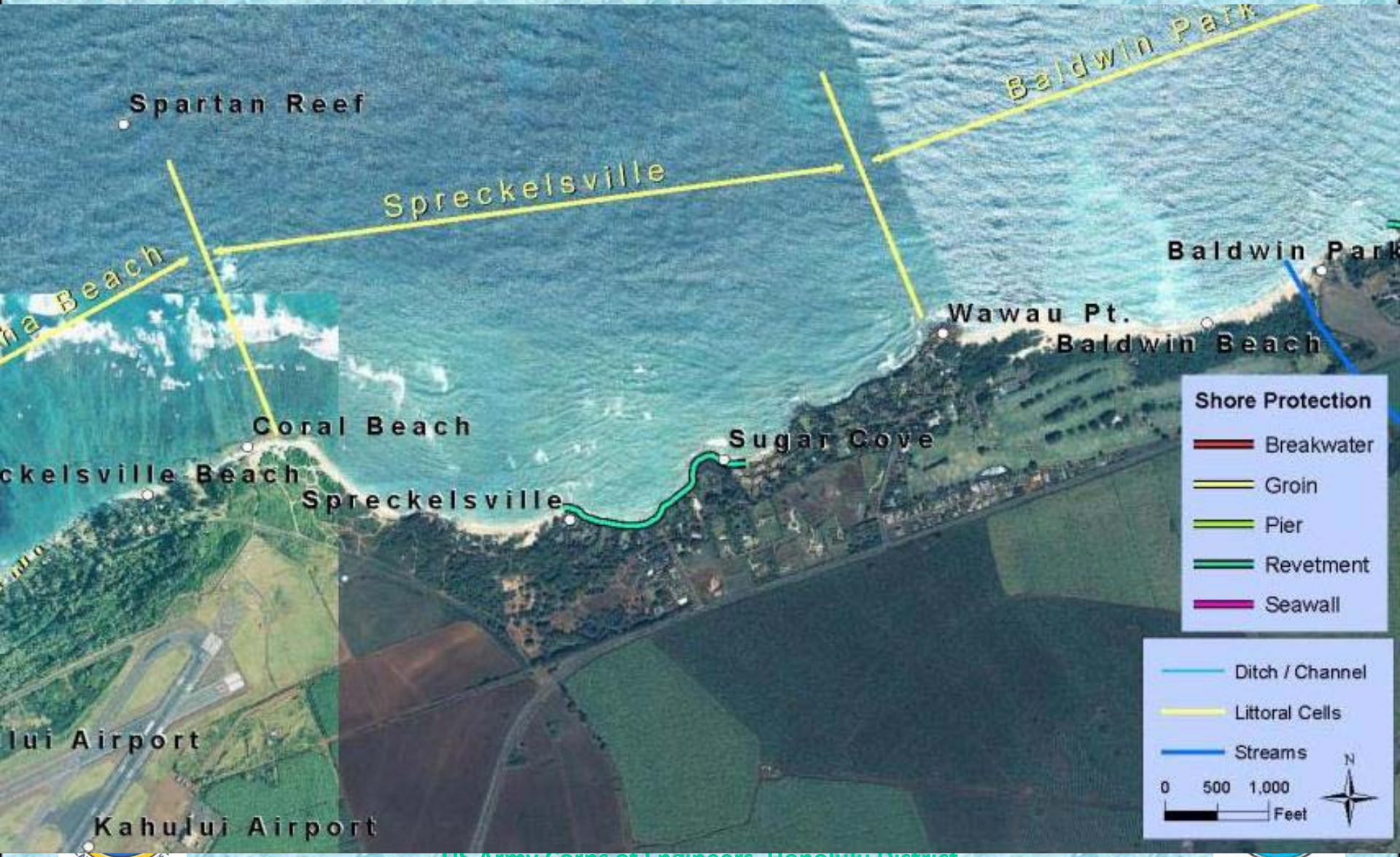
Kanaha Cell – Beach Volume History



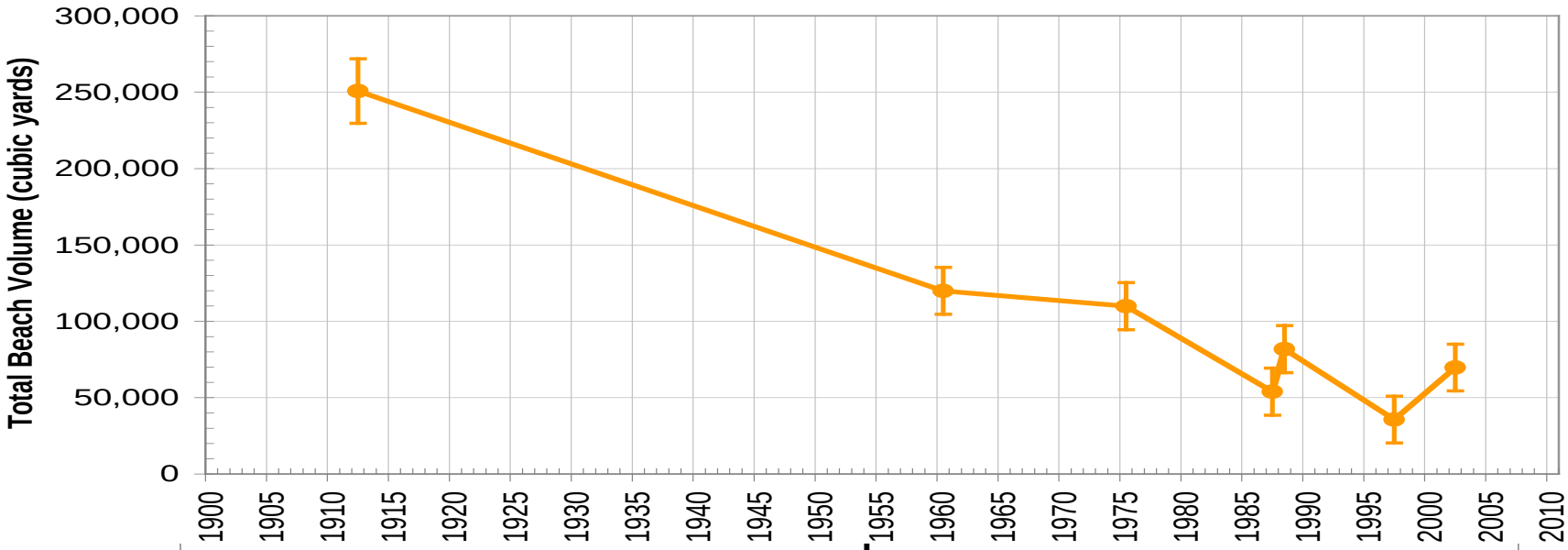


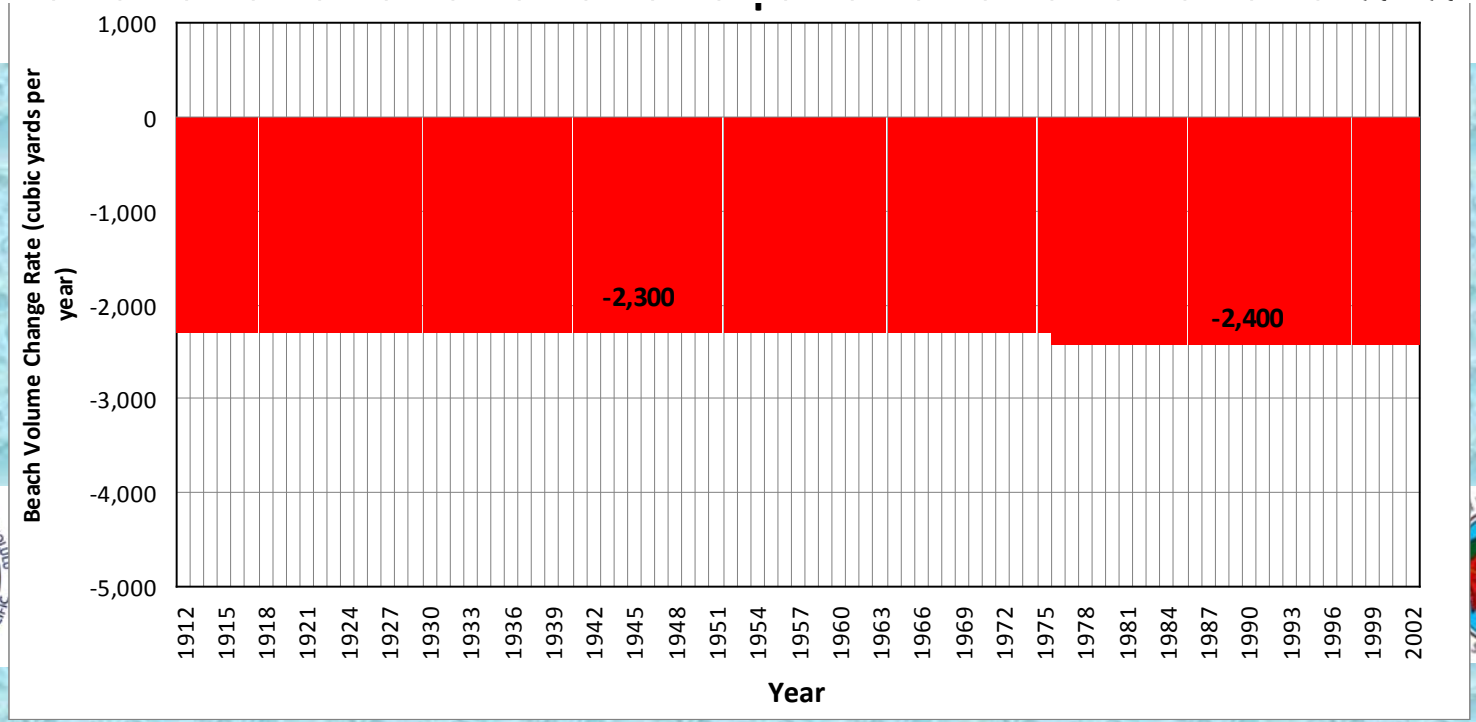
Kanaha Cell – Beach Volume Change Rate

Specklesville Cell – Shoreline Features



Specklesville Cell – Beach Volume History





Specklesville– Beach Volume Change Rate

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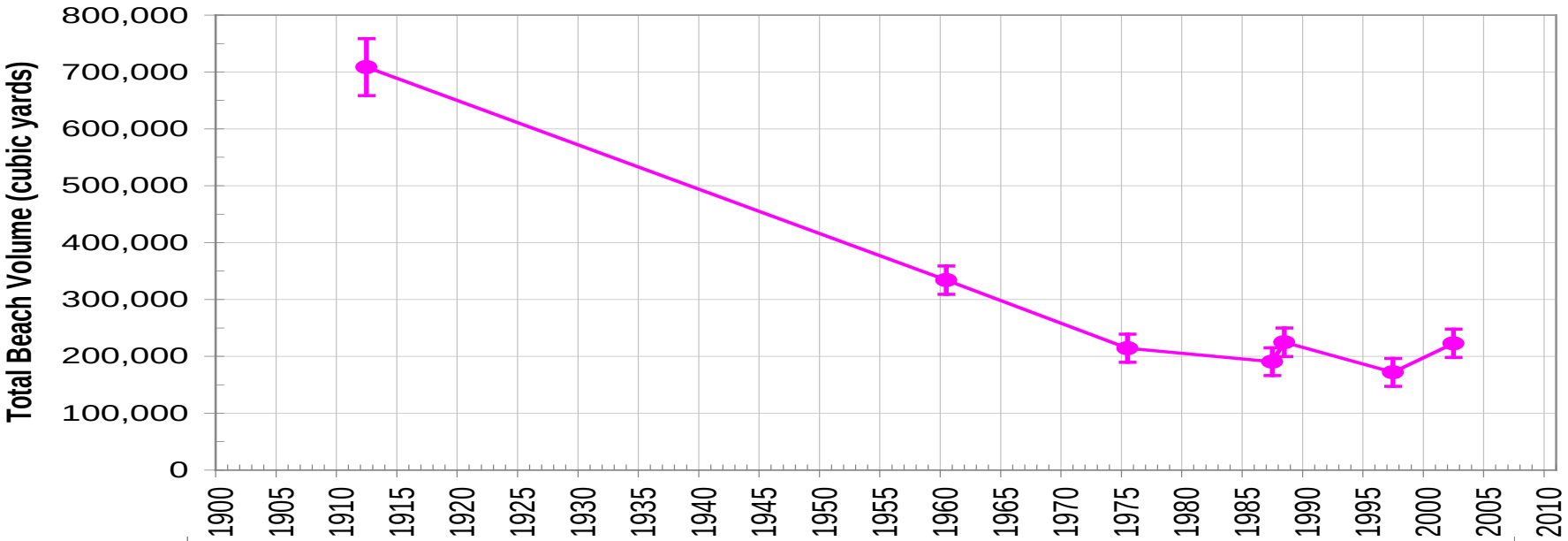
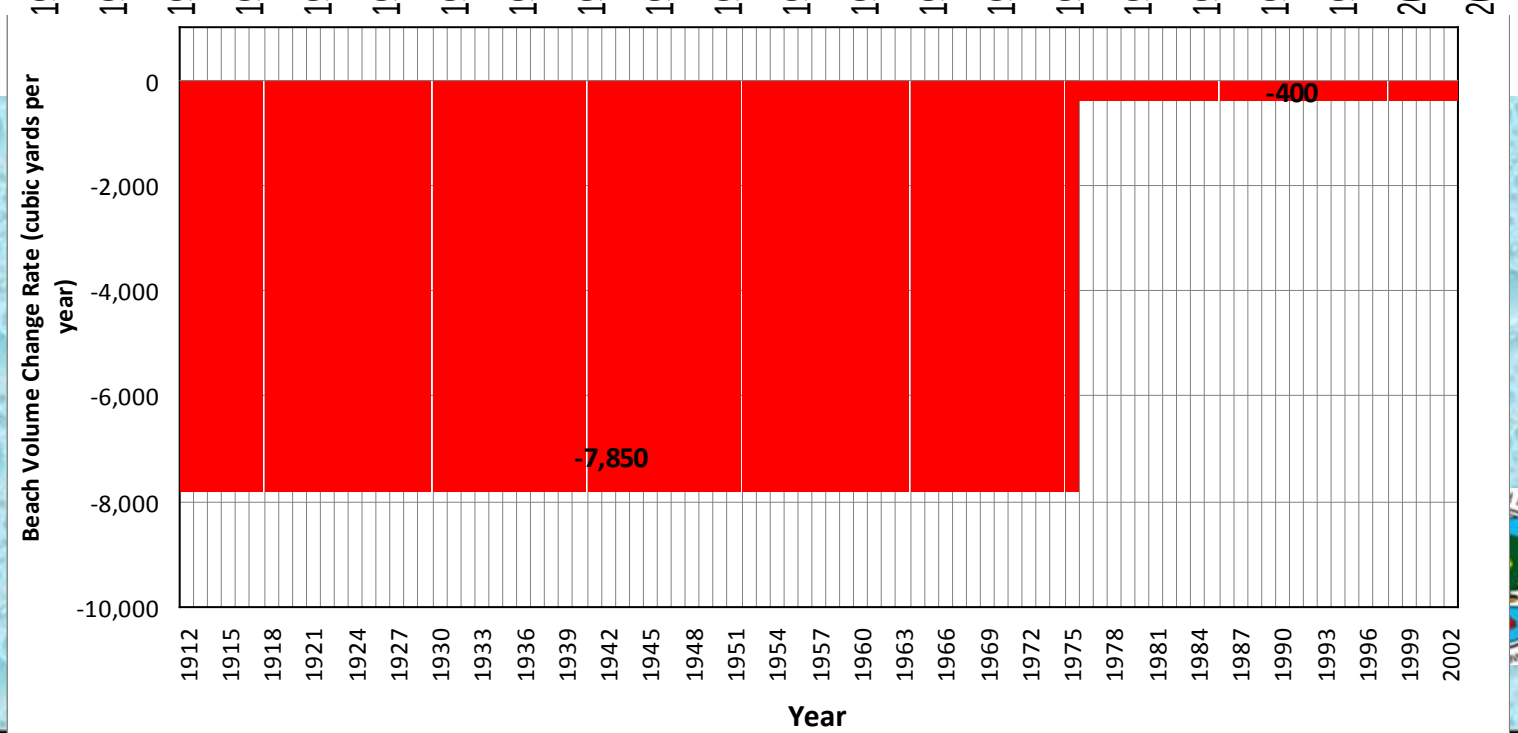
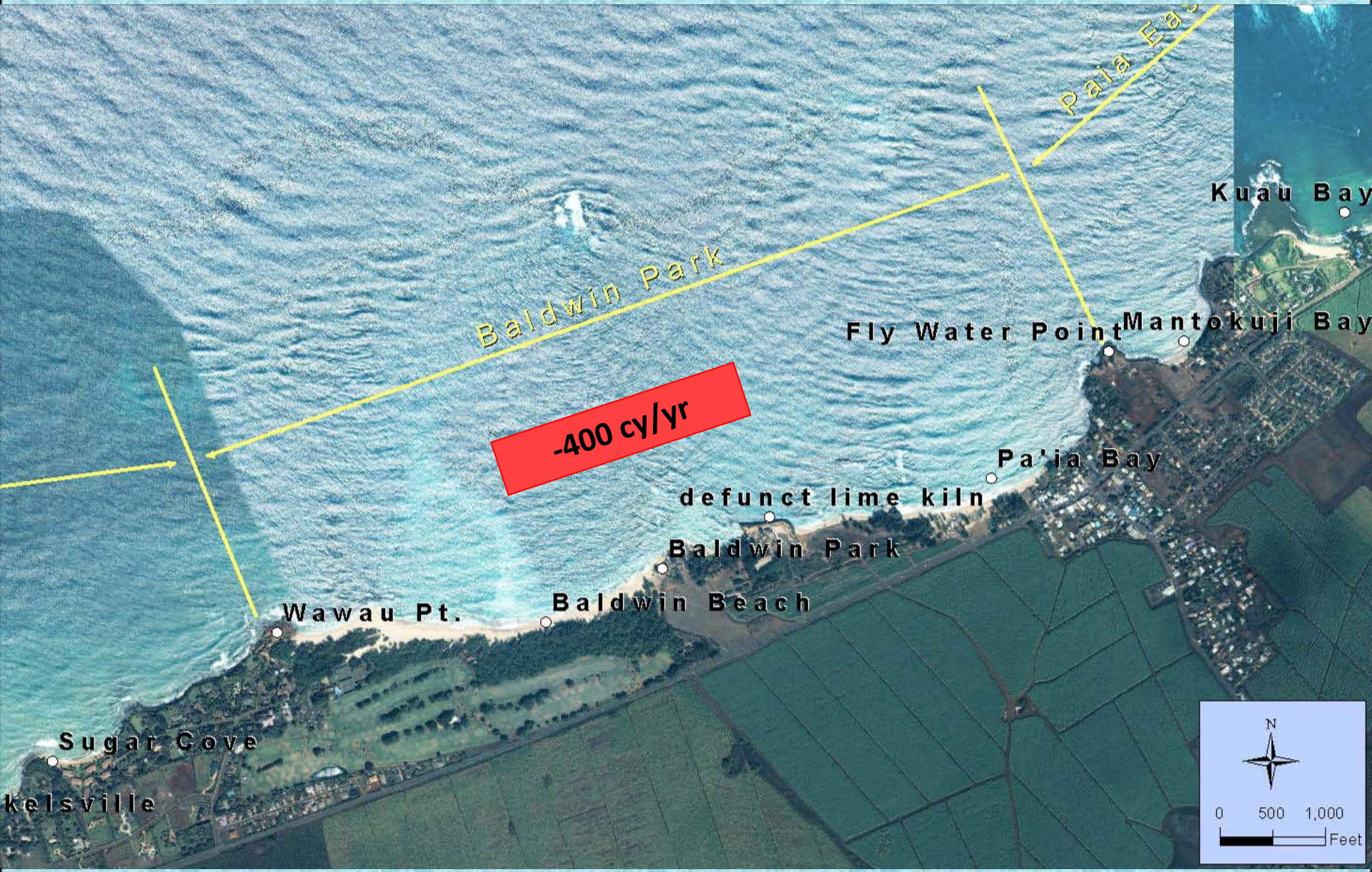
Baldwin Park Cell – Shoreline Features

Baldwin Park – Beach Volume History

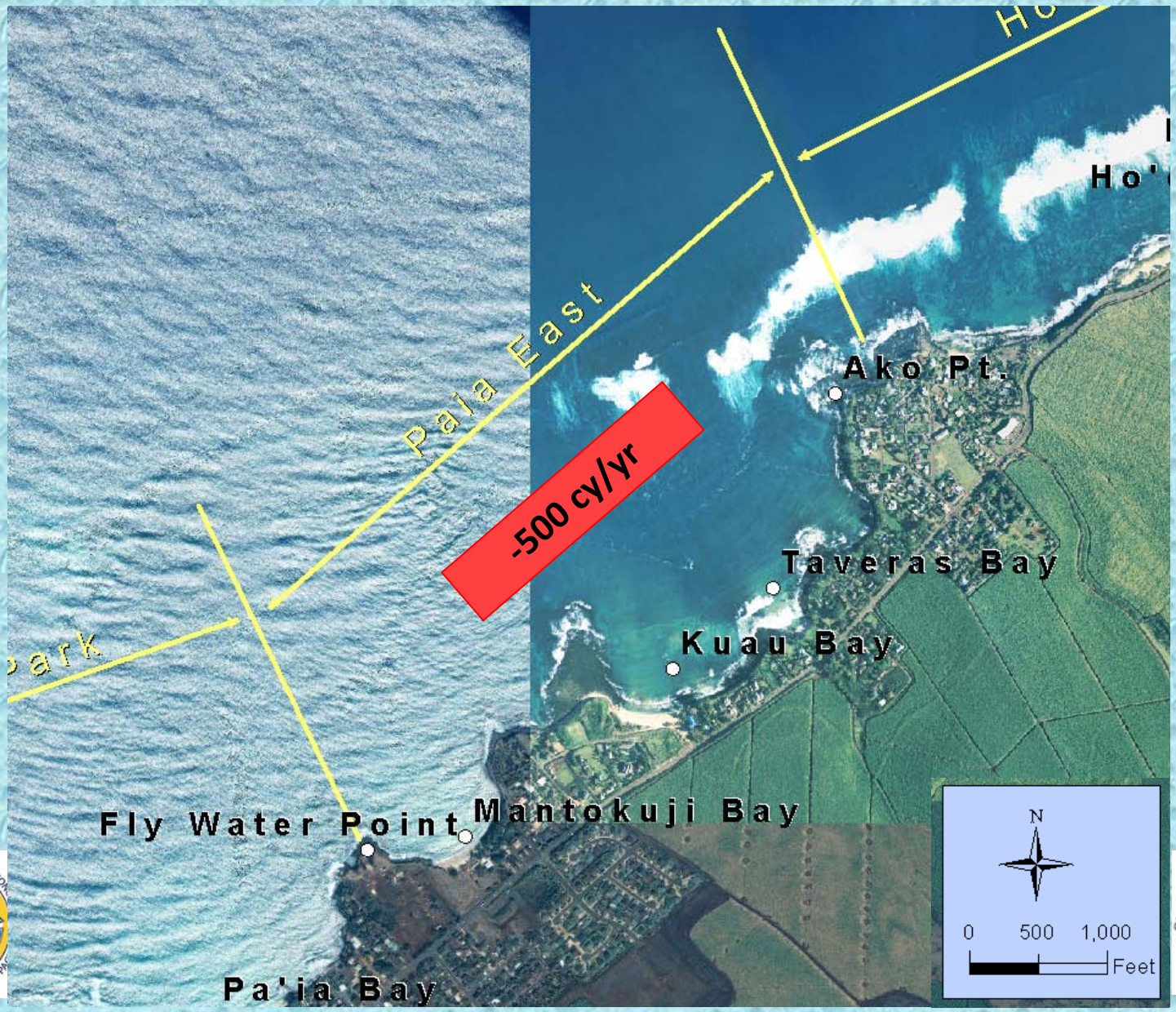




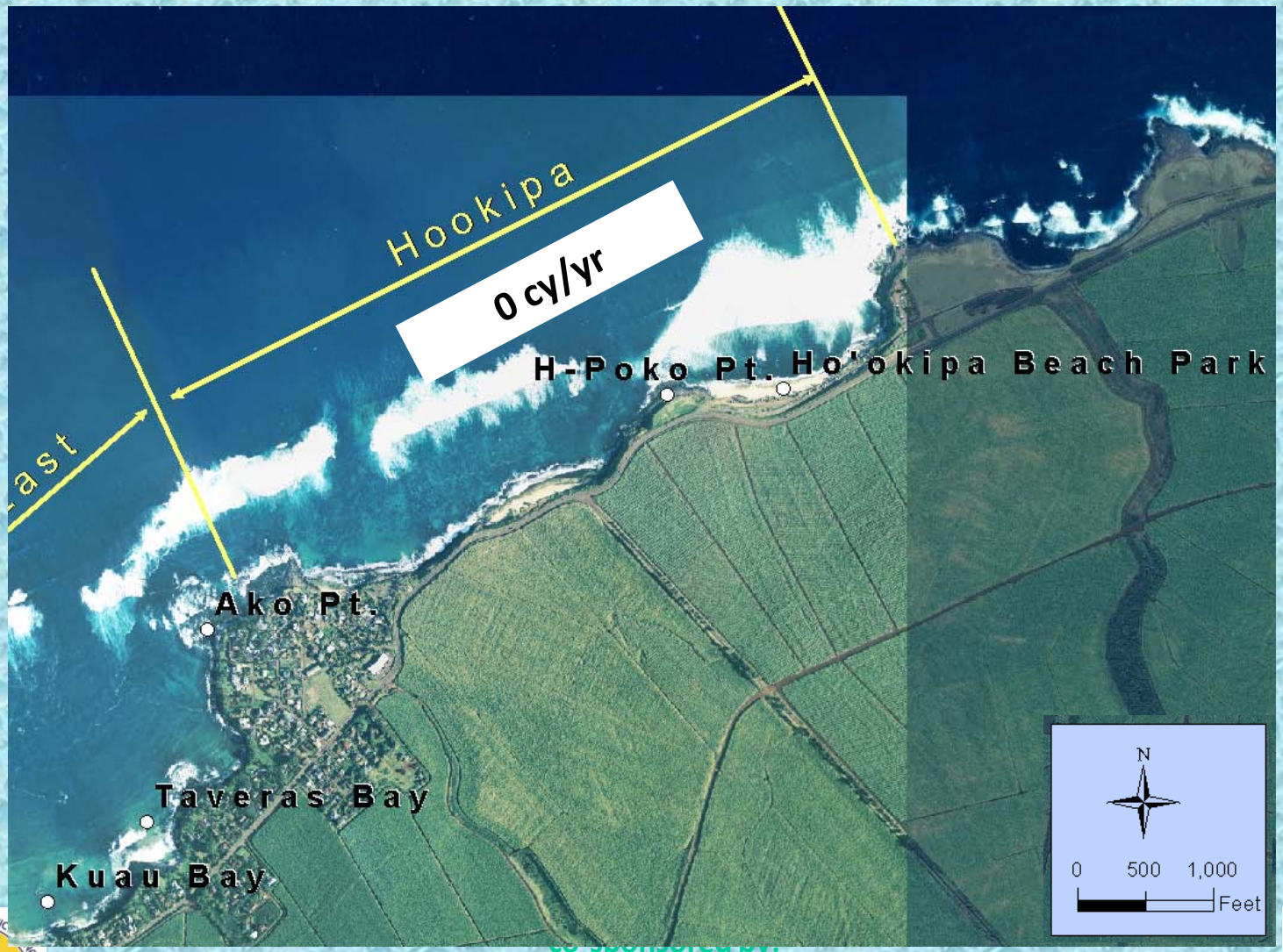
Baldwin Park – Beach Volume Change Rate



Paia East Cell – Beach Volume Change Rate



Hookipa Cell – Beach Volume Change Rate



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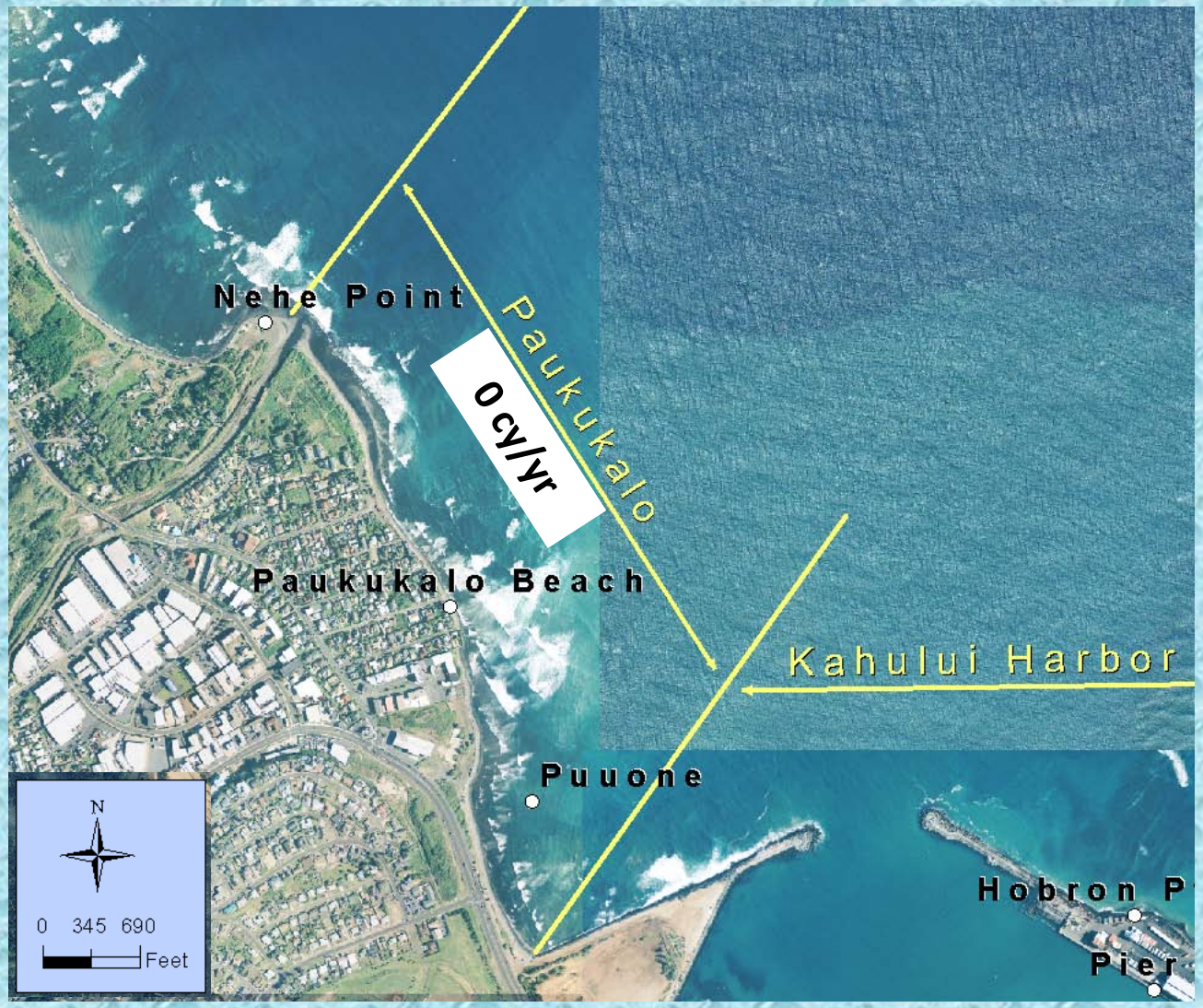
Paukukalo – Beach Volume Change Rate



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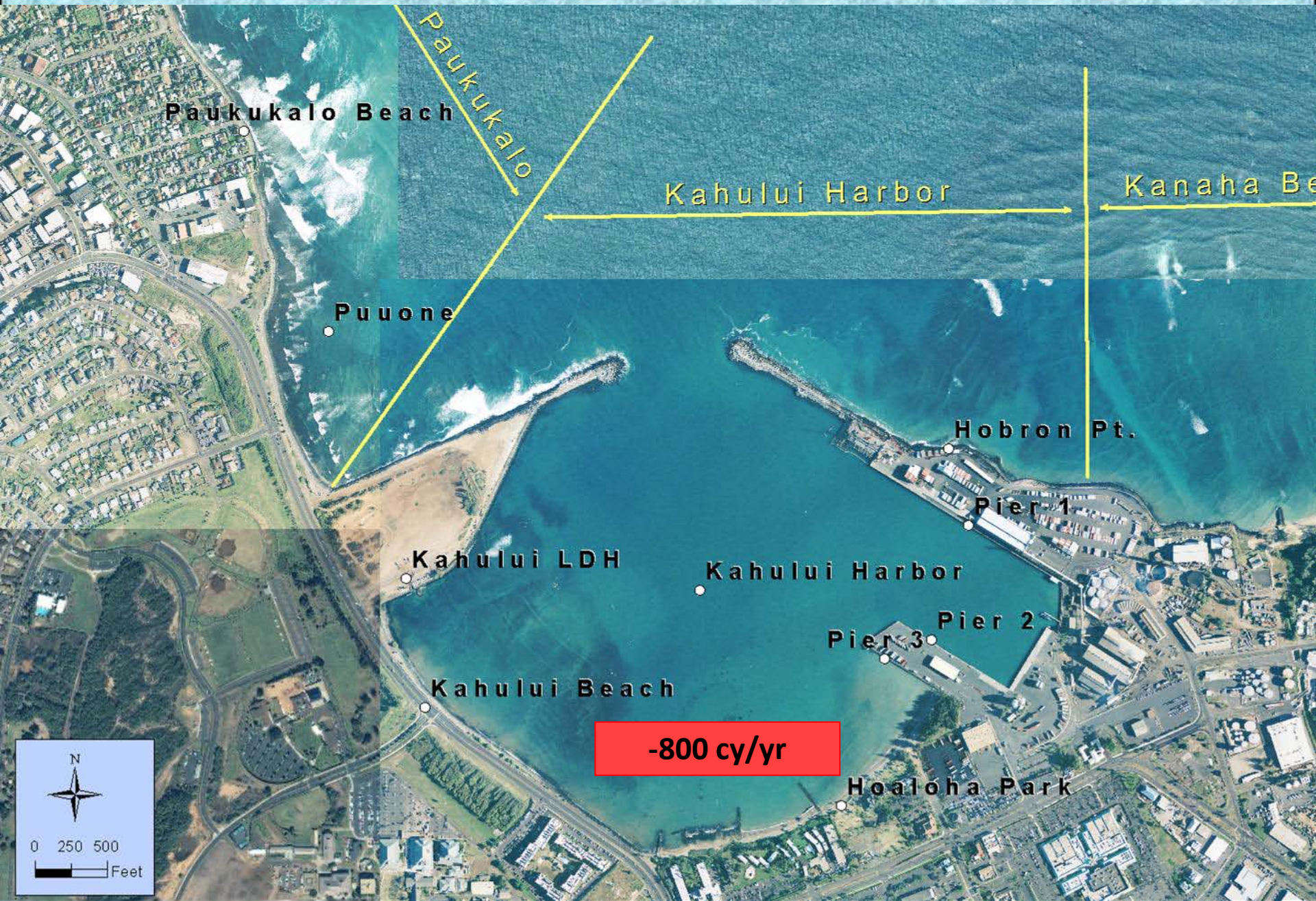
Kahului Harbor – Beach Volume Change Rate



Summary – Kahului Region

- **Kanaha Beach-WWRF area and Baldwin Park beaches have historically high historic erosion rates**
  - However, since ~1976, Baldwin Park erosion rate relatively low.
    - Kanaha Beach erosion rate has gotten worse
- **Specklesville and Paia East relatively constant erosion rate over period of record.**
- **Paukukalo cell beach volume stable since ~1960.**

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Sediment Budget by Littoral Cell – Kihei Region

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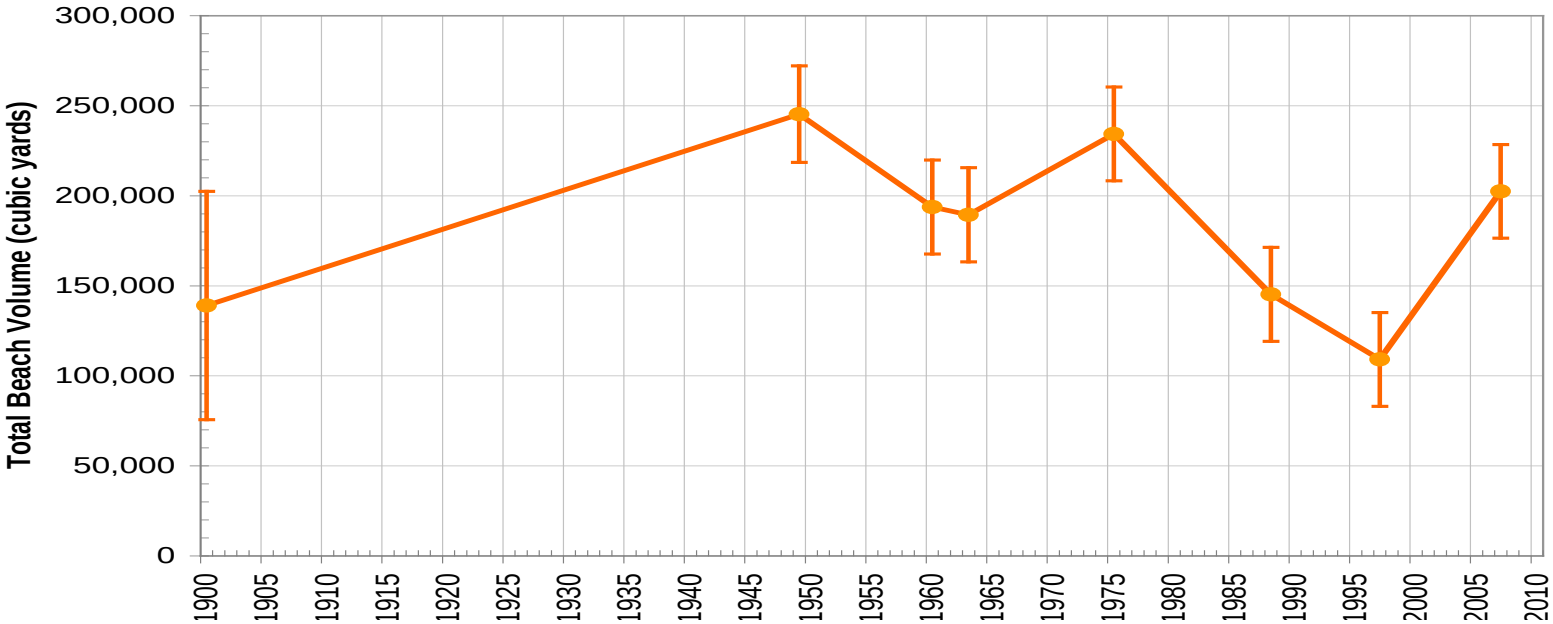
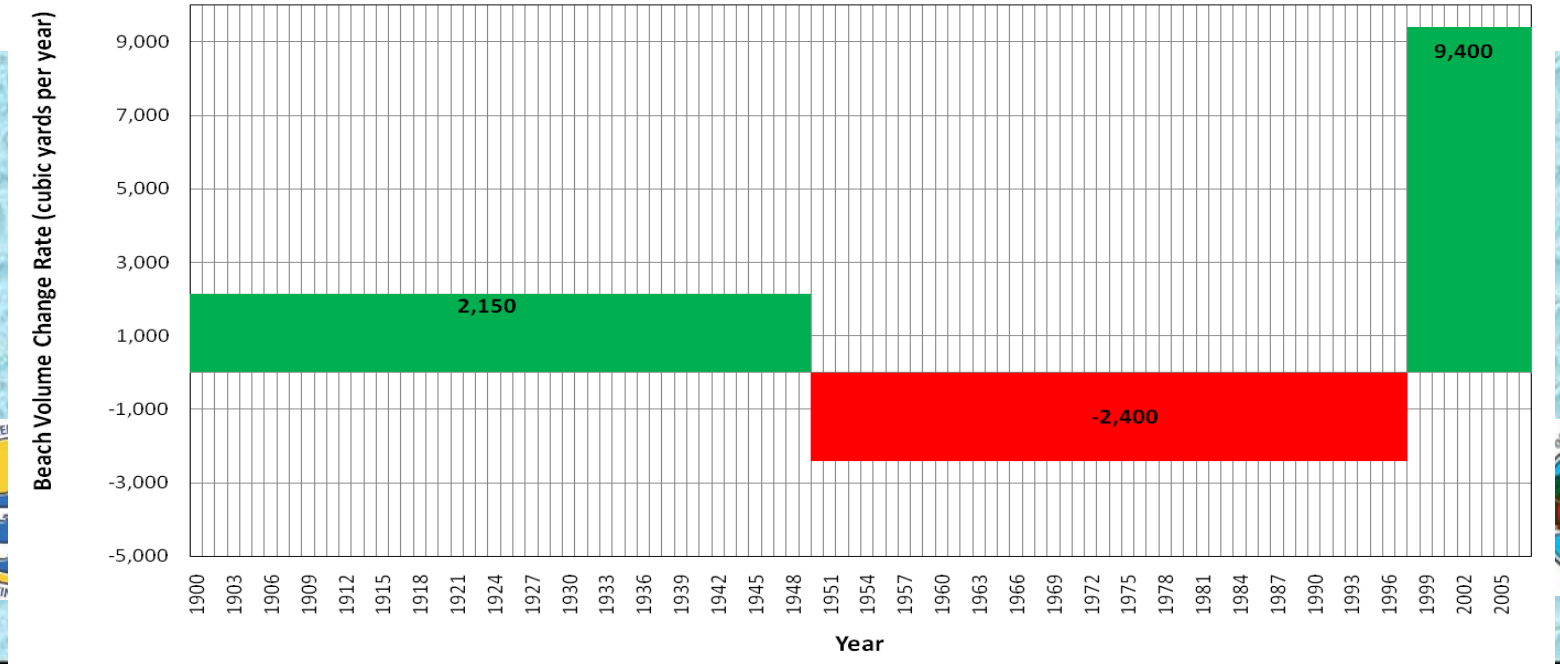
North Kihei Cell – Shoreline Features

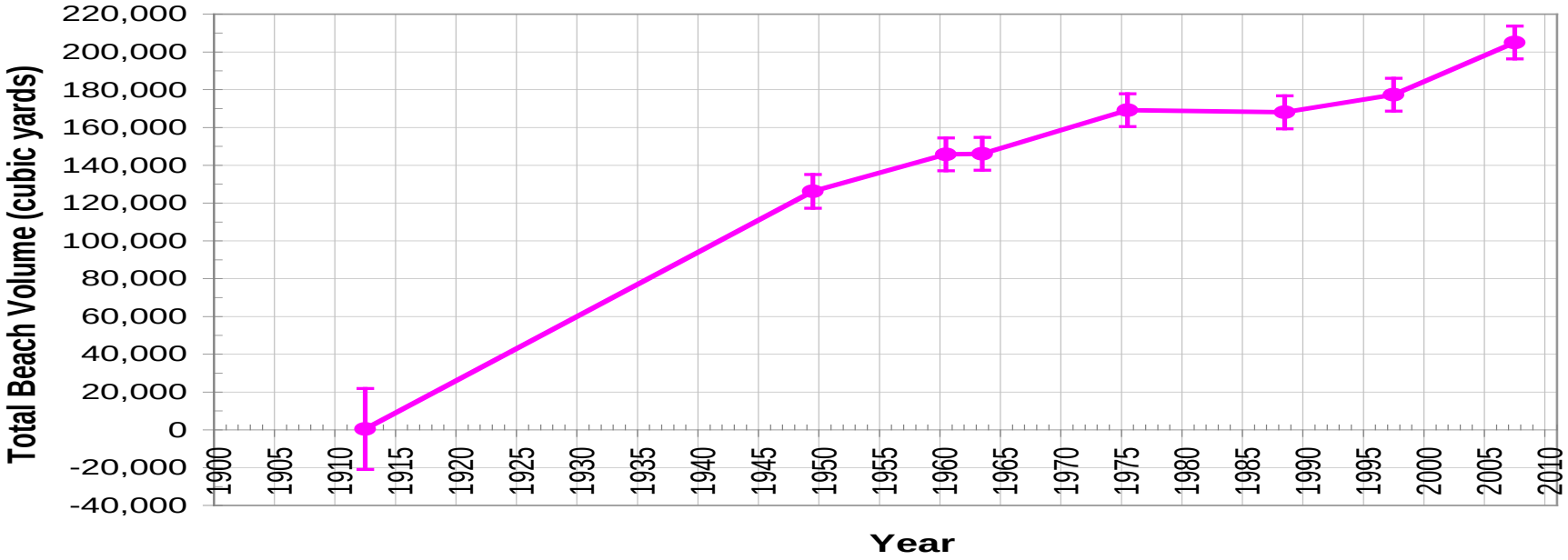
North Kihei Cell – Beach Volume History

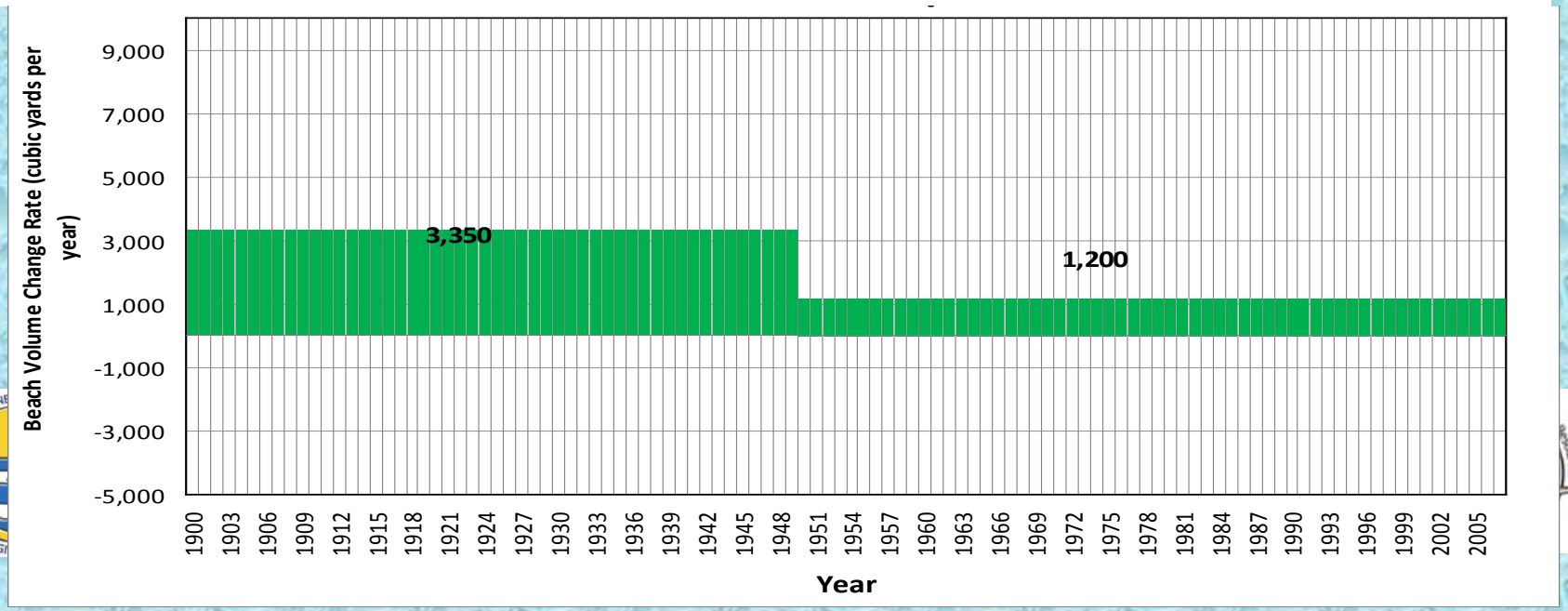




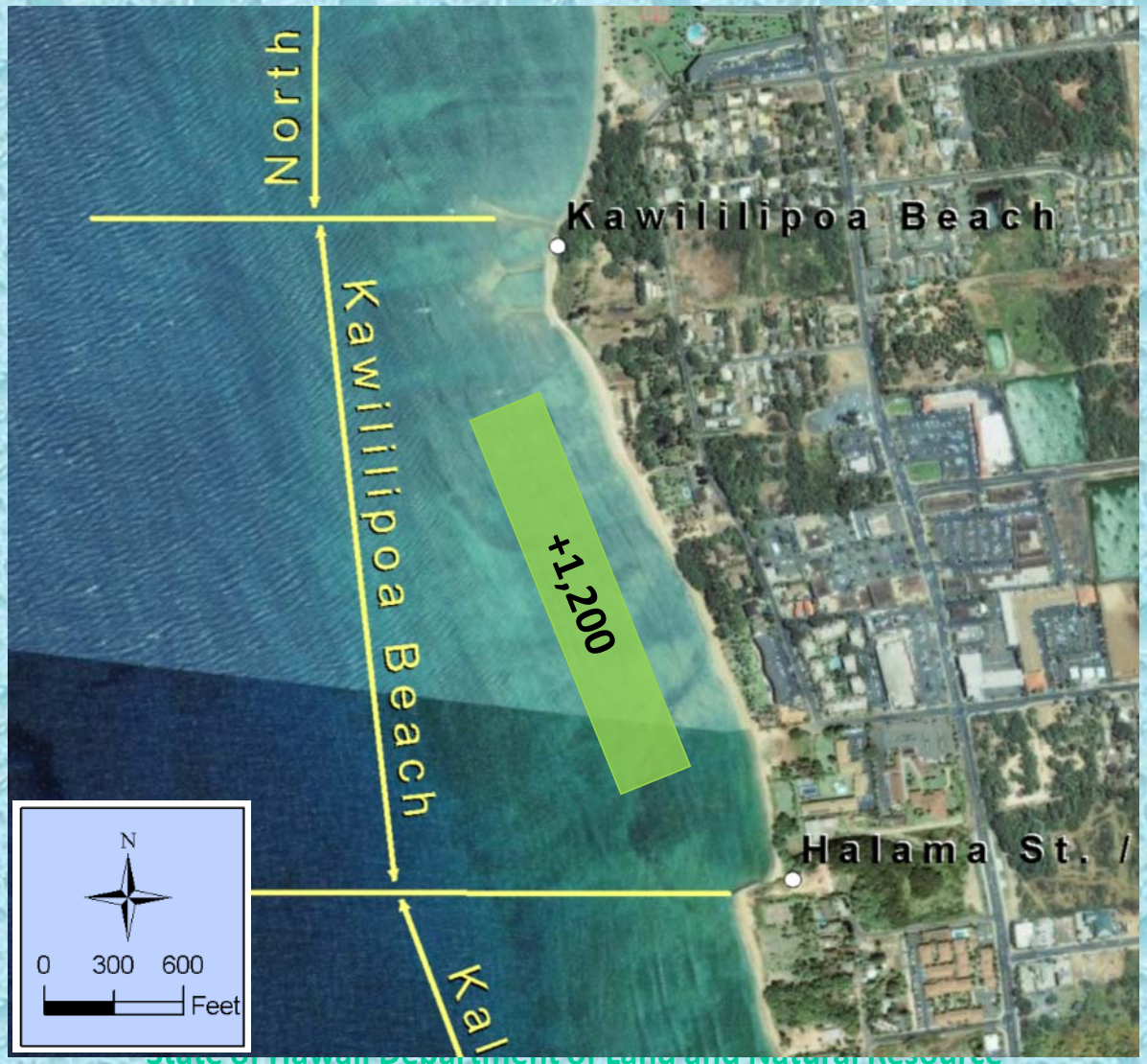
North Kihei – Beach Volume Change Rate

Kawililipoa – Beach Volume History





Kawililipoa– Beach Volume Change Rate



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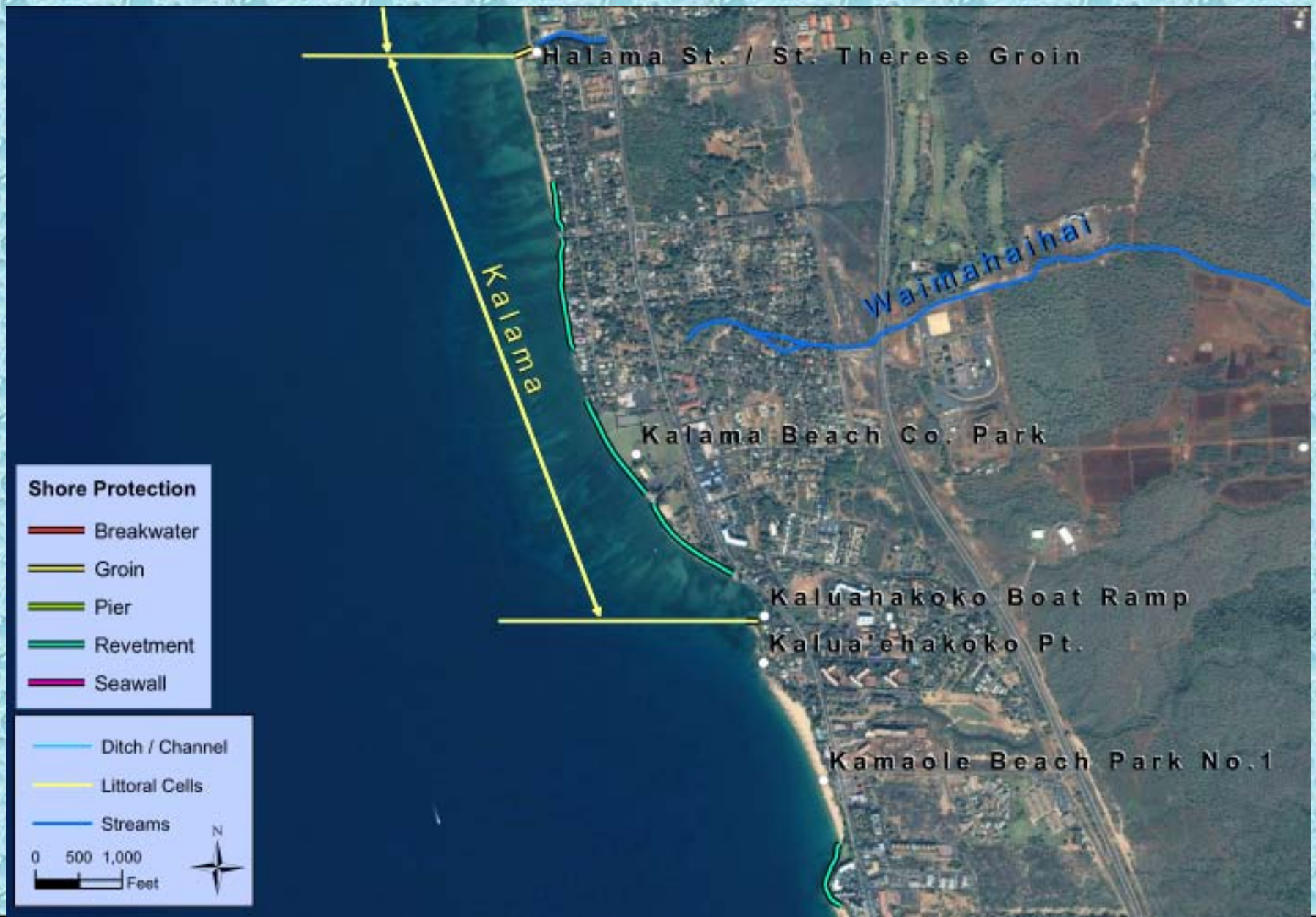
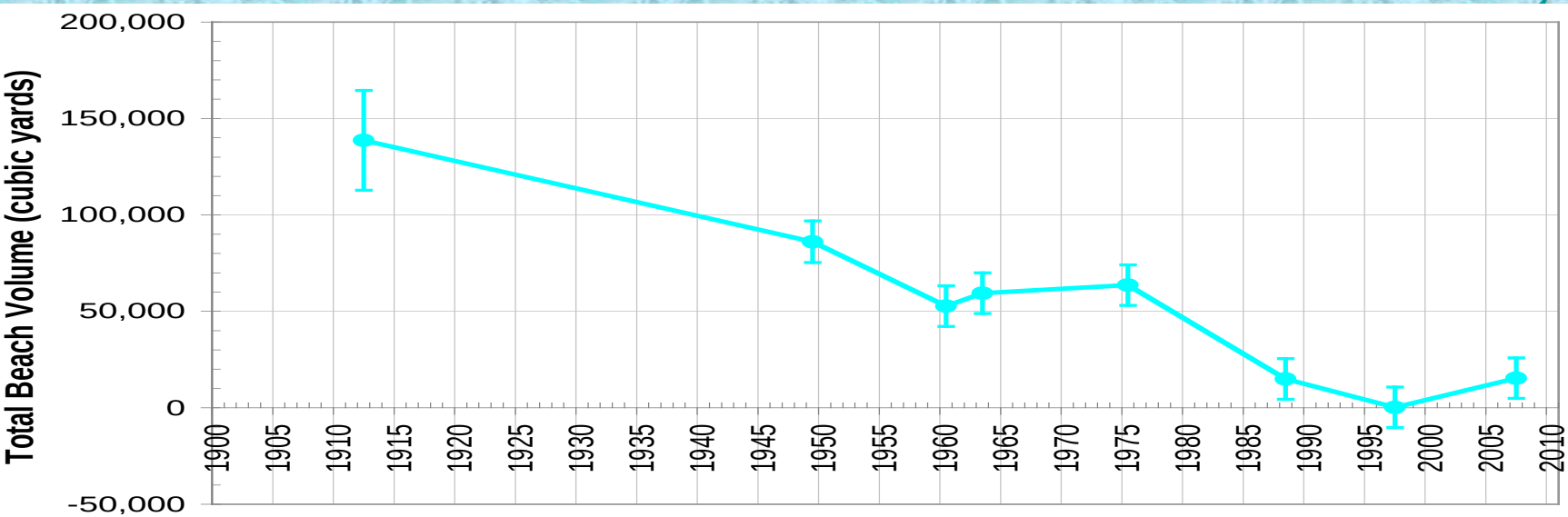
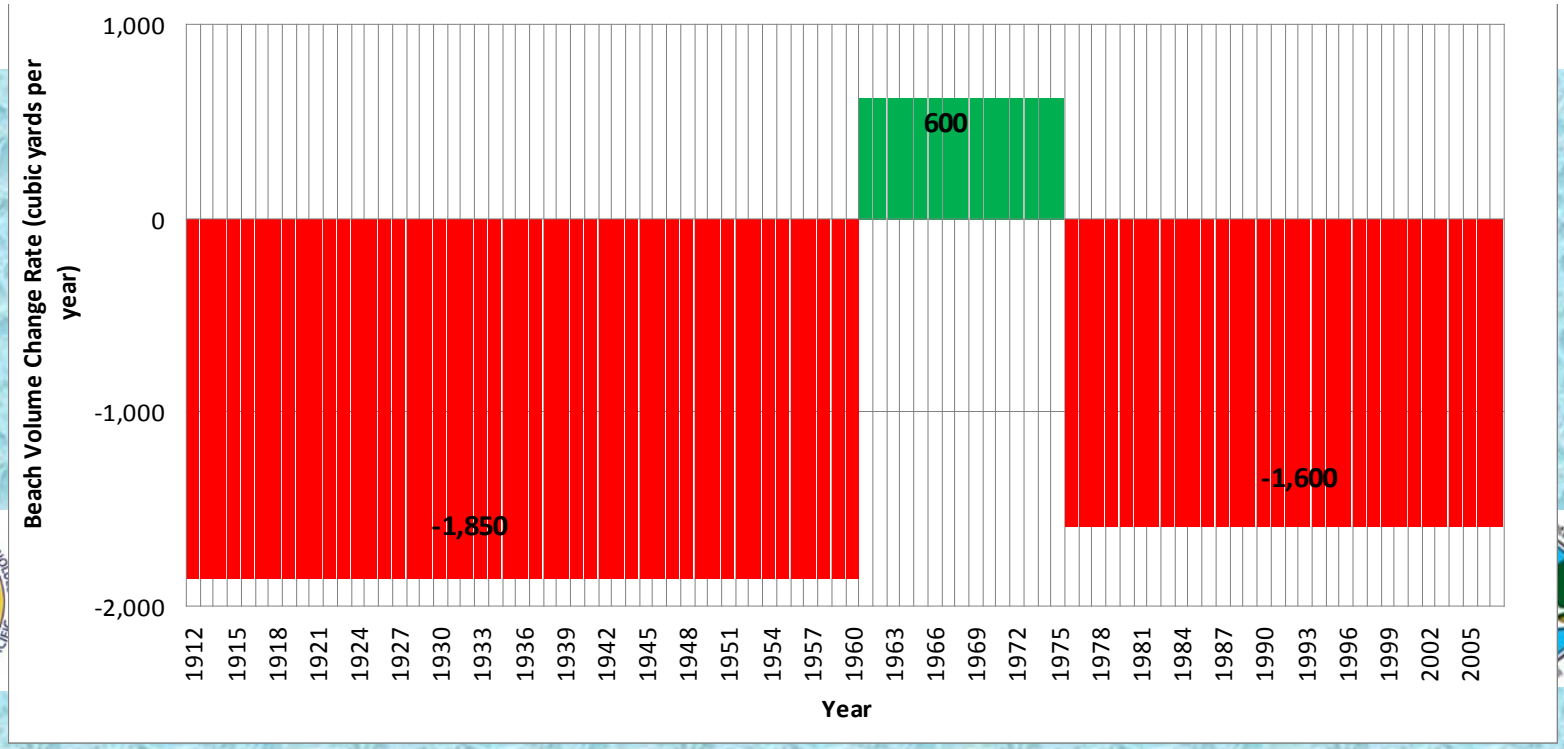
Kalama Cell – Shoreline Features

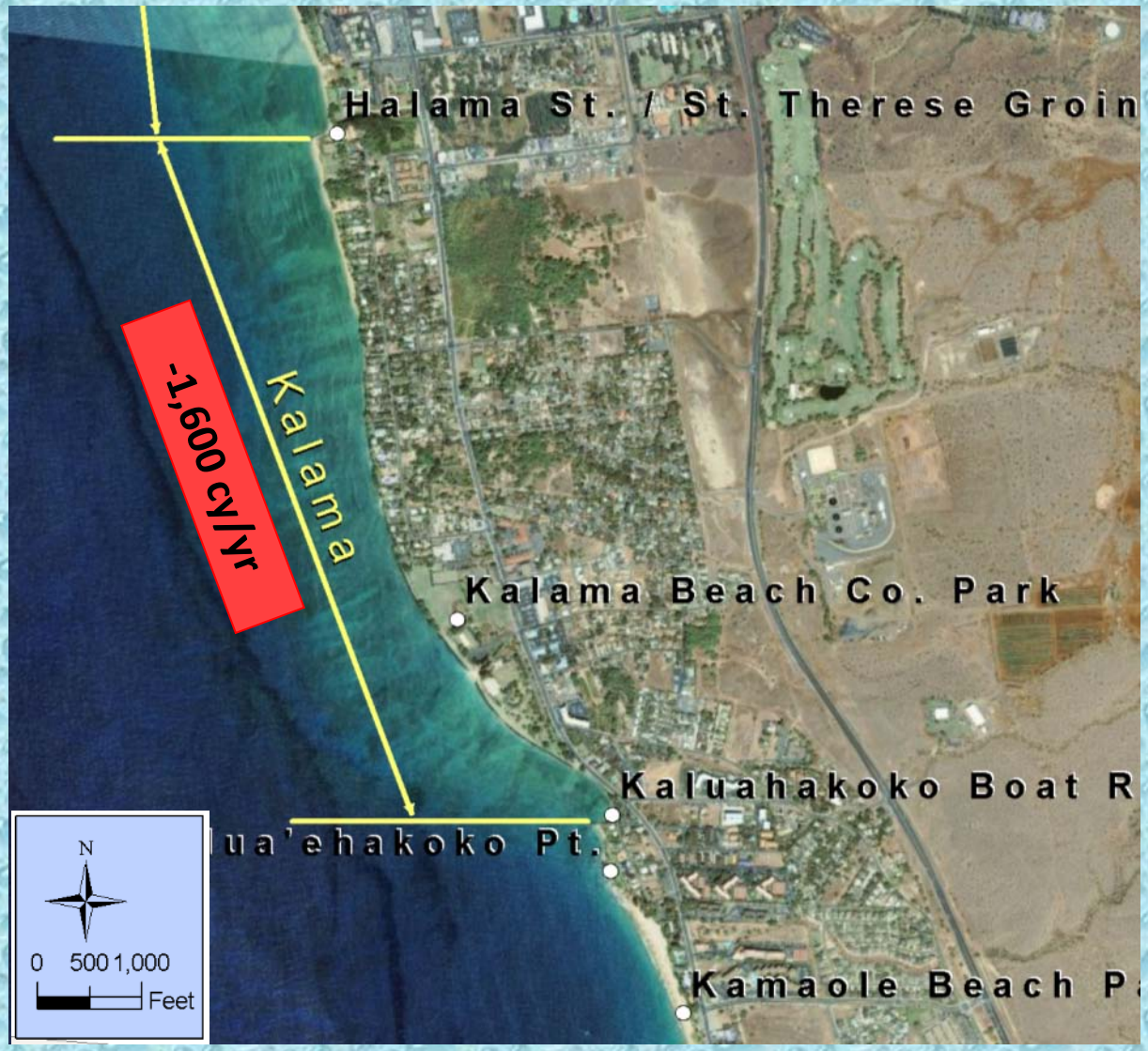


Kalama Cell – Beach Volume History





Kalama – Beach Volume Change Rate



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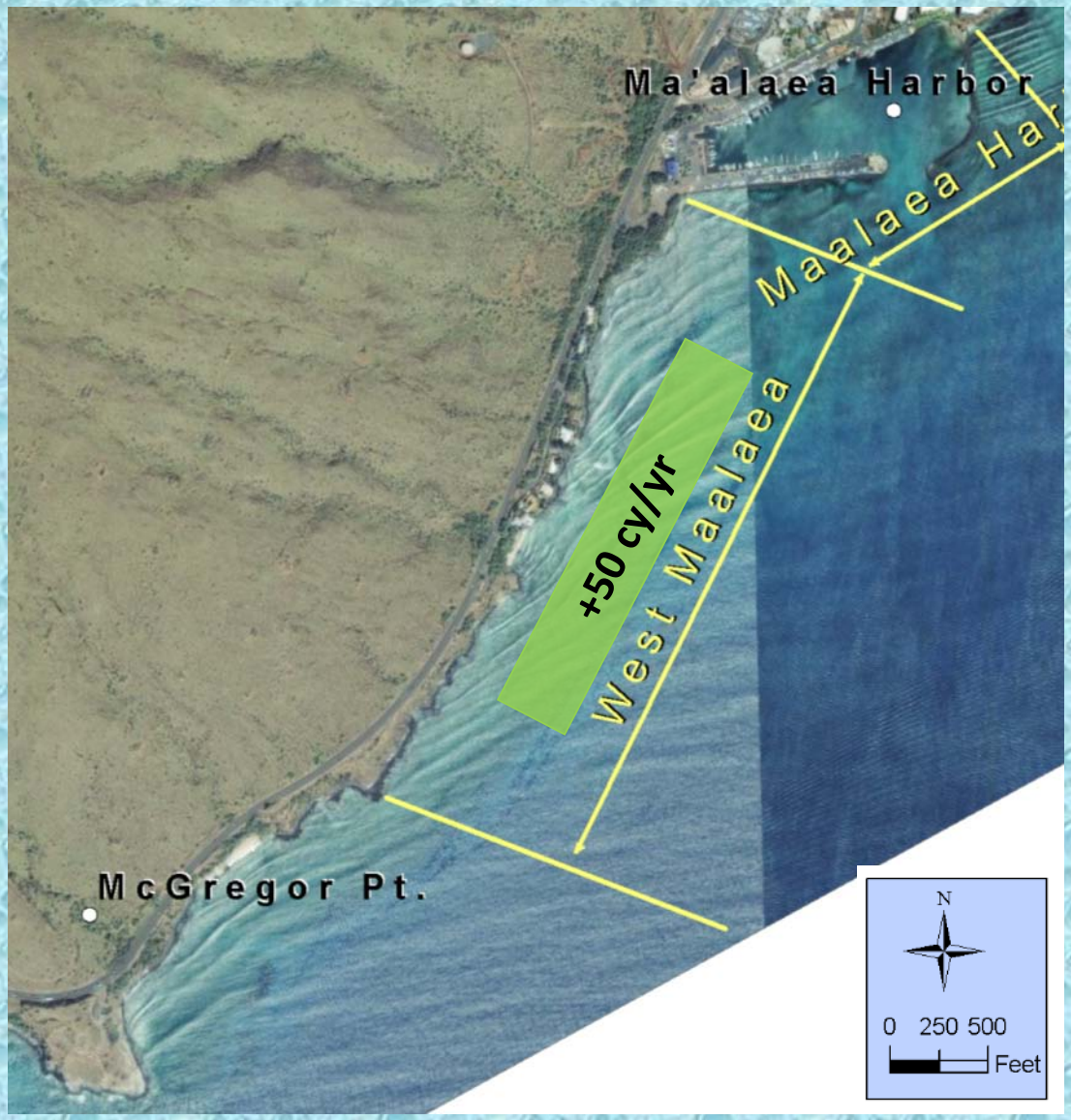
West Maalaea Cell – Beach Volume Change Rate



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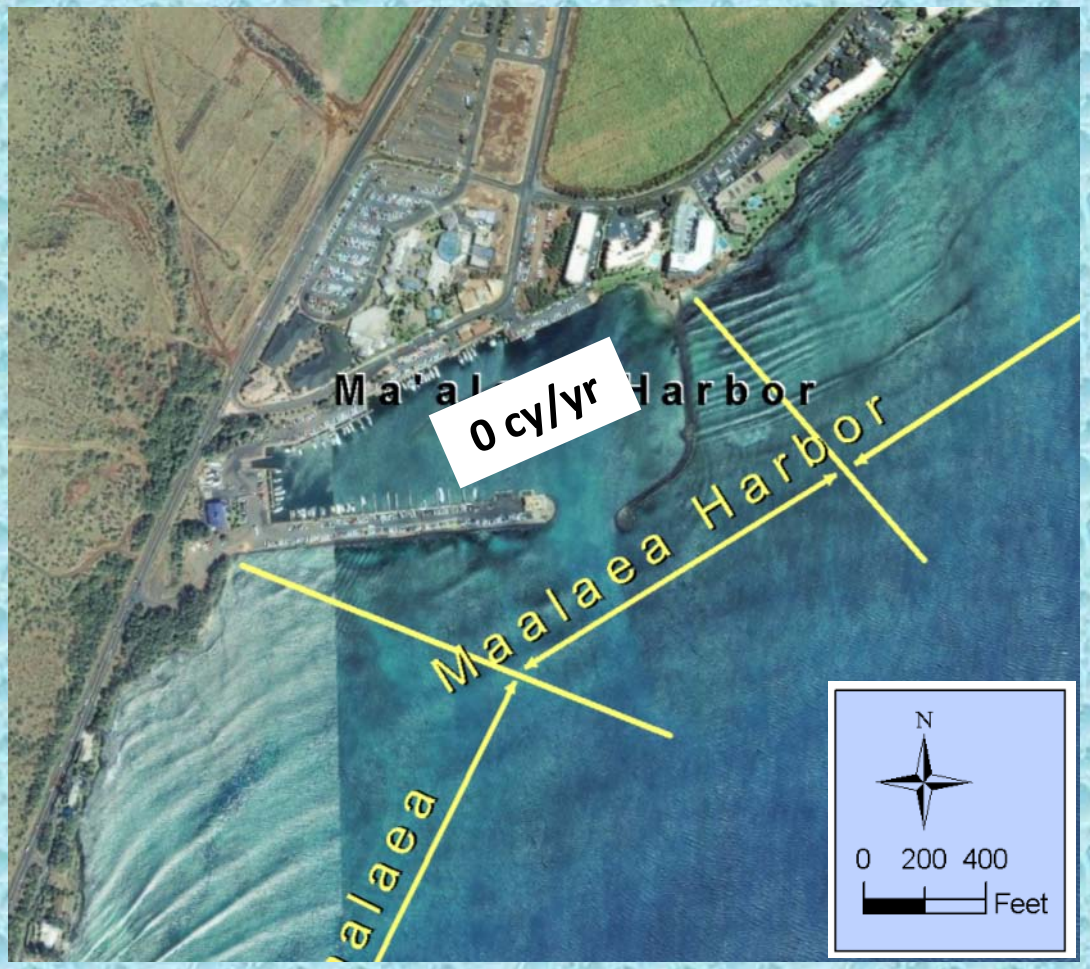
Maalaea Harbor – Beach Volume Change Rate



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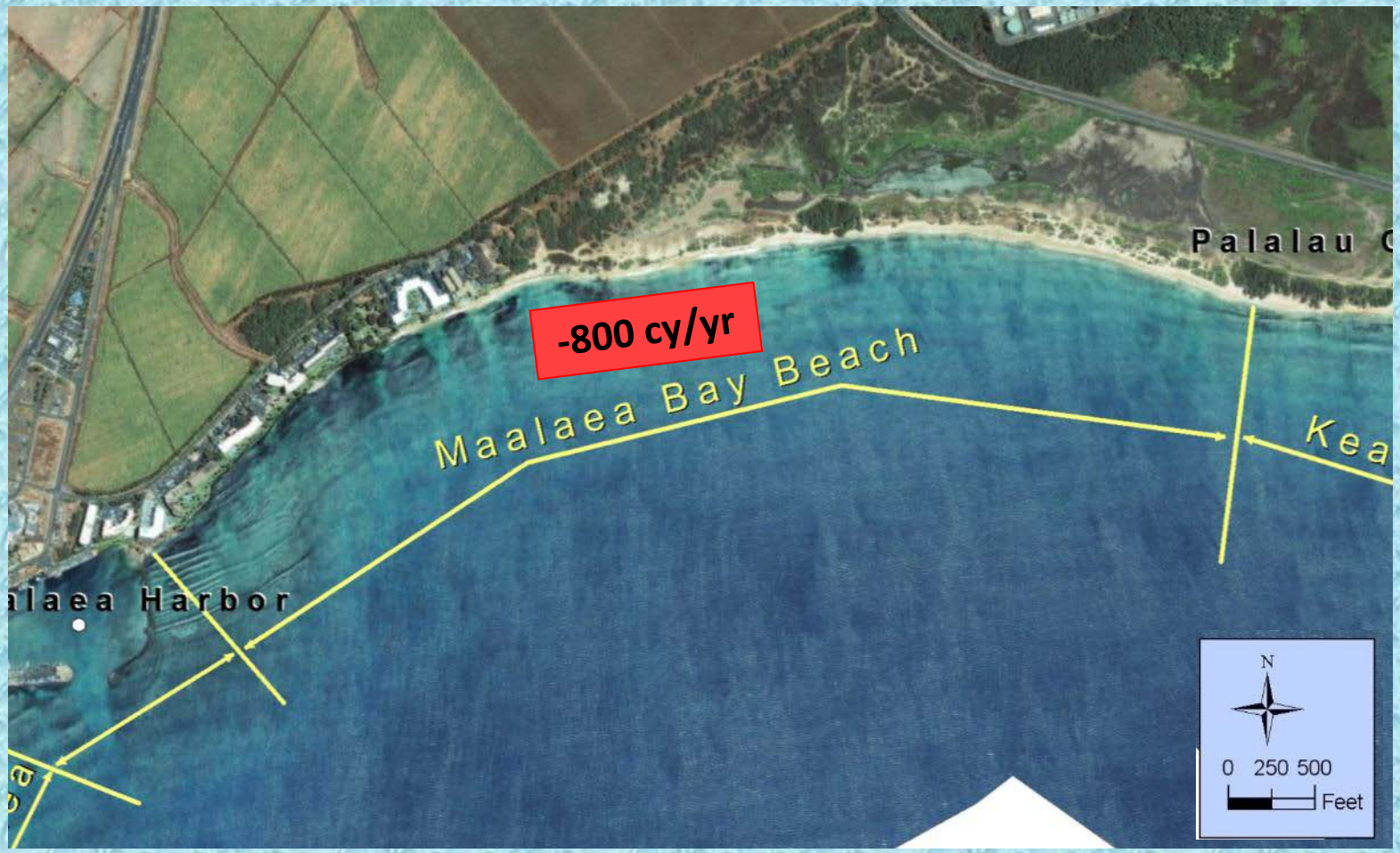
Maalaea Bay Beach –Volume Change Rate



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Kealia Cell– Beach Volume Change Rate

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Summary – Kihei Region

- North Kihei and Kawililipoa cells currently accretional
  - Although based on limited data points
- Kealia and Kalama have highest erosion rates within Kihei region
- Maalaea Bay Beach cell erosion rate has slowed since ~1950.

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Recommendations for Further Study

- Complete wave transformation and circulation modeling to define sediment transport directions.
- Develop data on sediment yields (inputs) from streams and rivers.
- Quantify losses associated with winds and dune breaching.
- Analyze grain size compatibility of beaches versus potential sand sources
- Perform jet probing of ocean sand sources

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Additional Slides – Kahului Region

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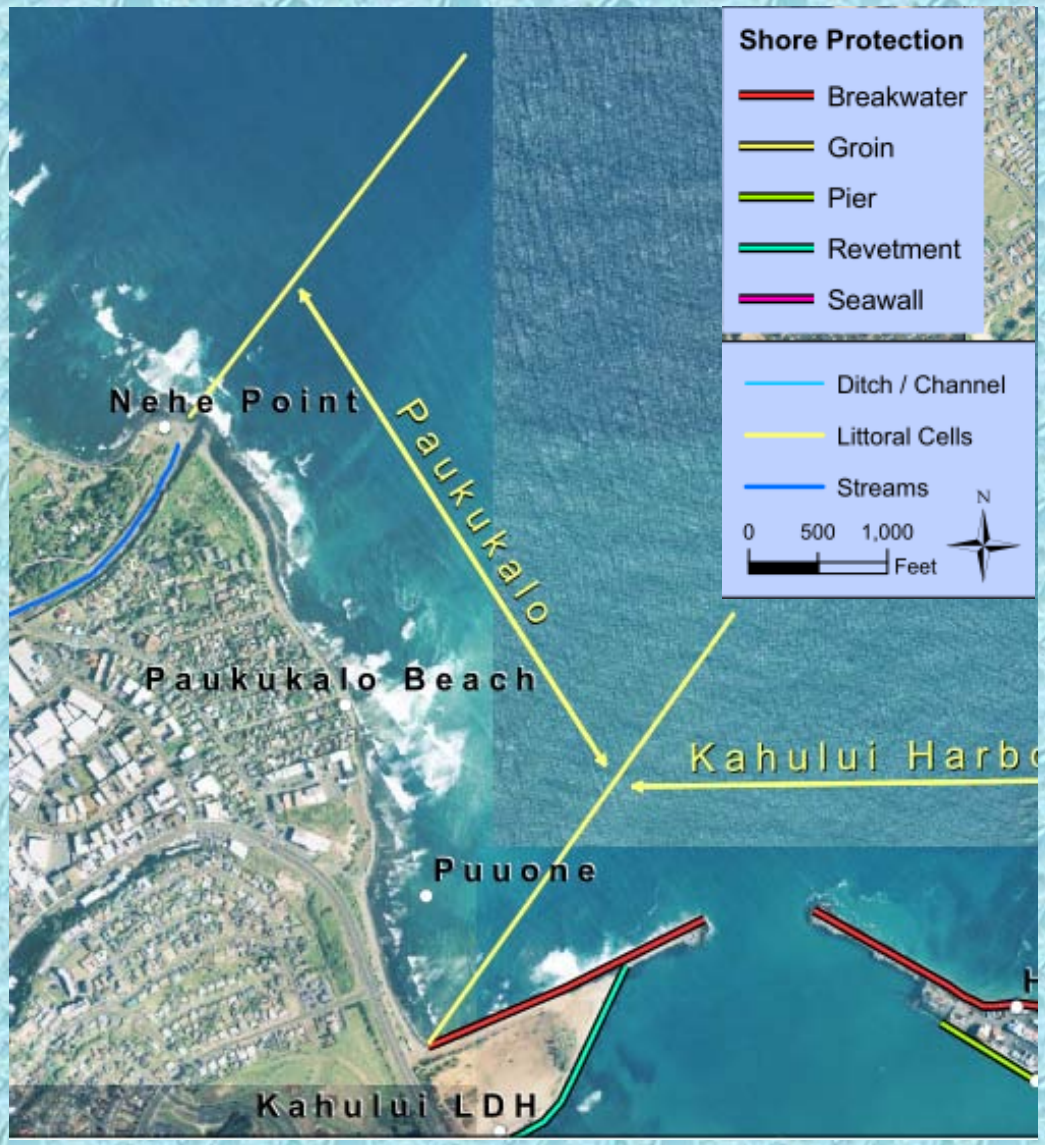
Paukukalo Cell - Shoreline Features



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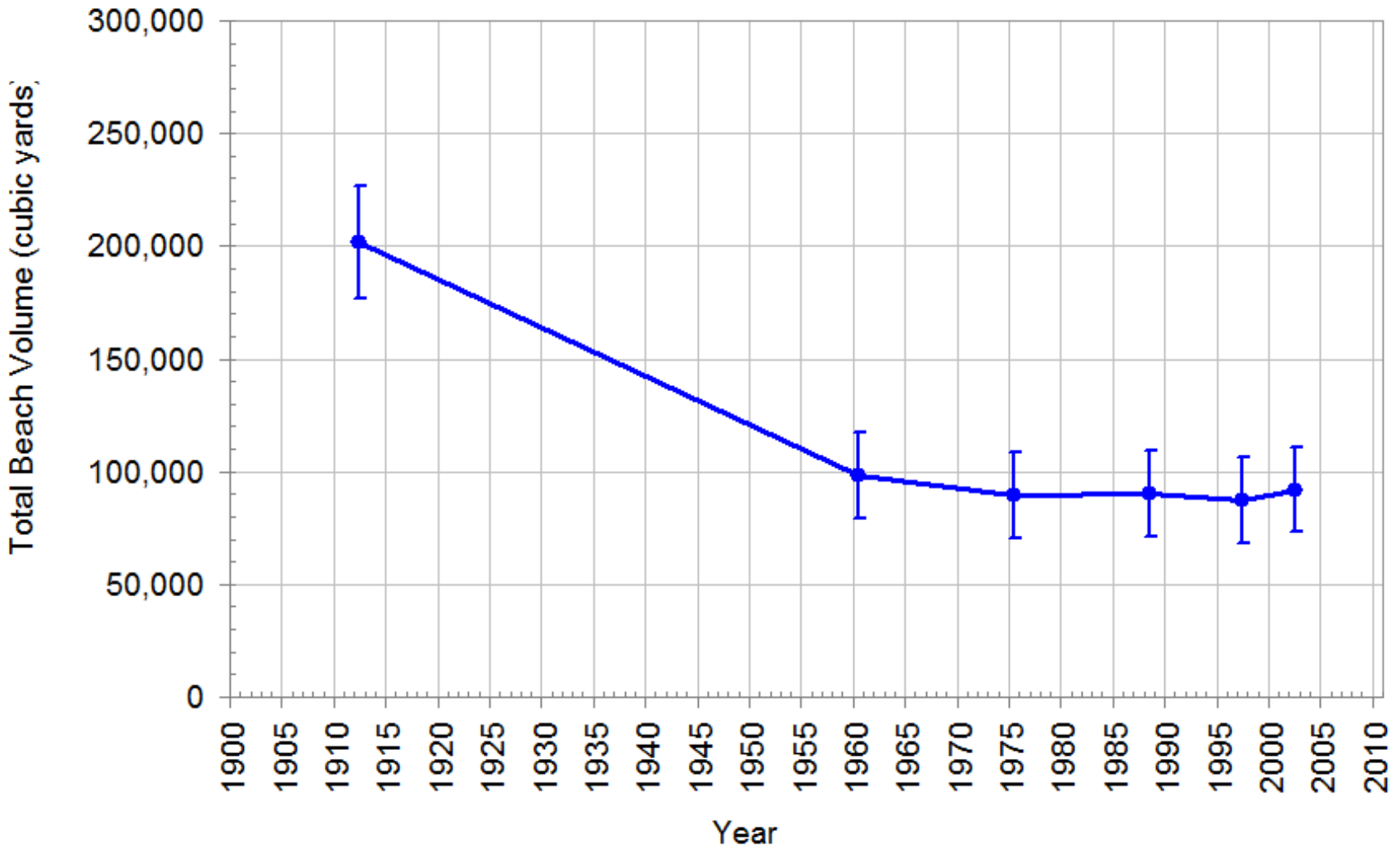
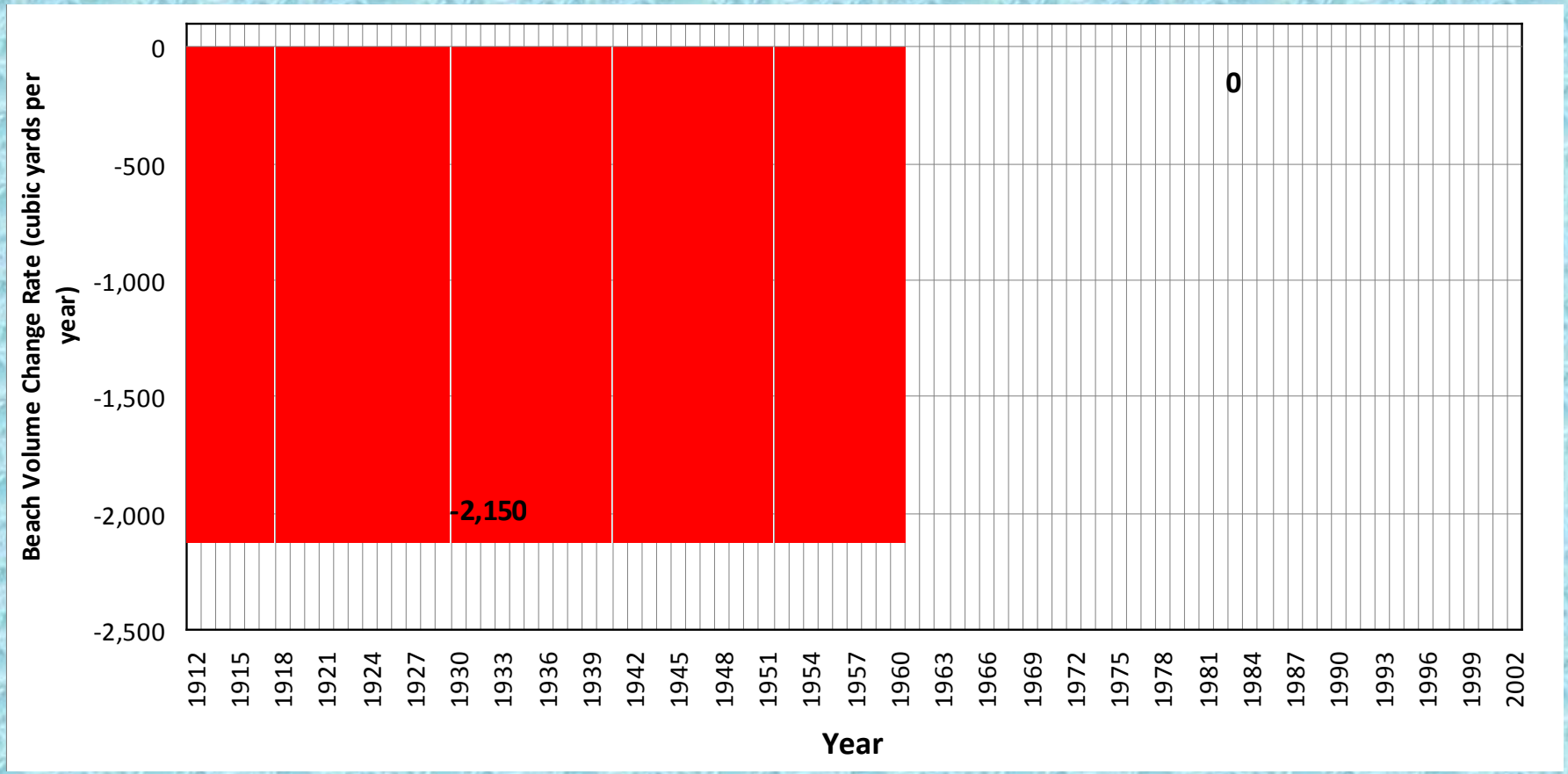
Paukukalo Cell – Beach Volume History



Paukukalo Cell – Beach Volume Change Rate History



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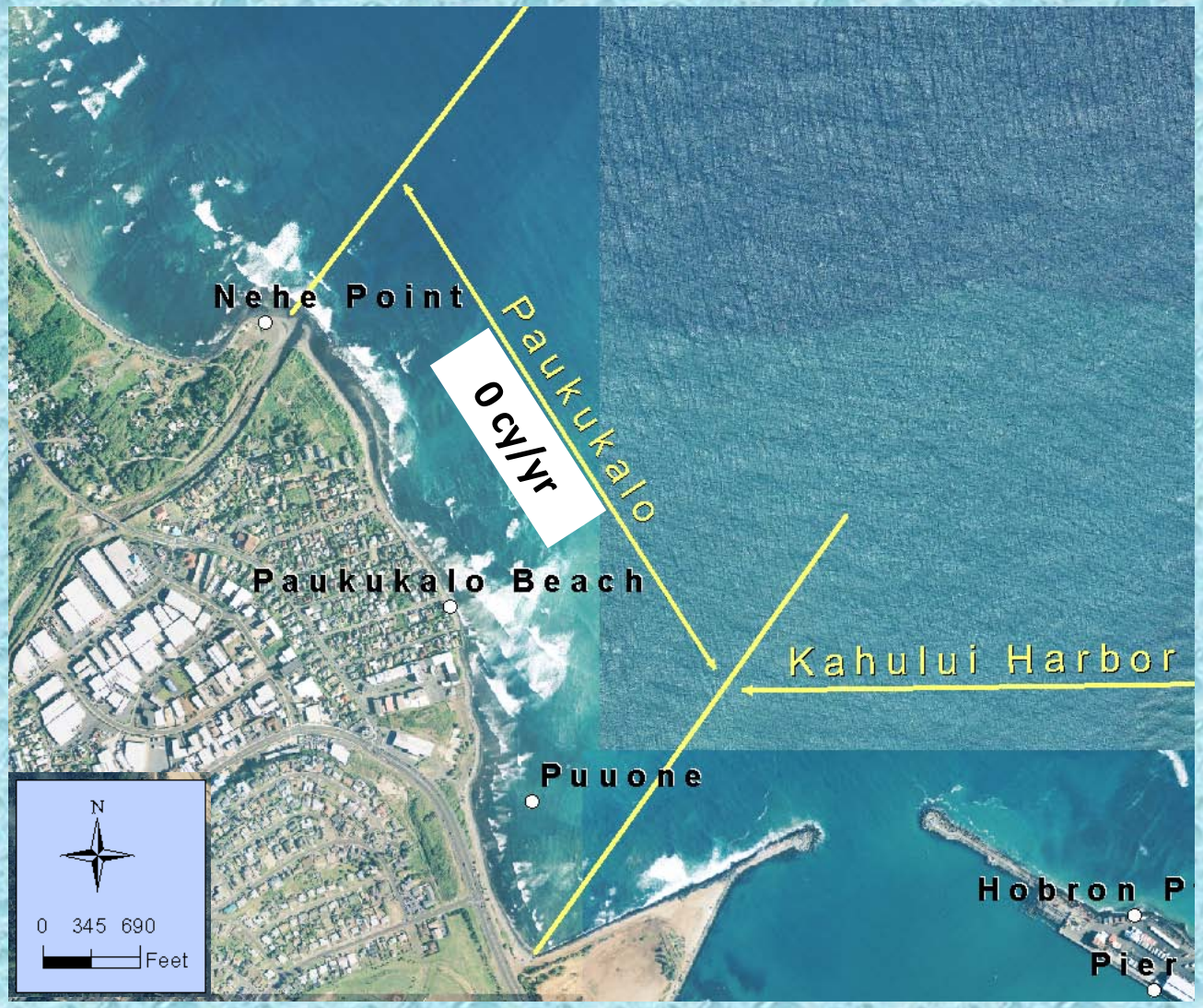
Paukukalo – Beach Volume Change Rate



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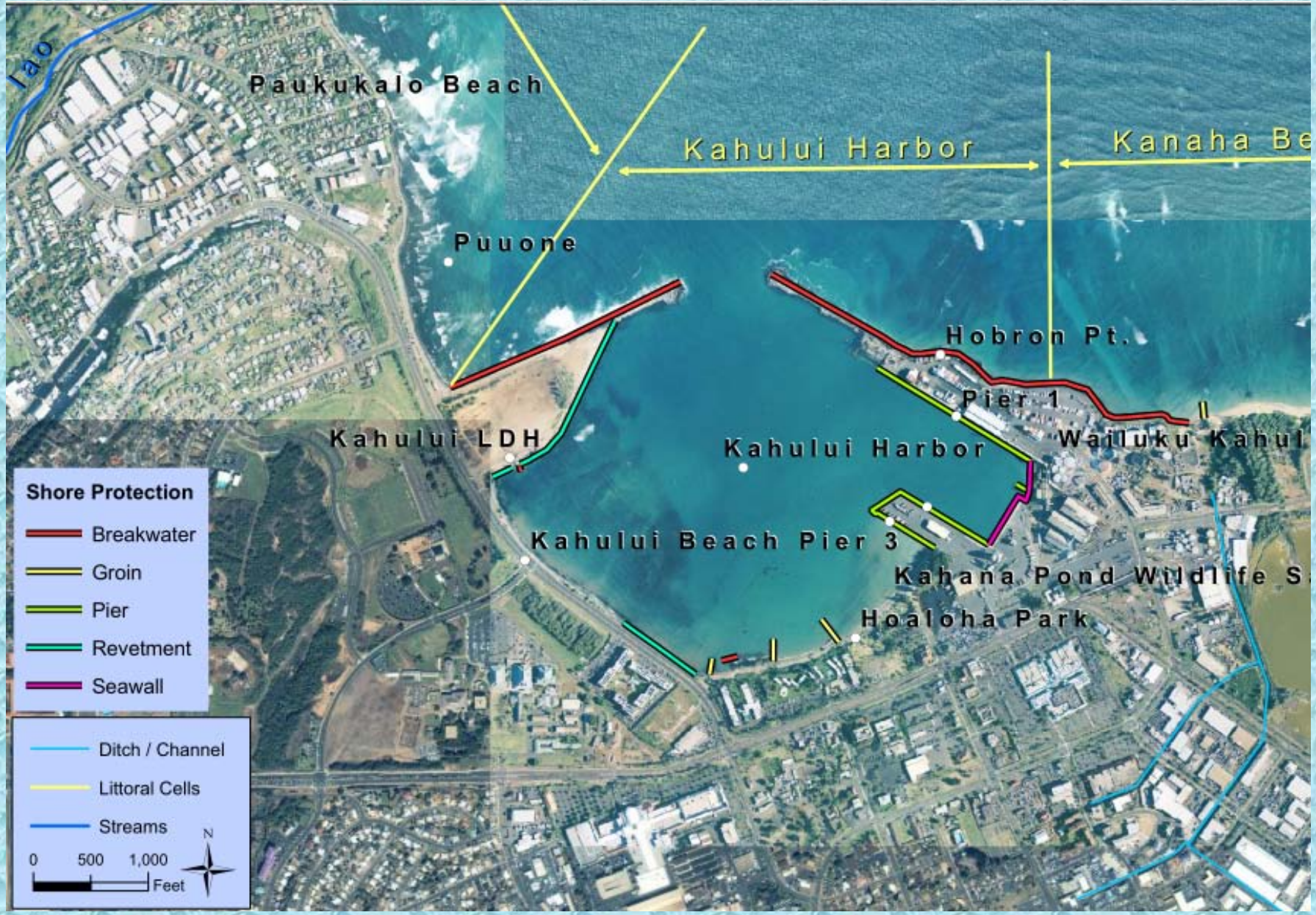
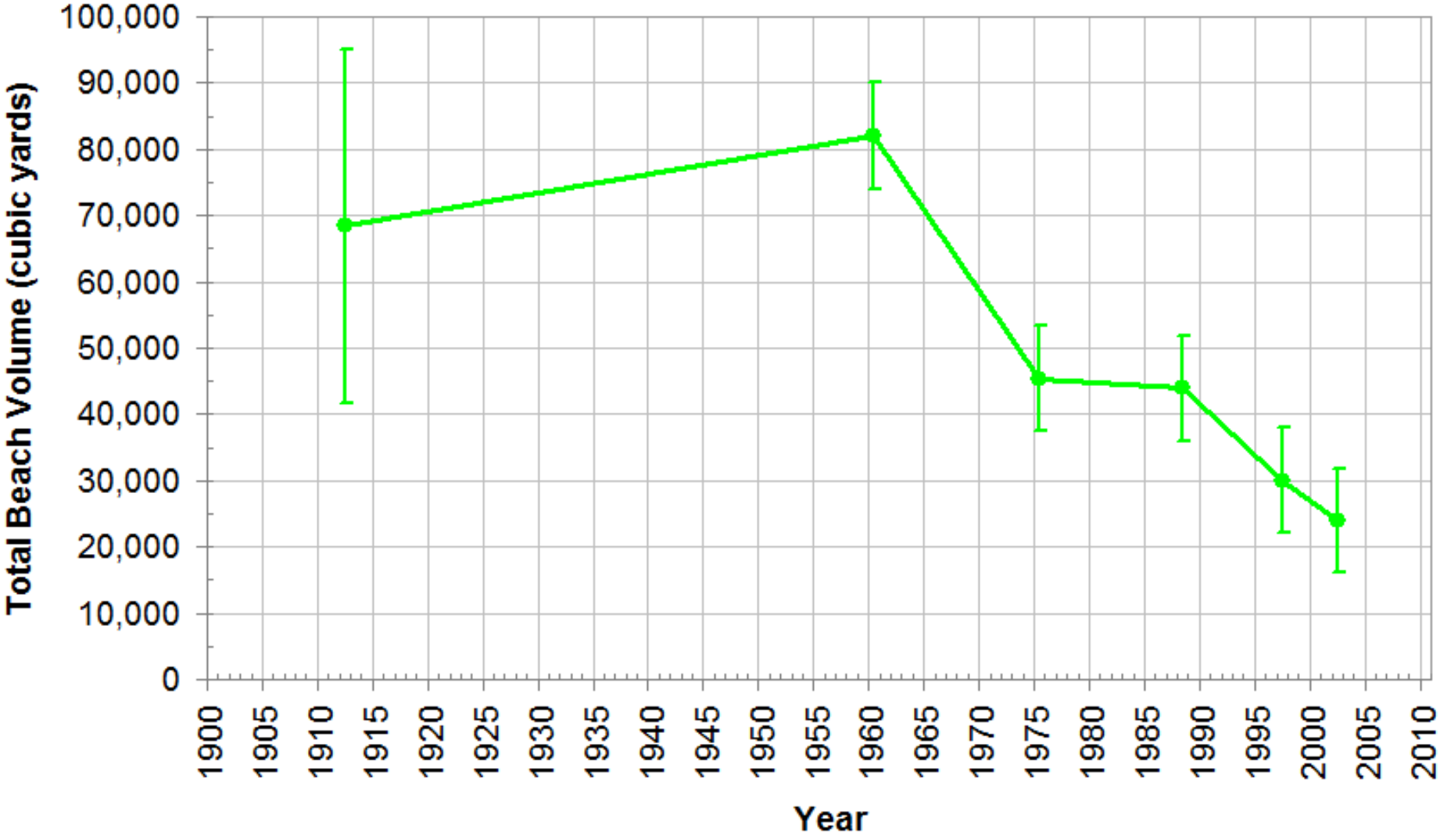
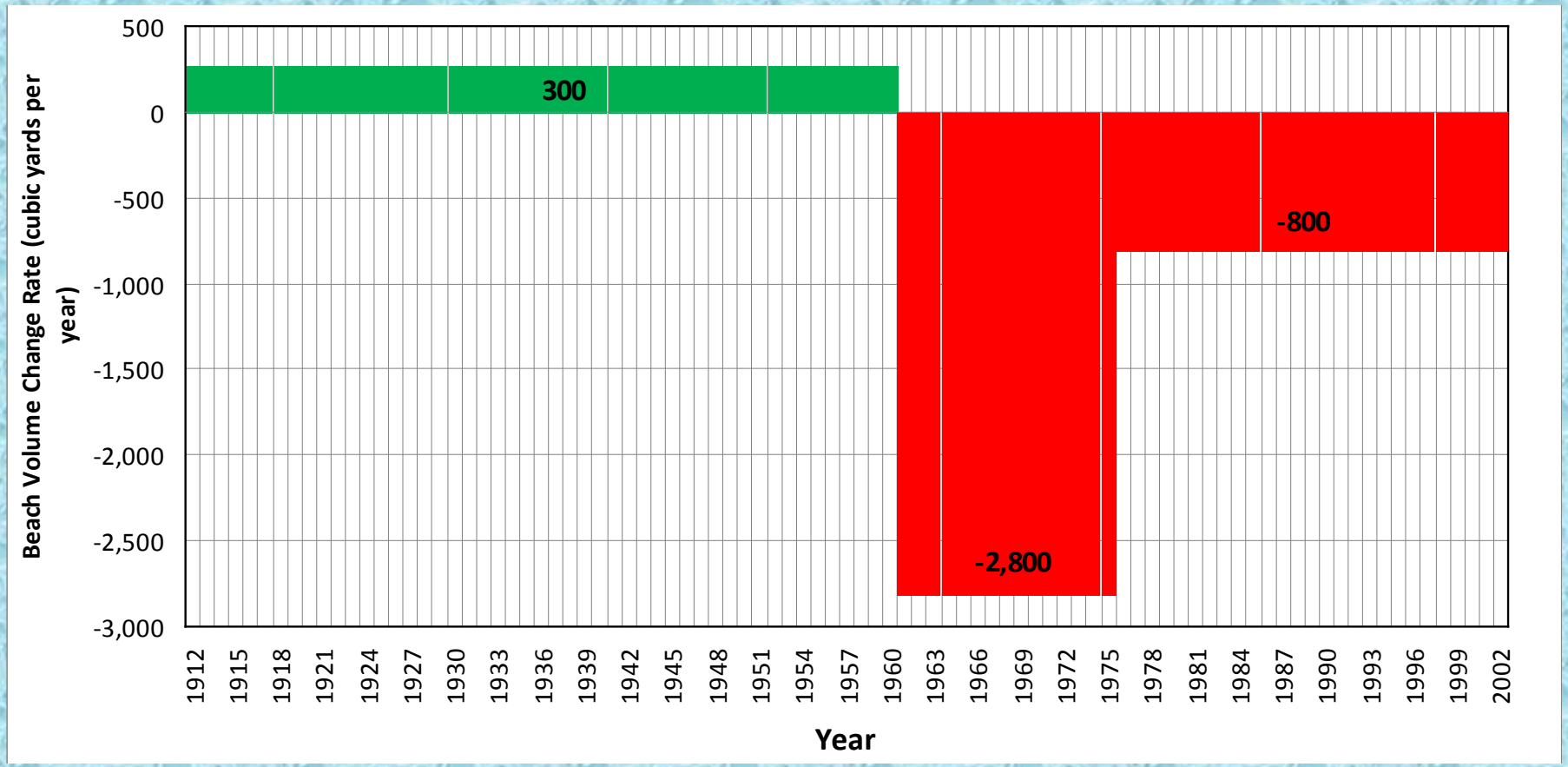
Kahului Harbor Cell – Shoreline Features



Kahului Harbor Cell – Beach Volume History



Kahului Harbor Cell – Beach Volume Change Rate History



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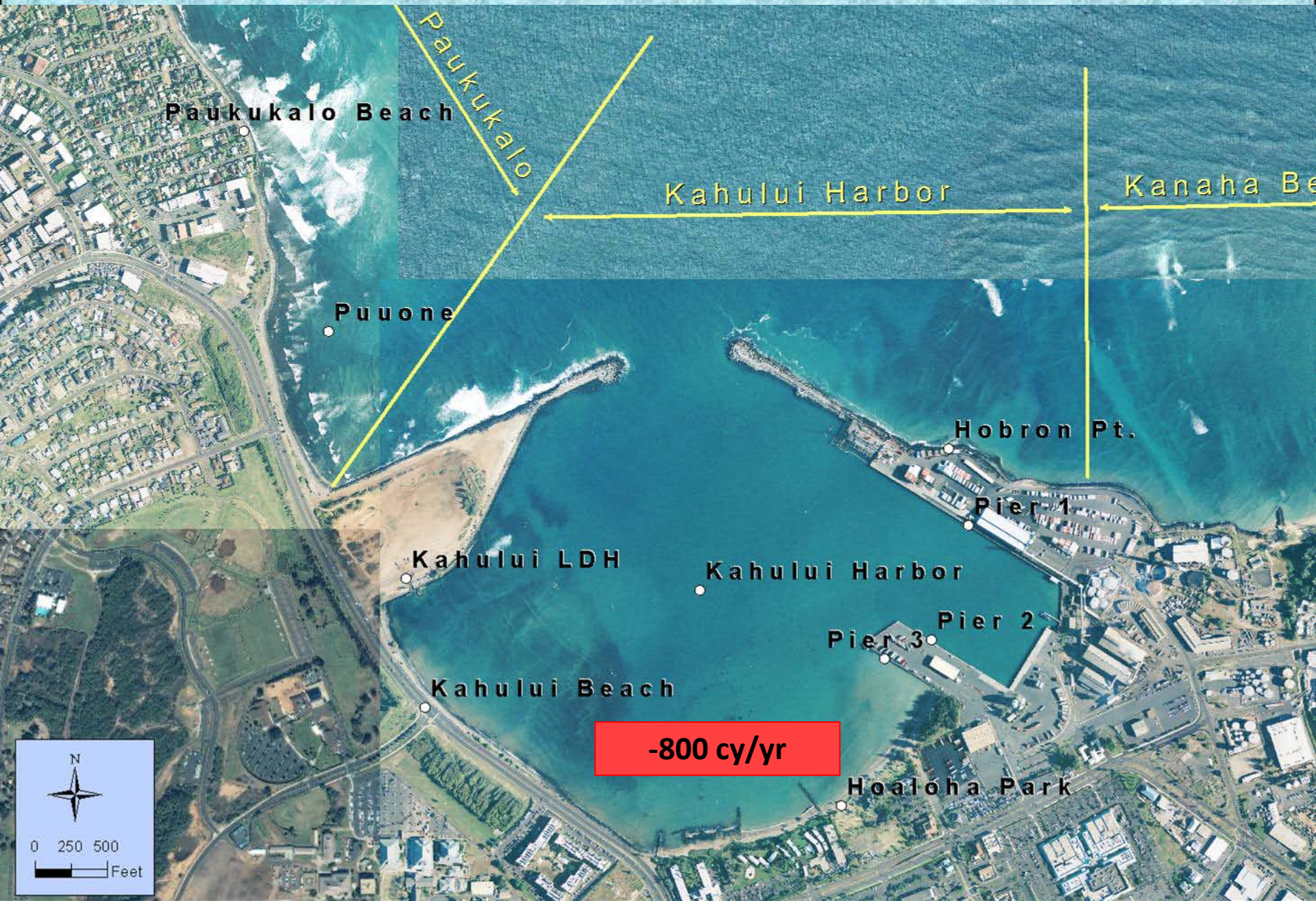
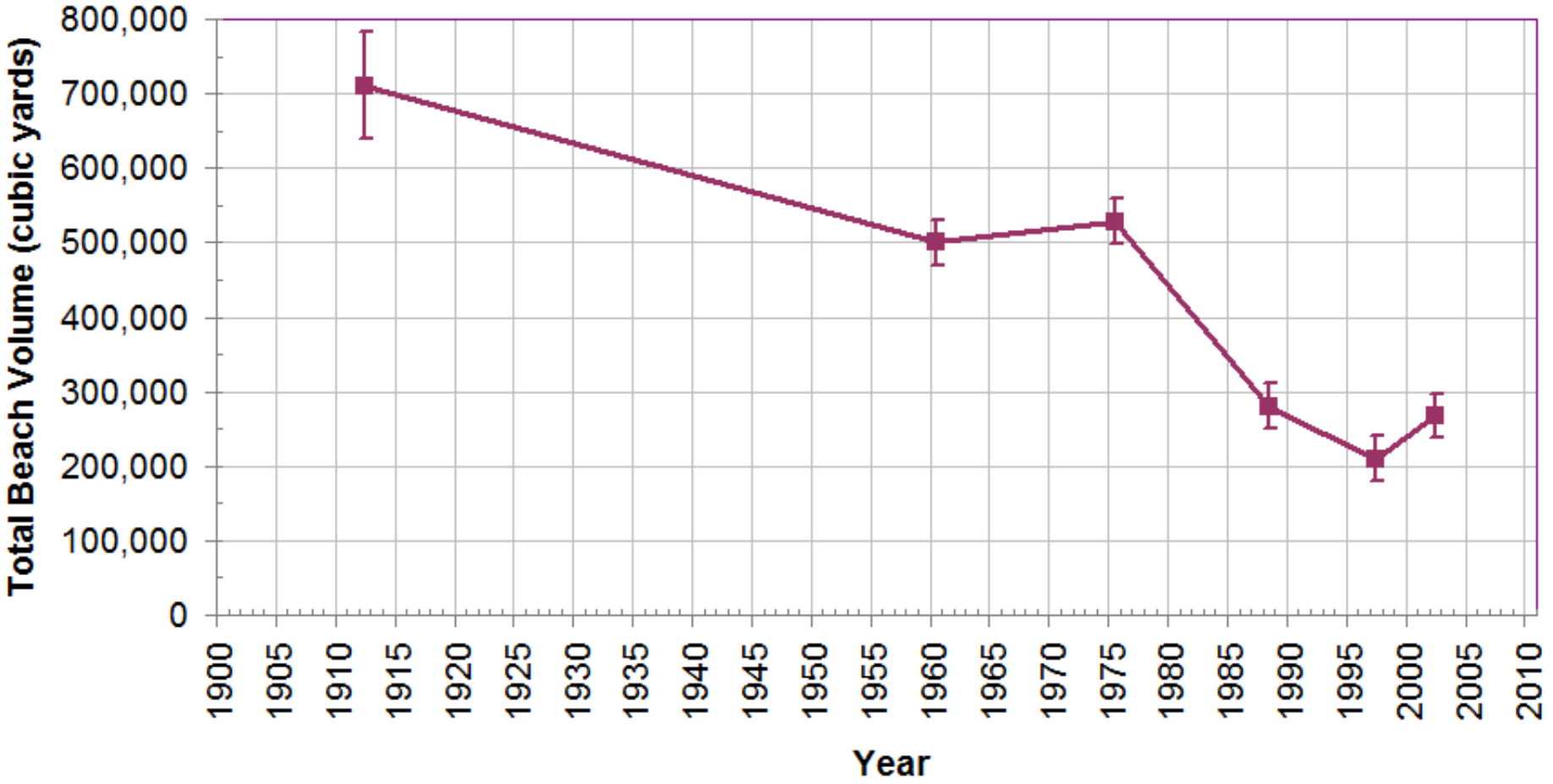
Kahului Harbor – Beach Volume Change Rate



Kanaha Beach Cell – Shoreline Features

Kanaha Cell – Beach Volume History



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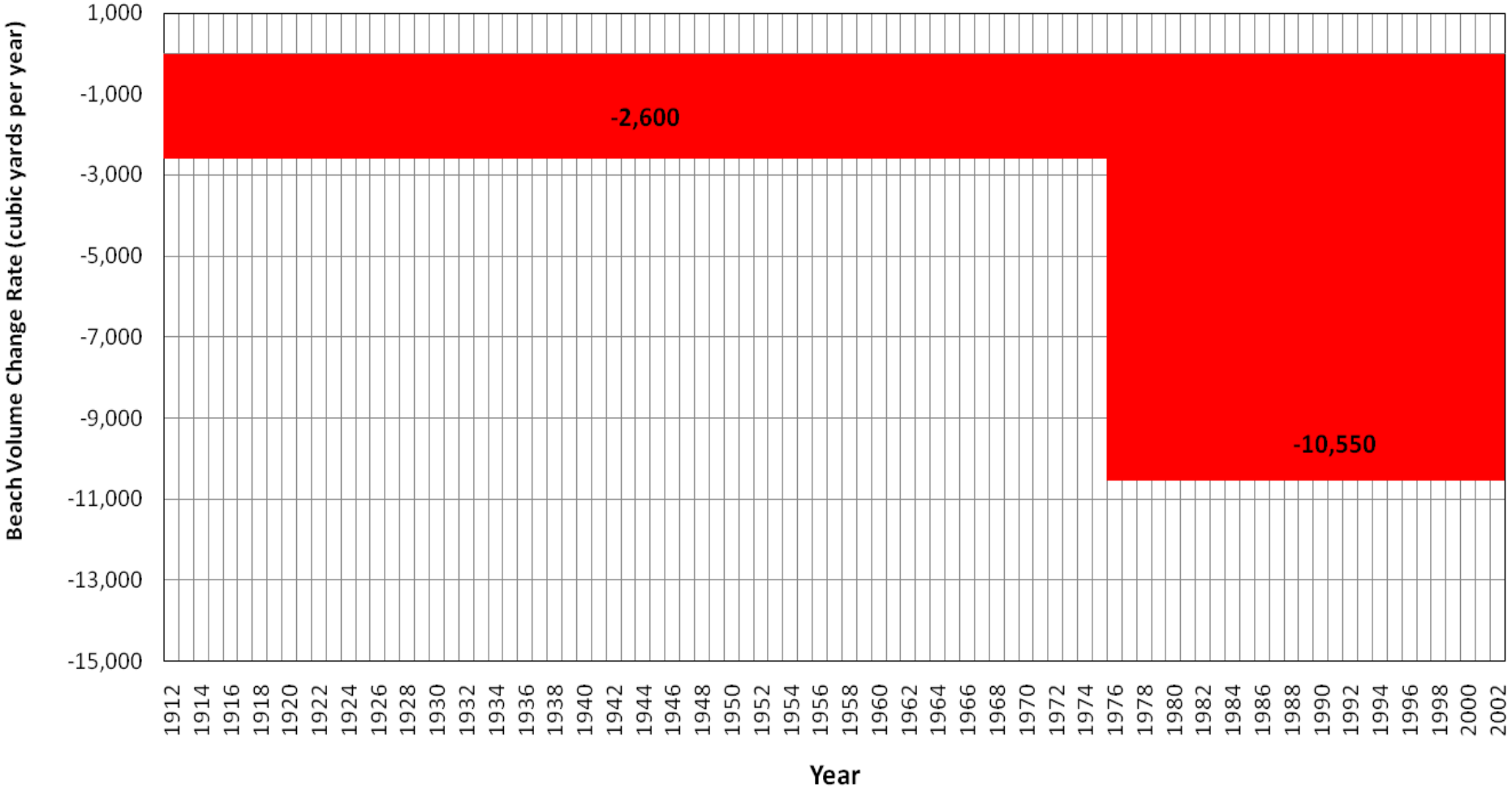
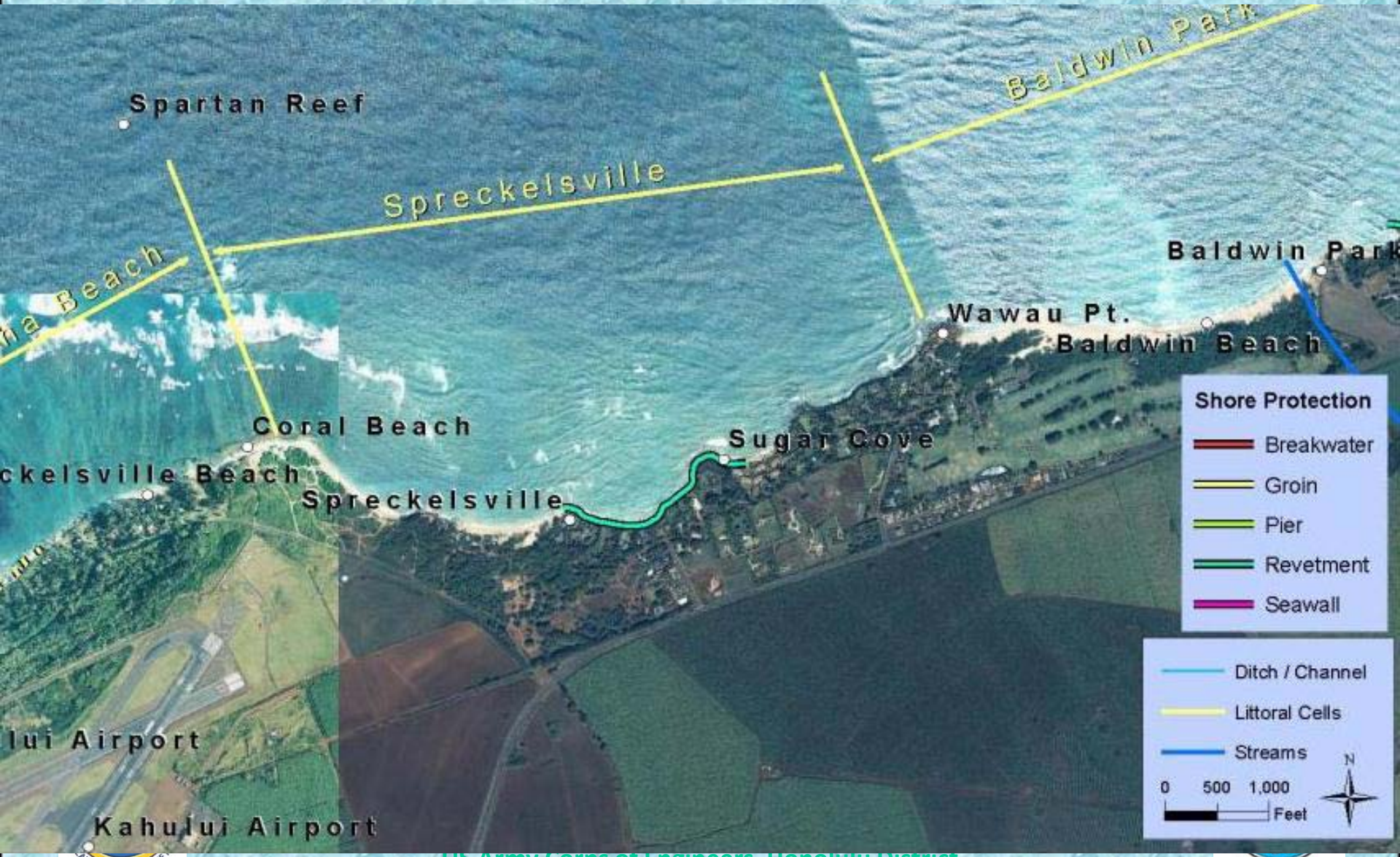
Kanaha Cell – Beach Volume Change Rate History

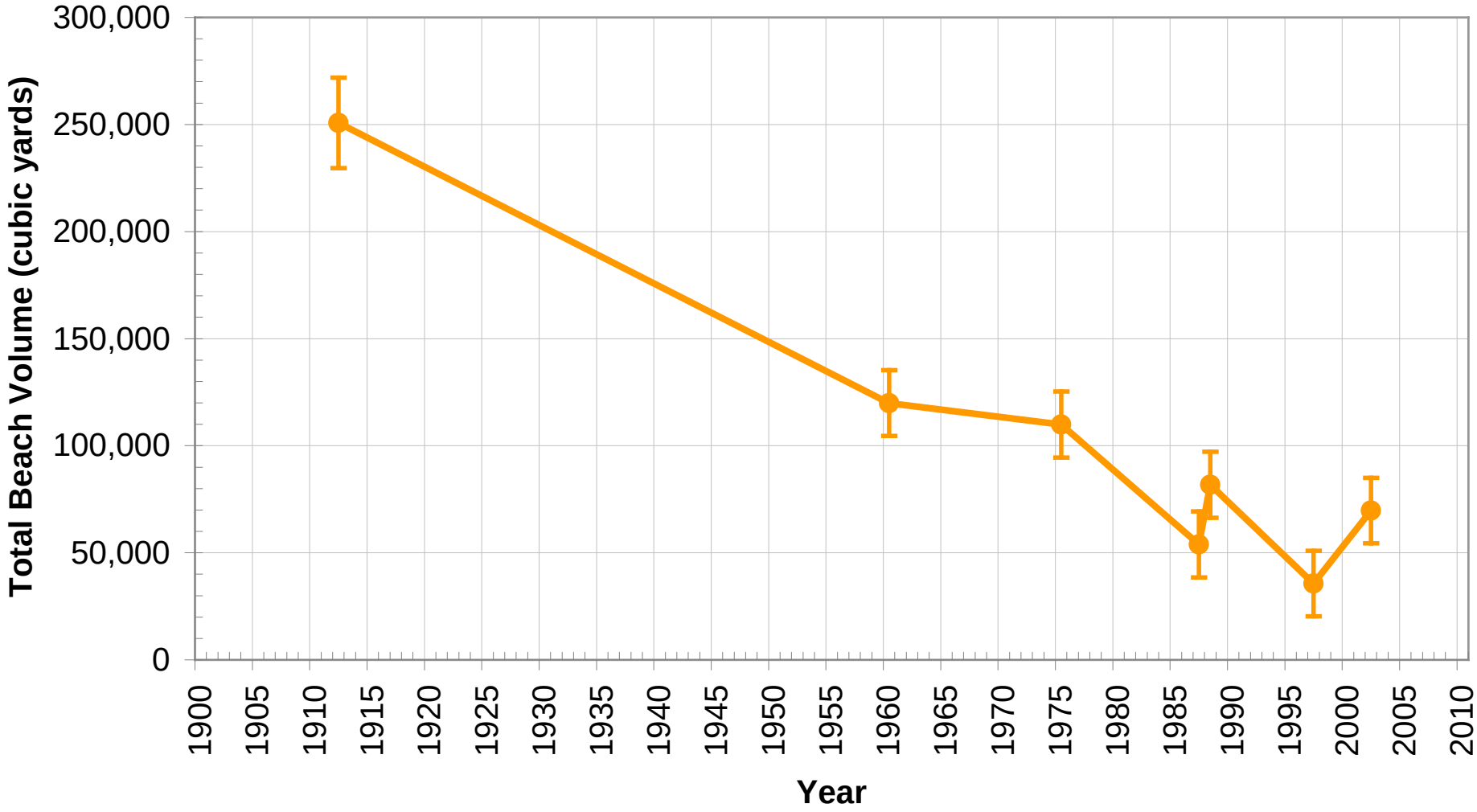


Kanaha Cell – Beach Volume Change Rate

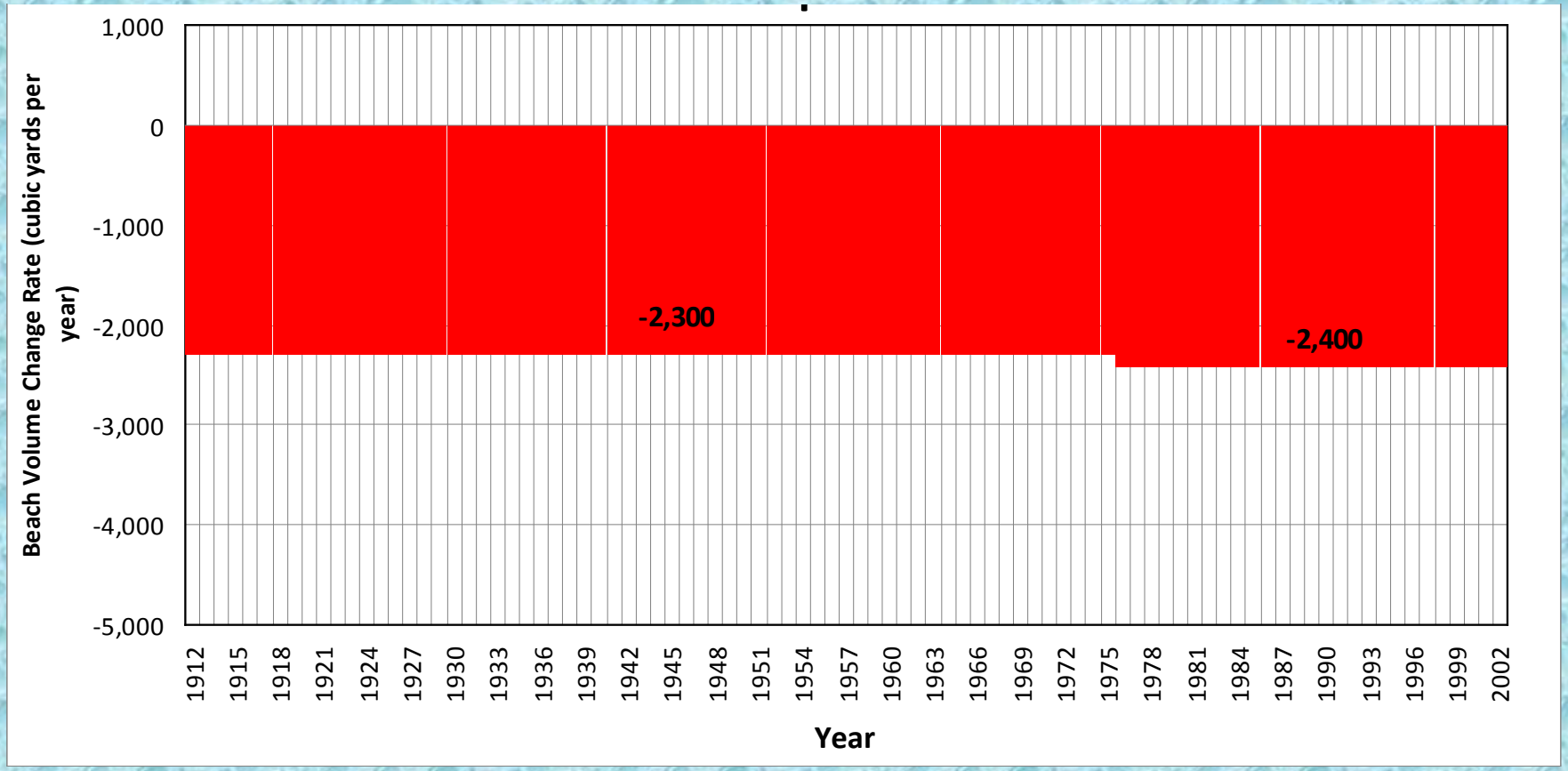
Specklesville Cell – Shoreline Features



Specklesville – Beach Volume History



Specklesville Cell – Beach Volume Change Rate History



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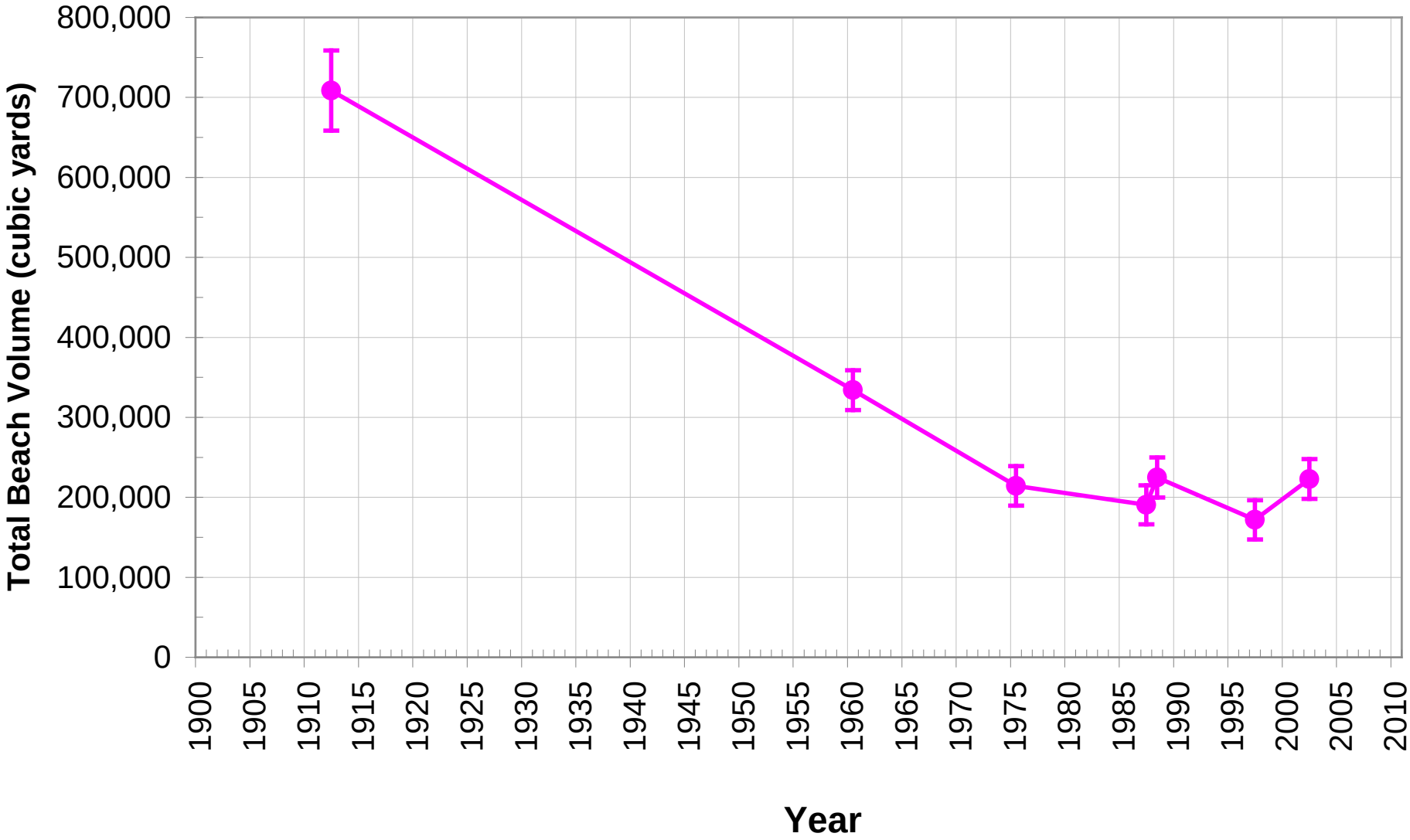
Specklesville– Beach Volume Change Rate

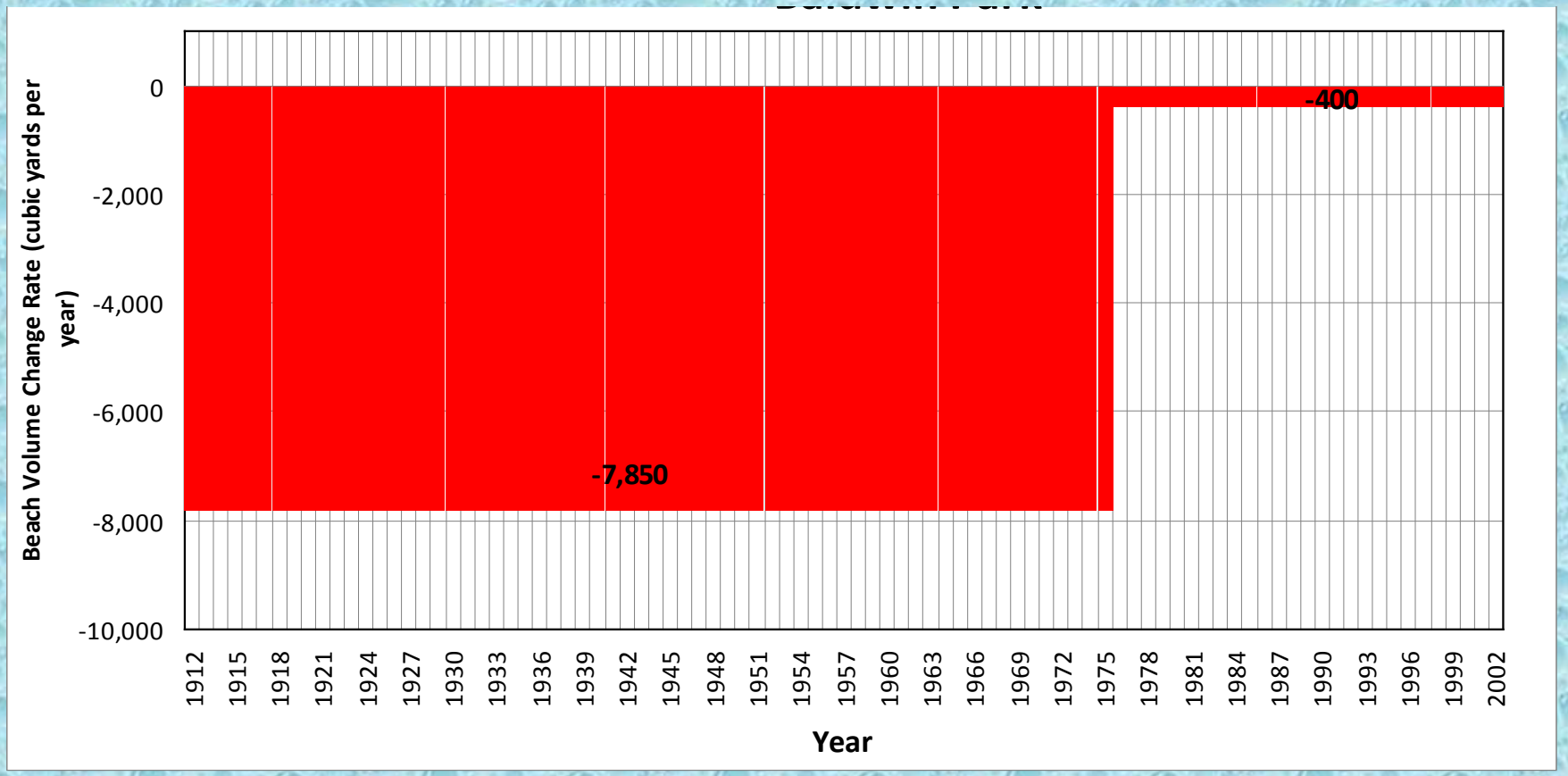
US Army Corps of Engineers, Honolulu District

Baldwin Park Cell – Shoreline Features

Baldwin Park – Beach Volume History



Baldwin Park Cell – Beach Volume Change Rate History



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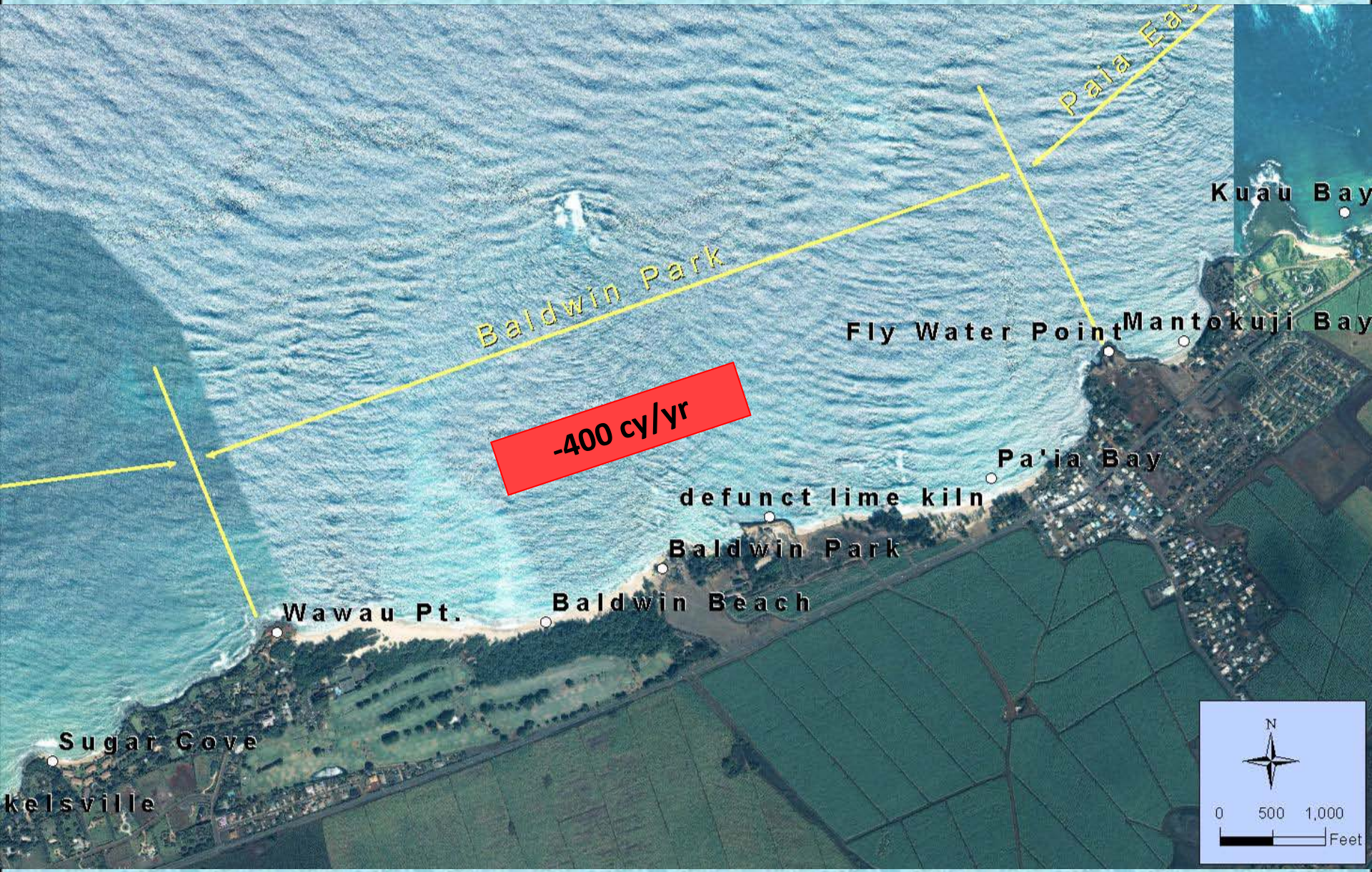
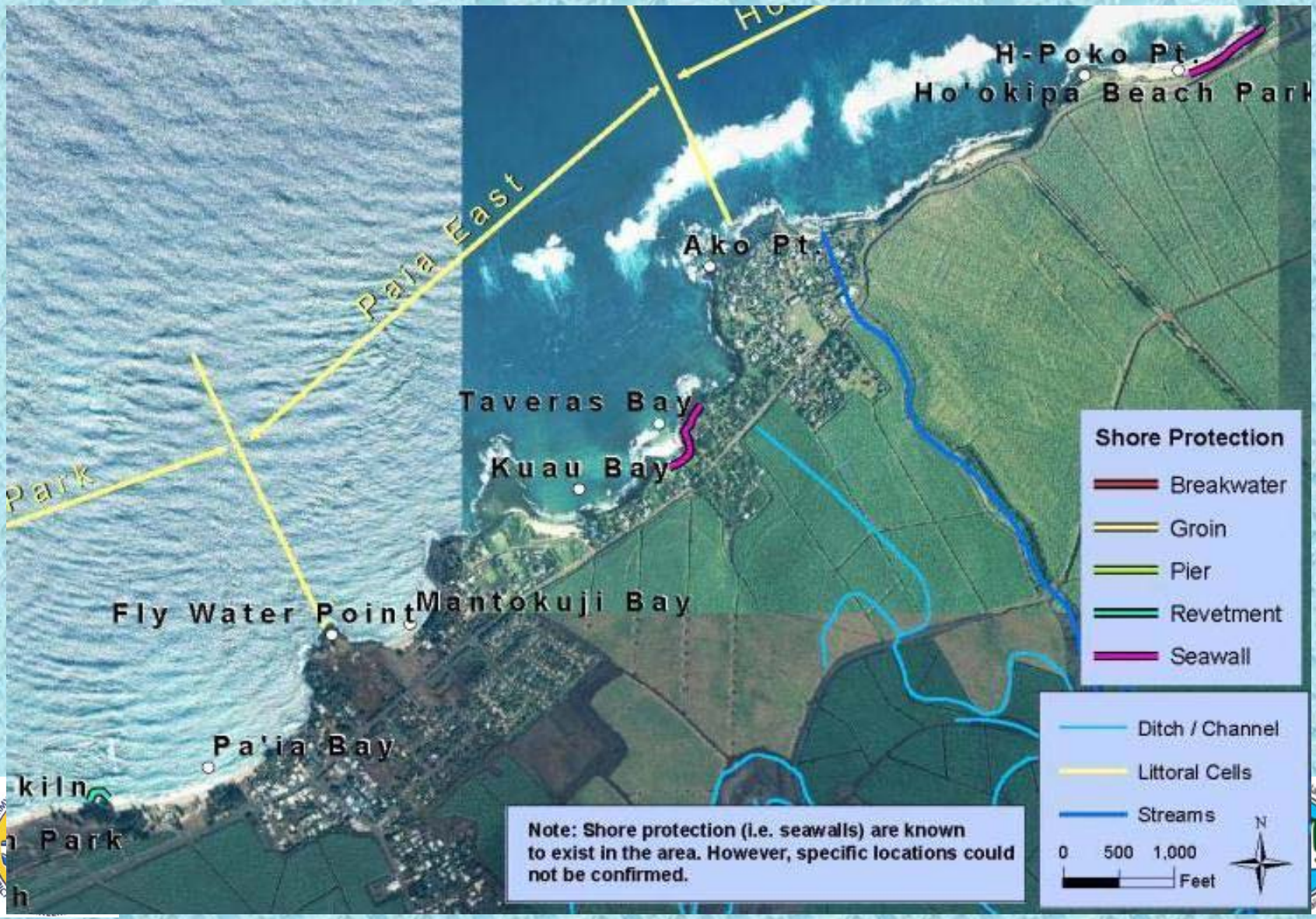
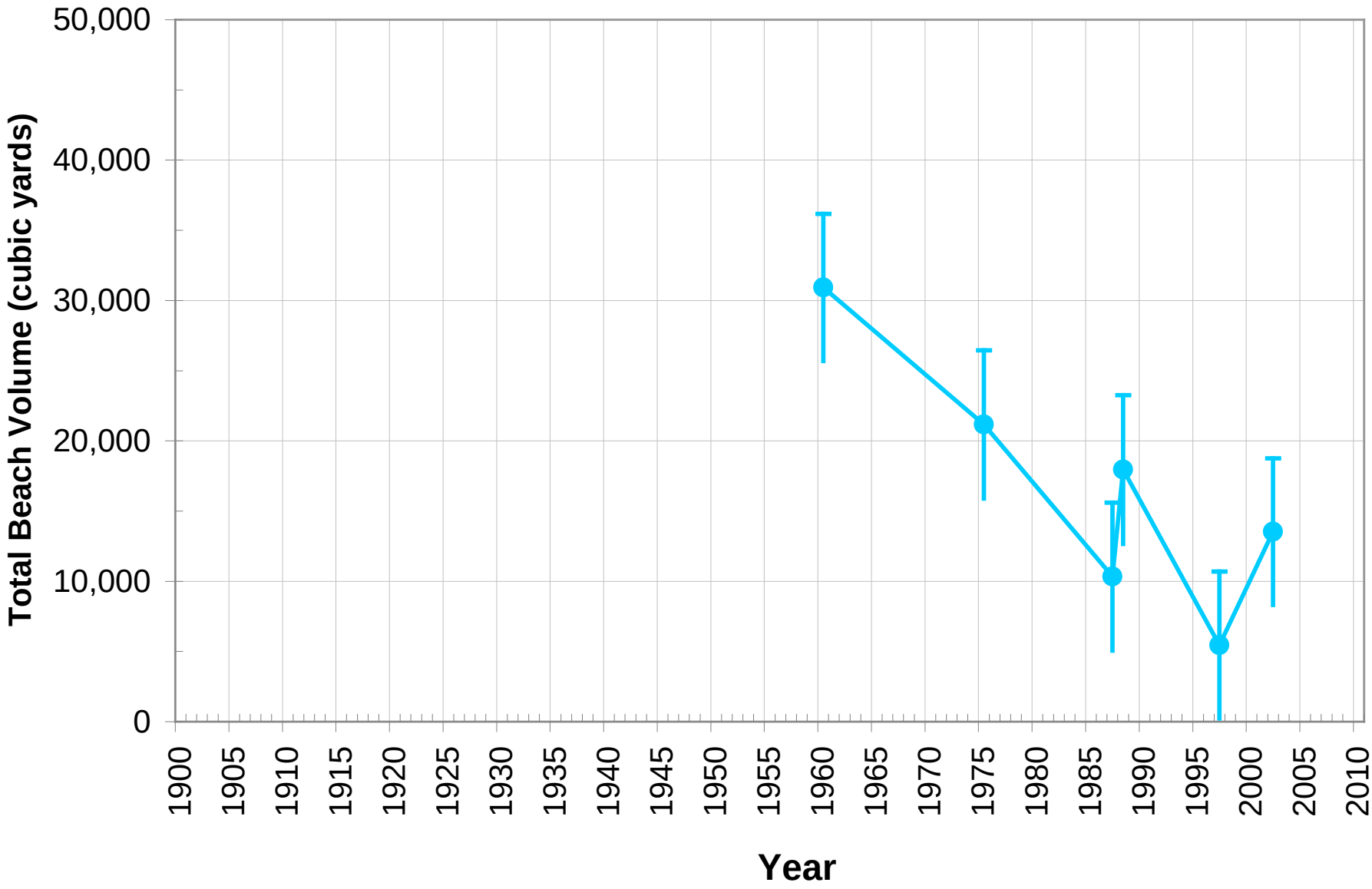
Baldwin Park – Beach Volume Change Rate



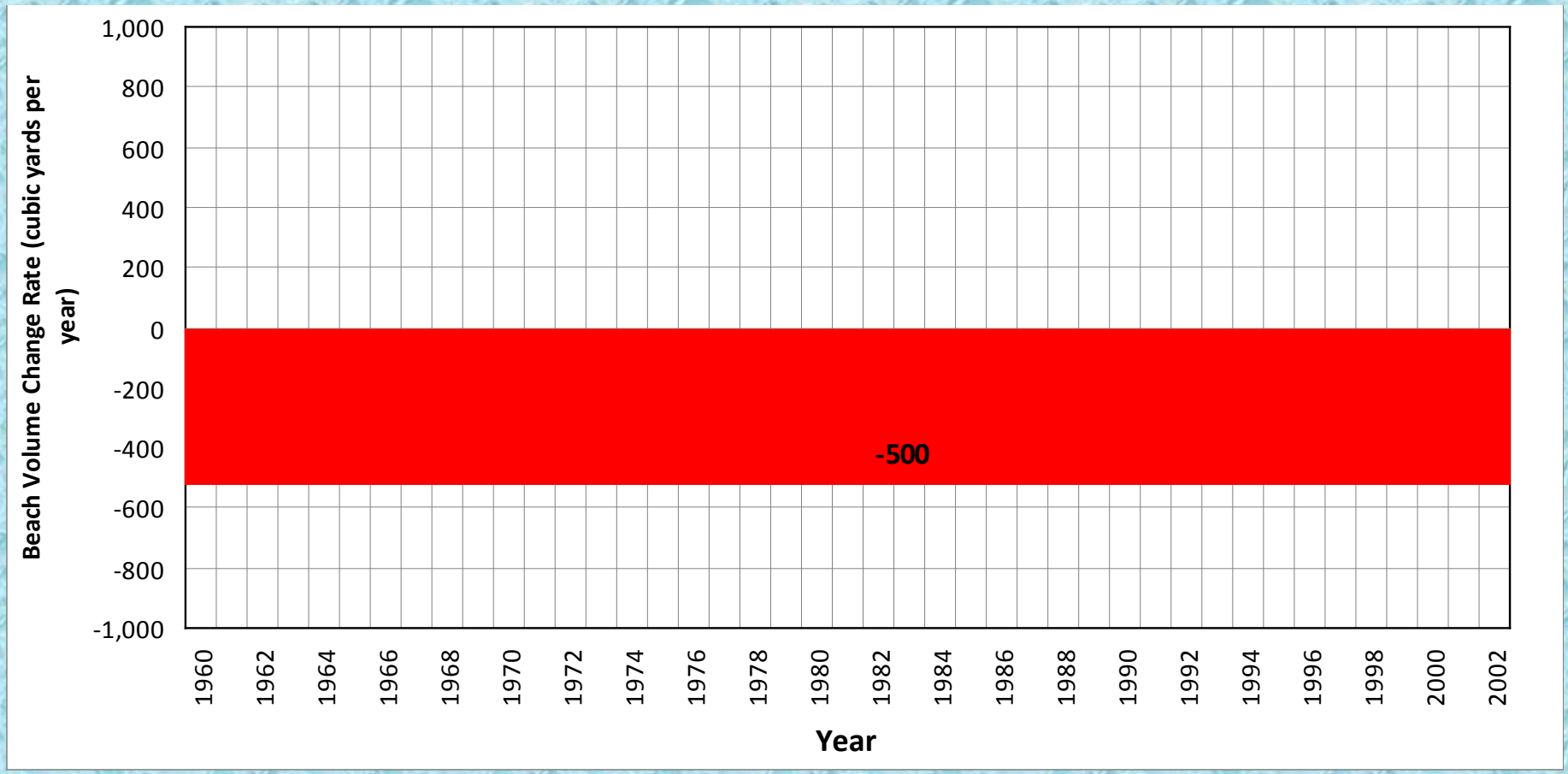
Paia East Cell – Shoreline Features



Paia East – Beach Volume History



Paia East Cell –
Beach Volume Change Rate History



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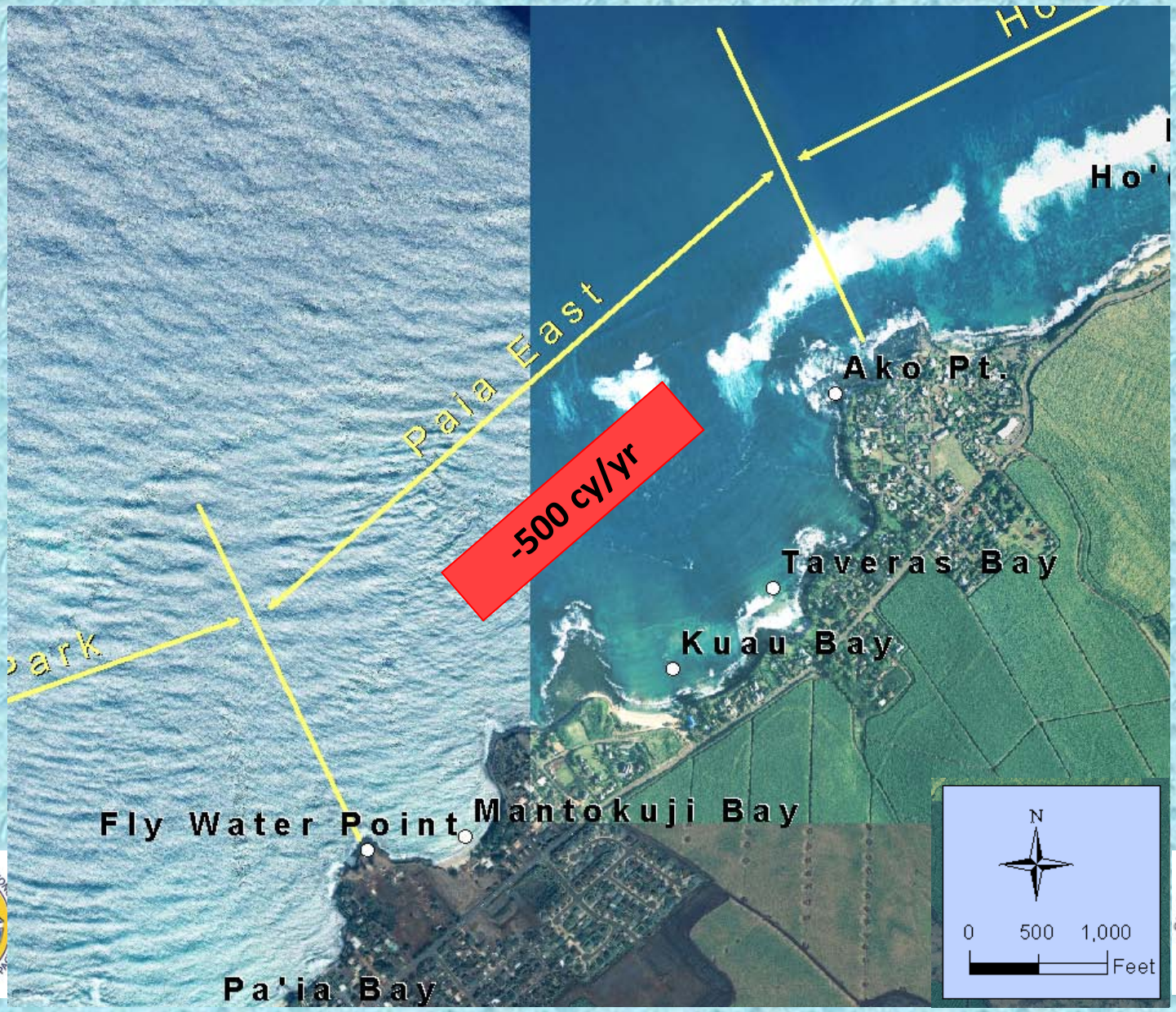
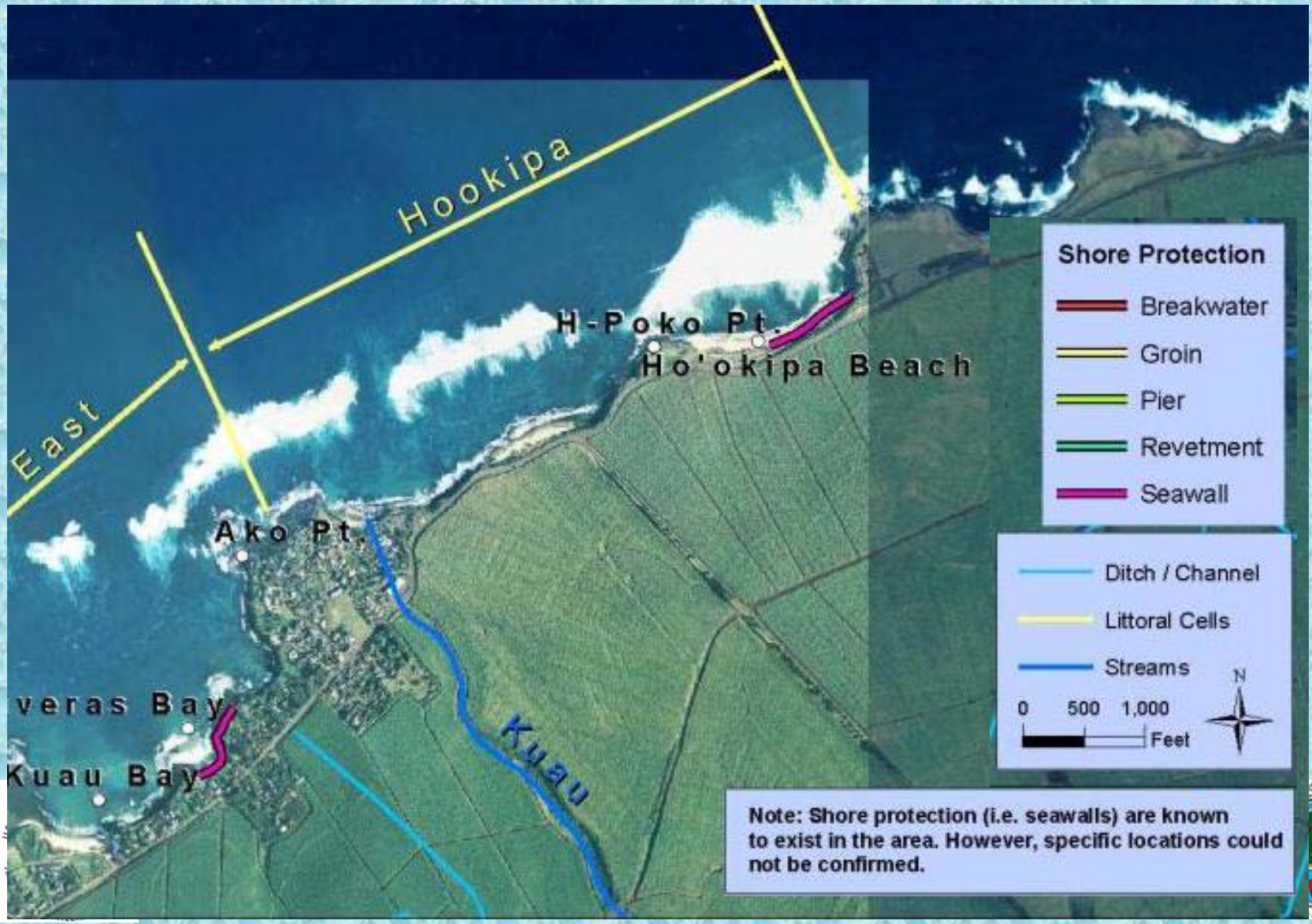
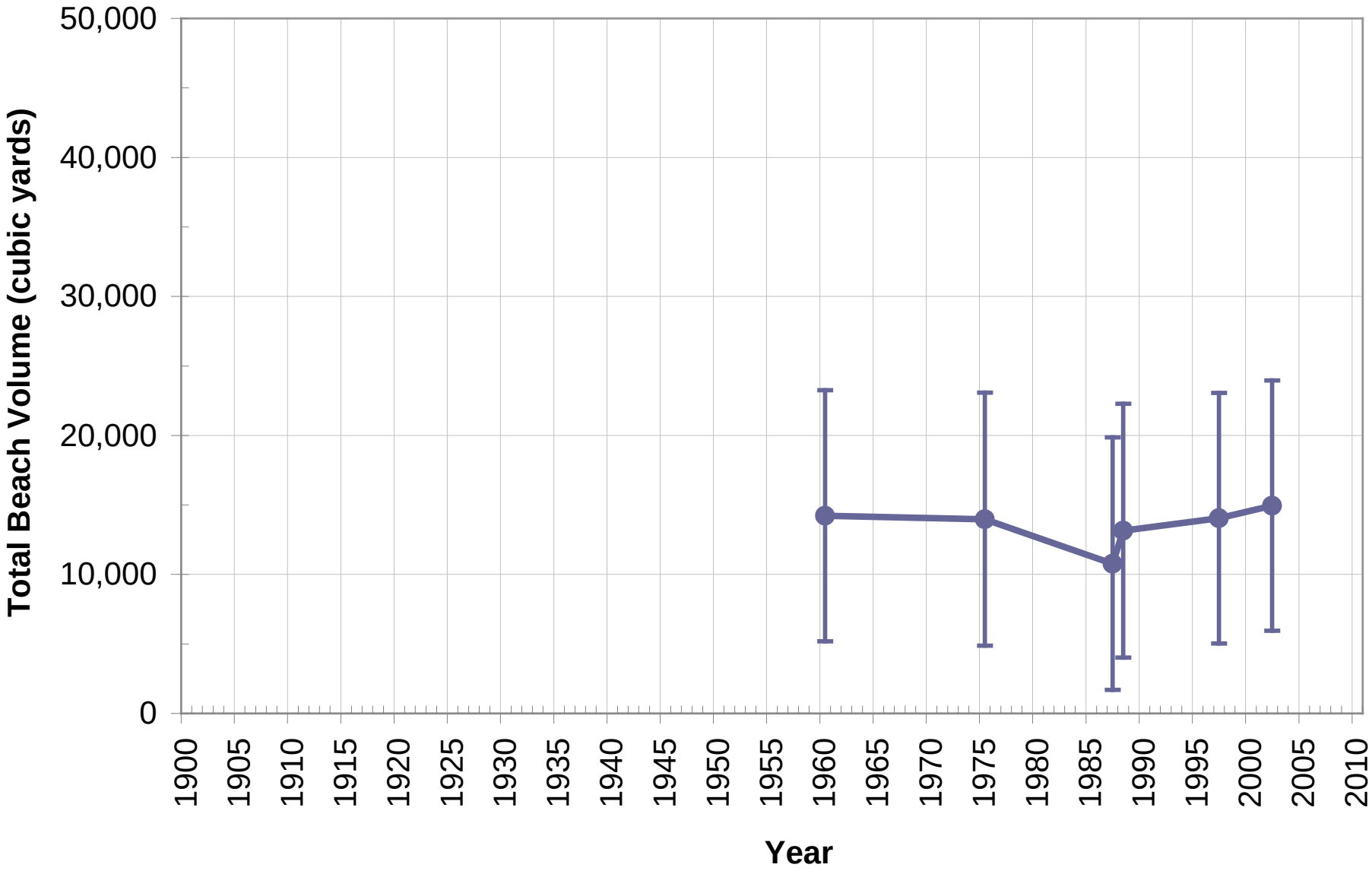
Paia East Cell – Beach Volume Change Rate



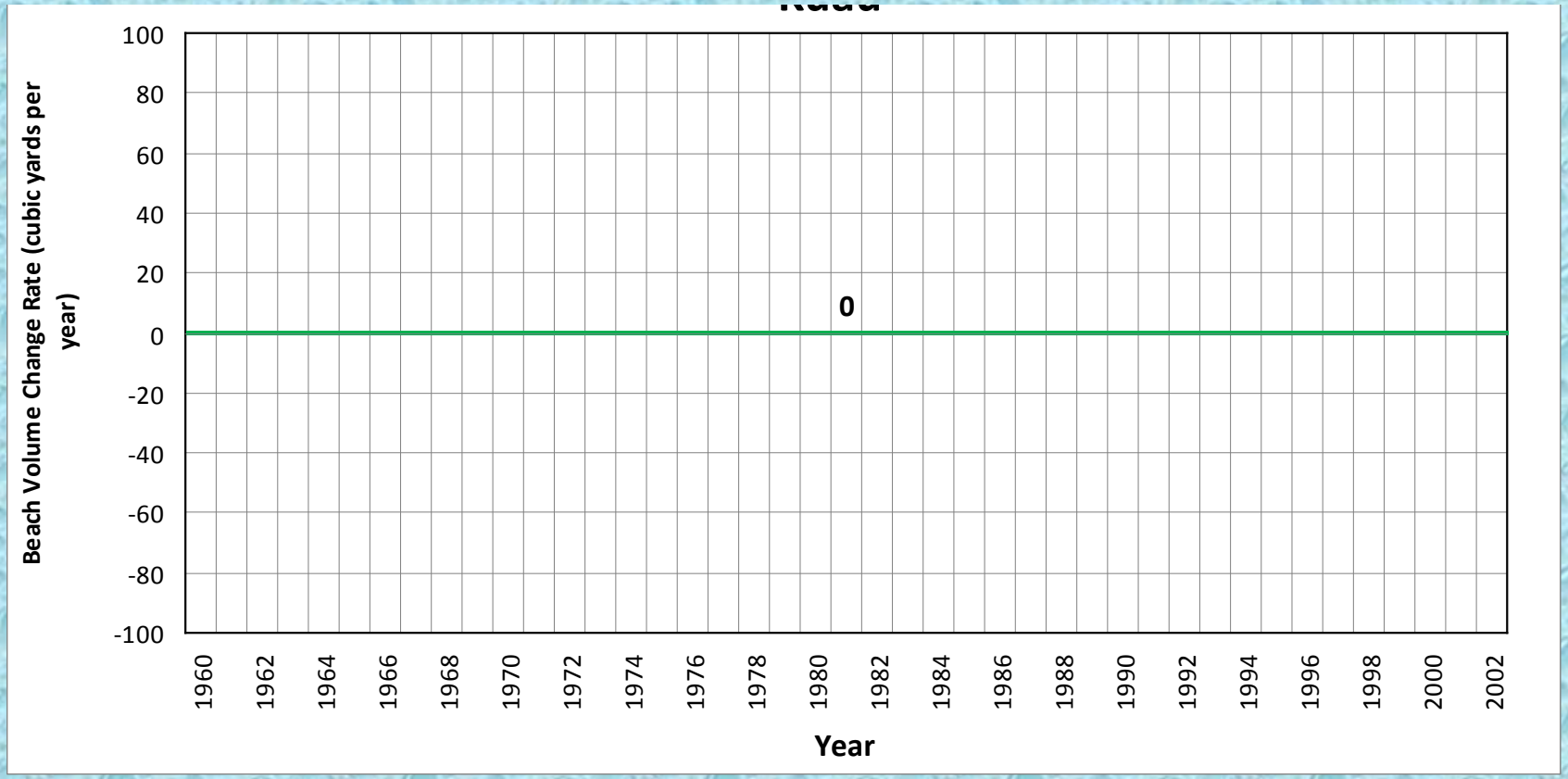
Hookipa Cell – Shoreline Features



Hookipa – Beach Volume History



Hookipa Cell – Beach Volume Change Rate History



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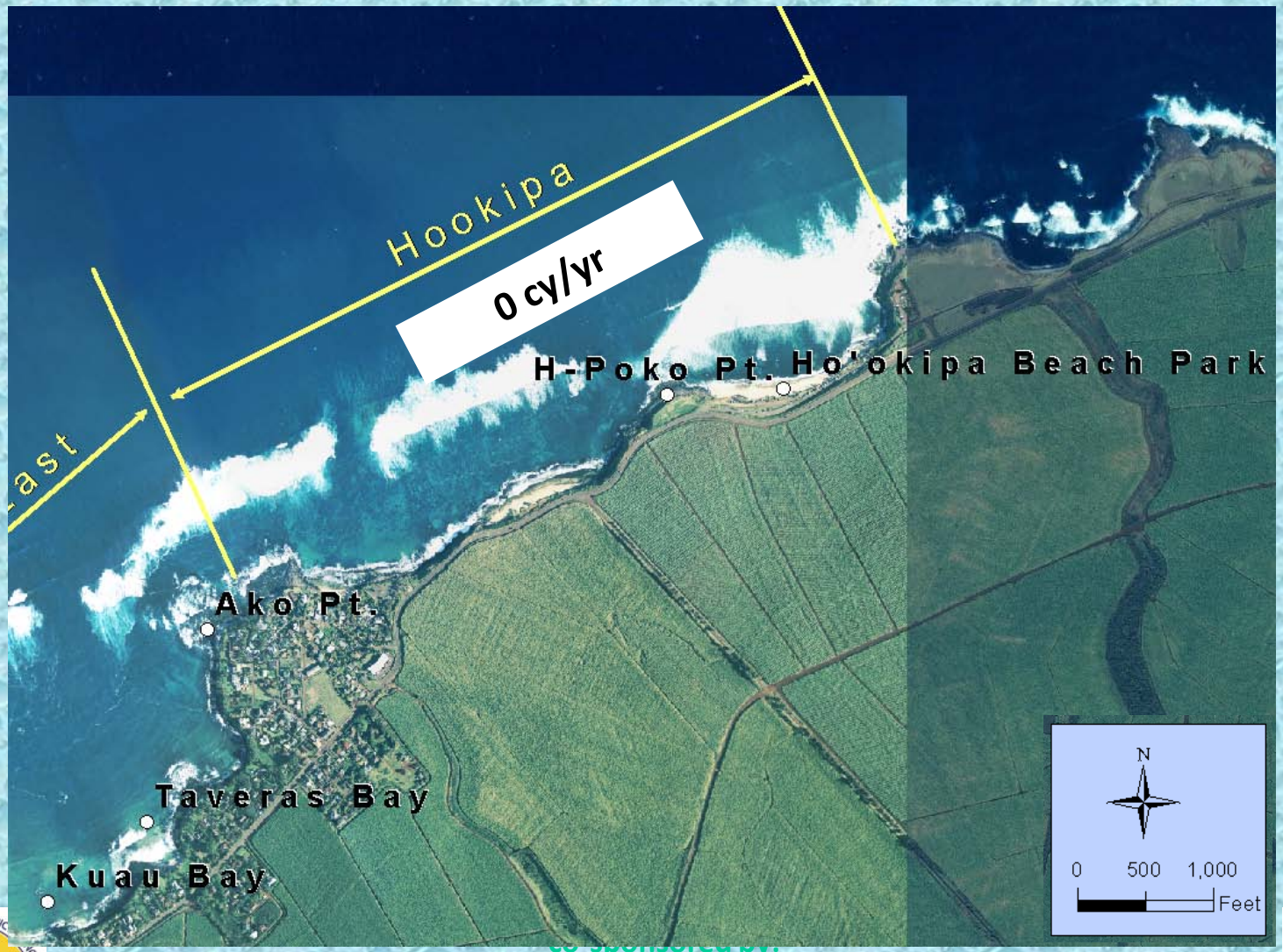
Hookipa – Beach Volume Change Rate



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Summary – Kahului Region

- **Kanaha Beach-WWRF area and Baldwin Park beaches have historically high historic erosion rates**
  - However, since ~1976, Baldwin Park erosion rate relatively low.
    - Kanaha Beach erosion rate has gotten worse
- **Specklesville and Paia East relatively constant erosion rate over period of record.**
- **Paukukalo cell beach volume stable since ~1960.**

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Additional Slides
- Kihei Region

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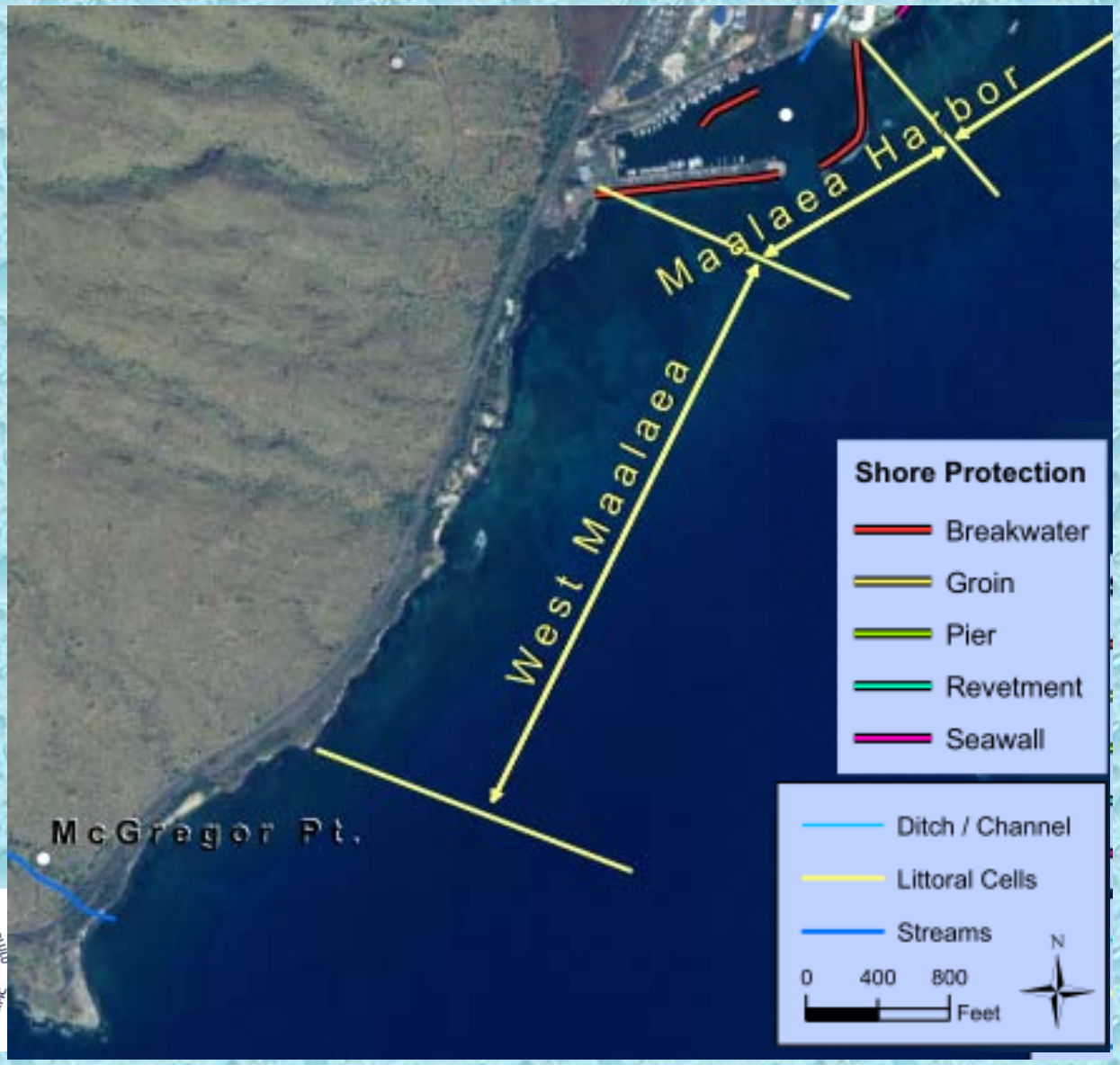
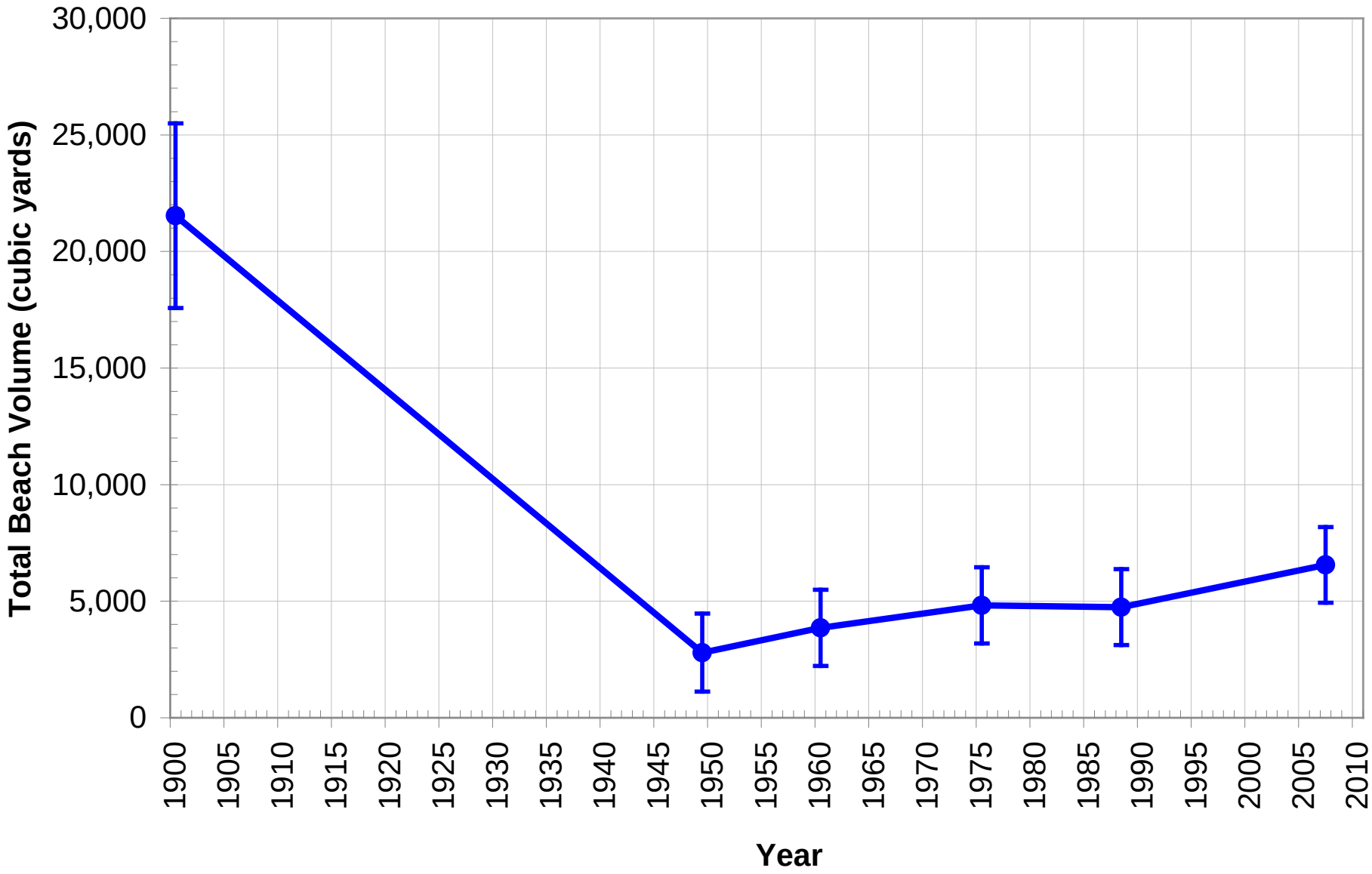
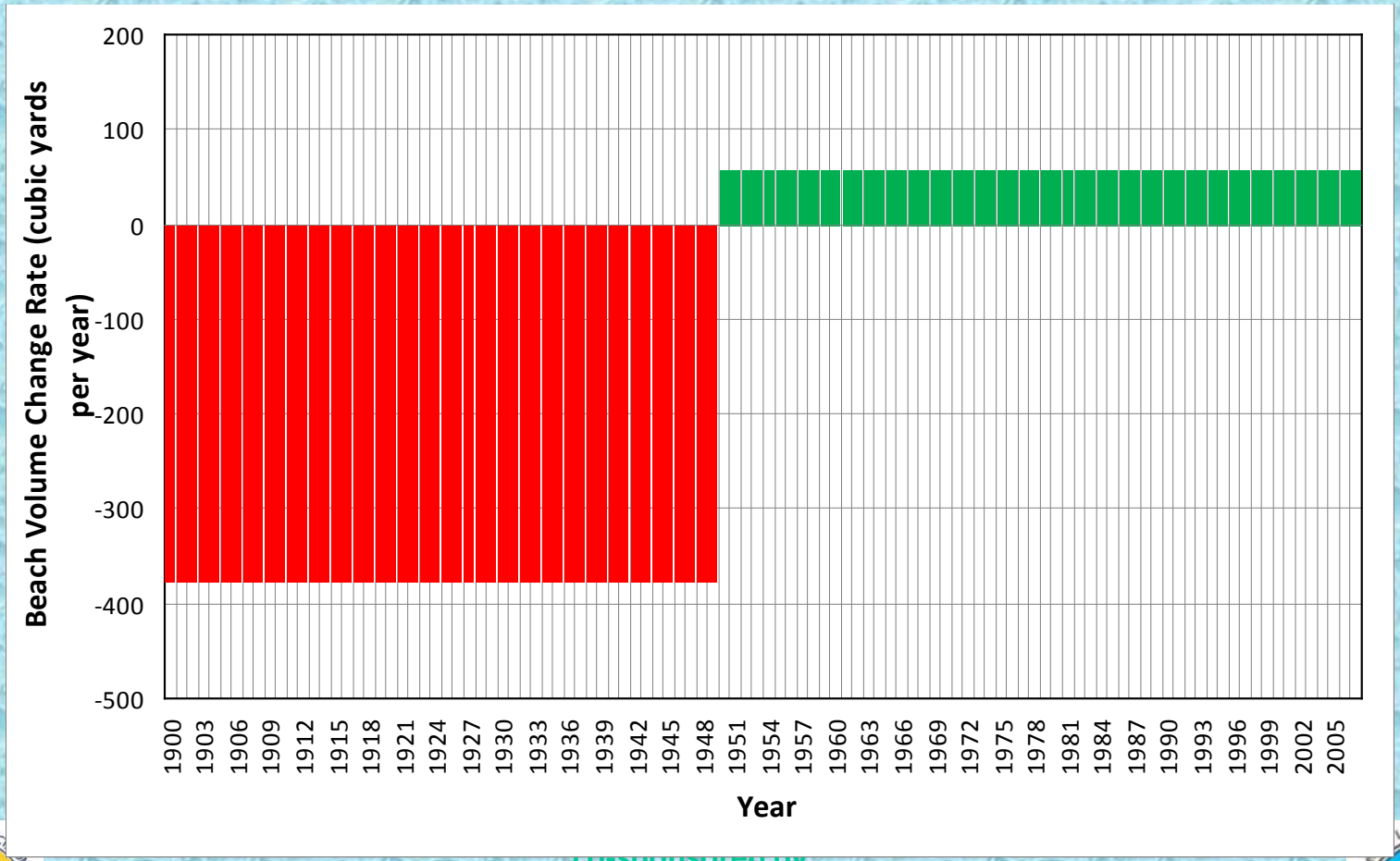
West Maalaea Cell – Shoreline Features



West Maalaea – Beach Volume History



West Maalaea Cell – Beach Volume Change Rate History



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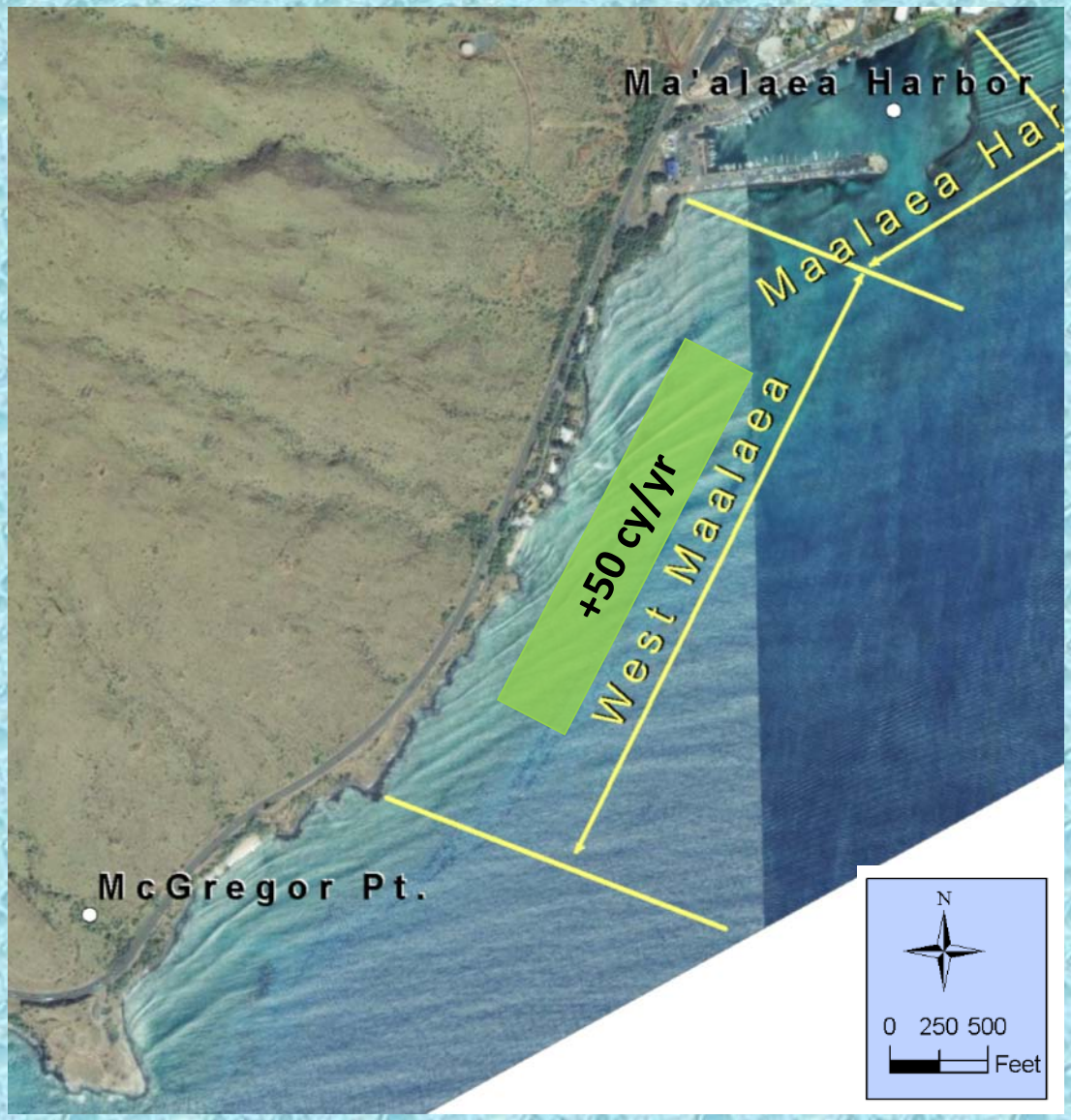
West Maalaea – Beach Volume Change Rate



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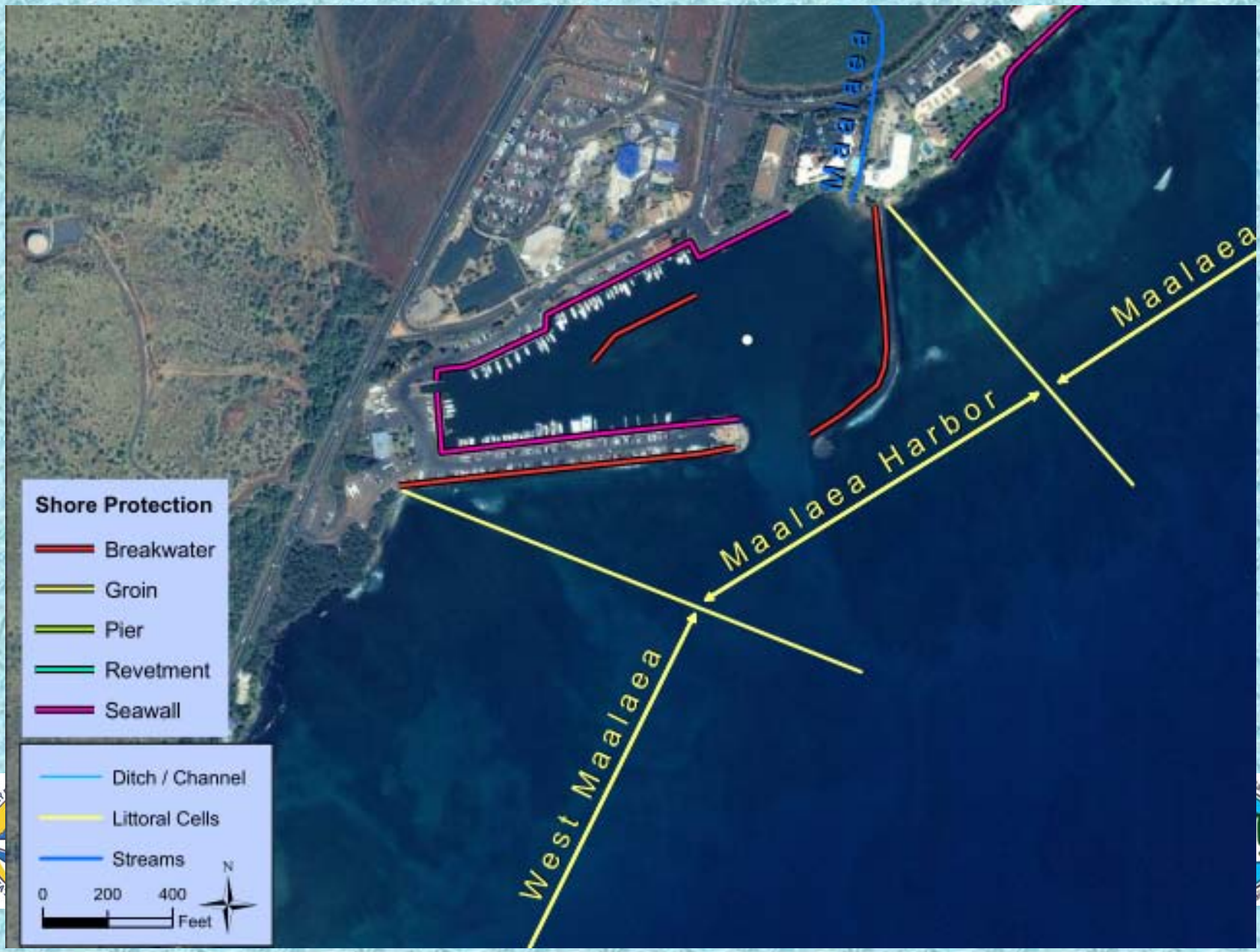
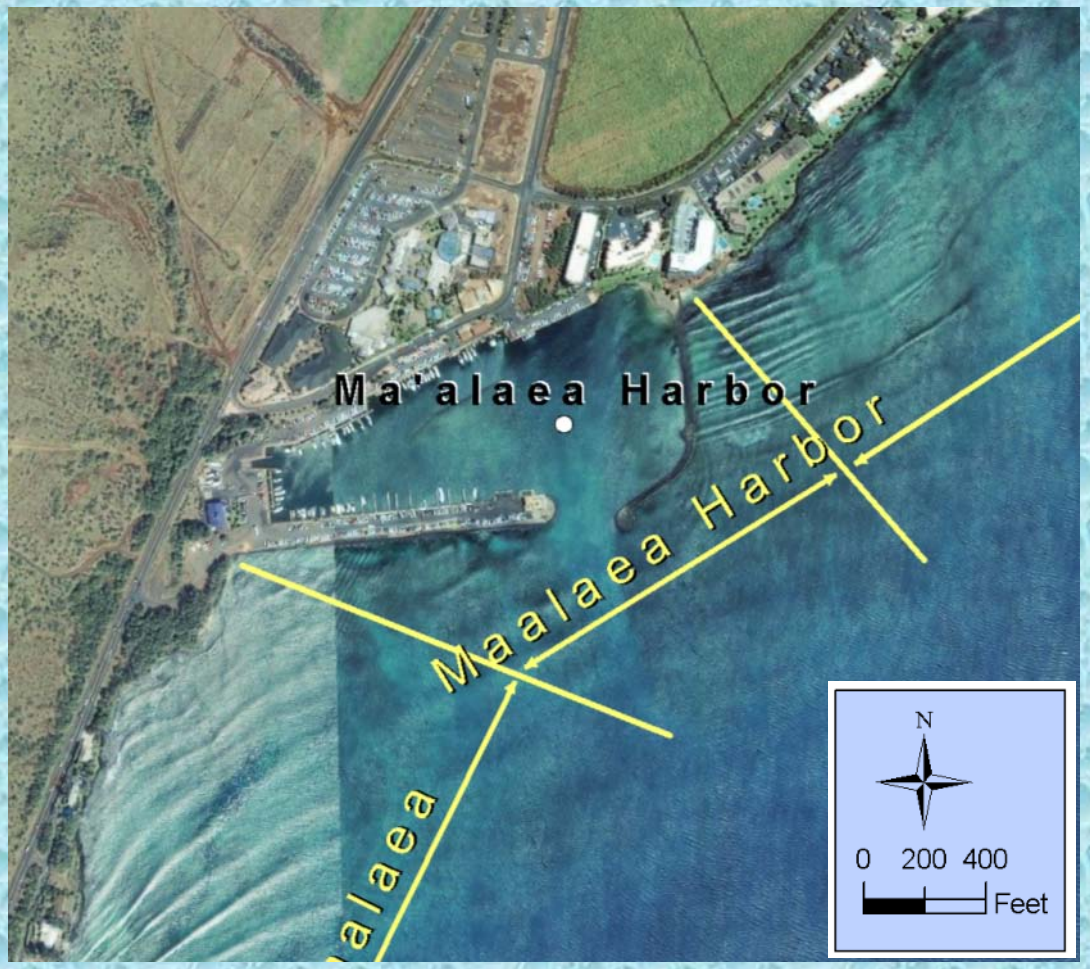
Maalaea Harbor Cell – Shoreline Features



Maalaea Harbor – Beach Volume Change Rate



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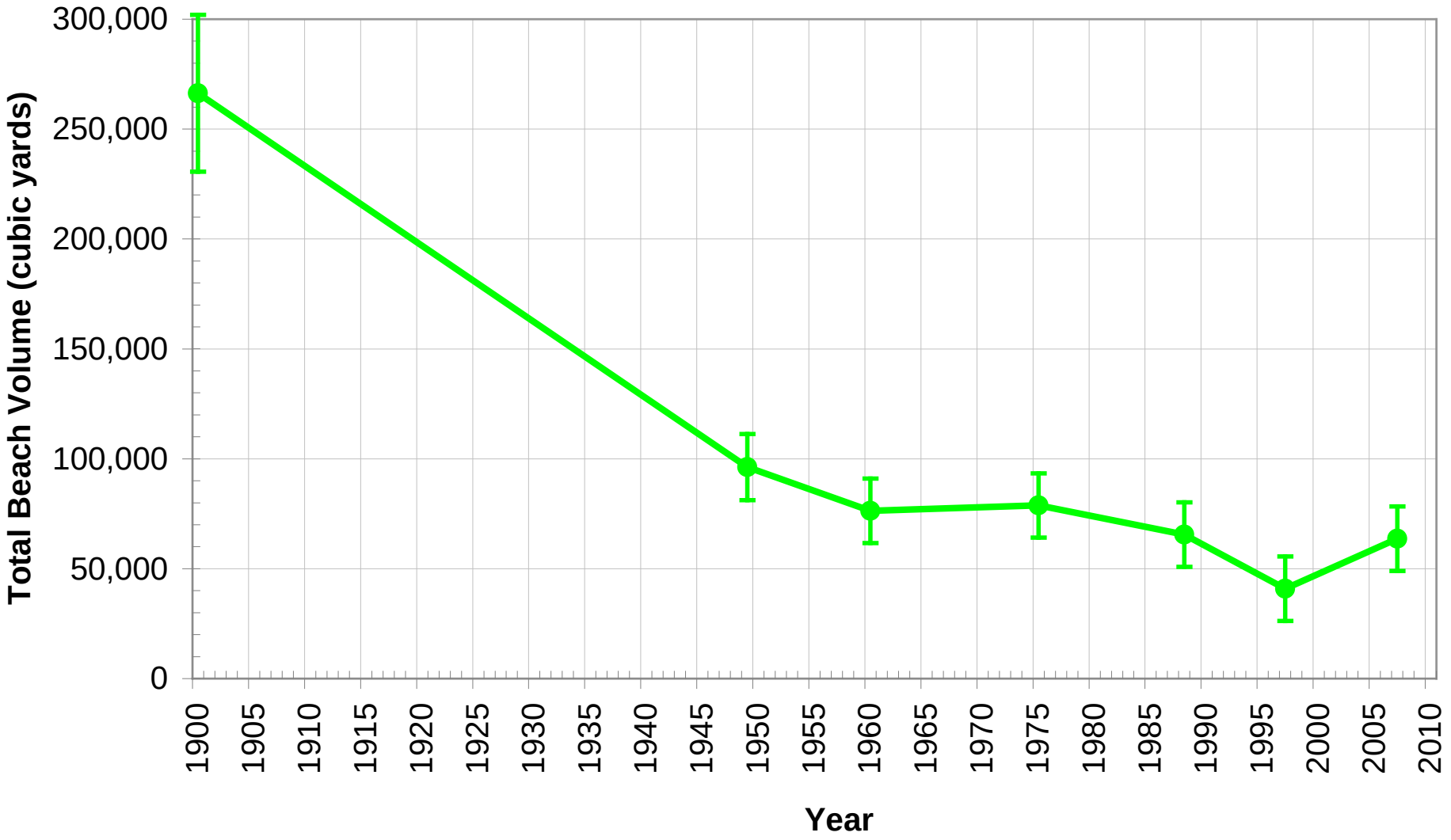
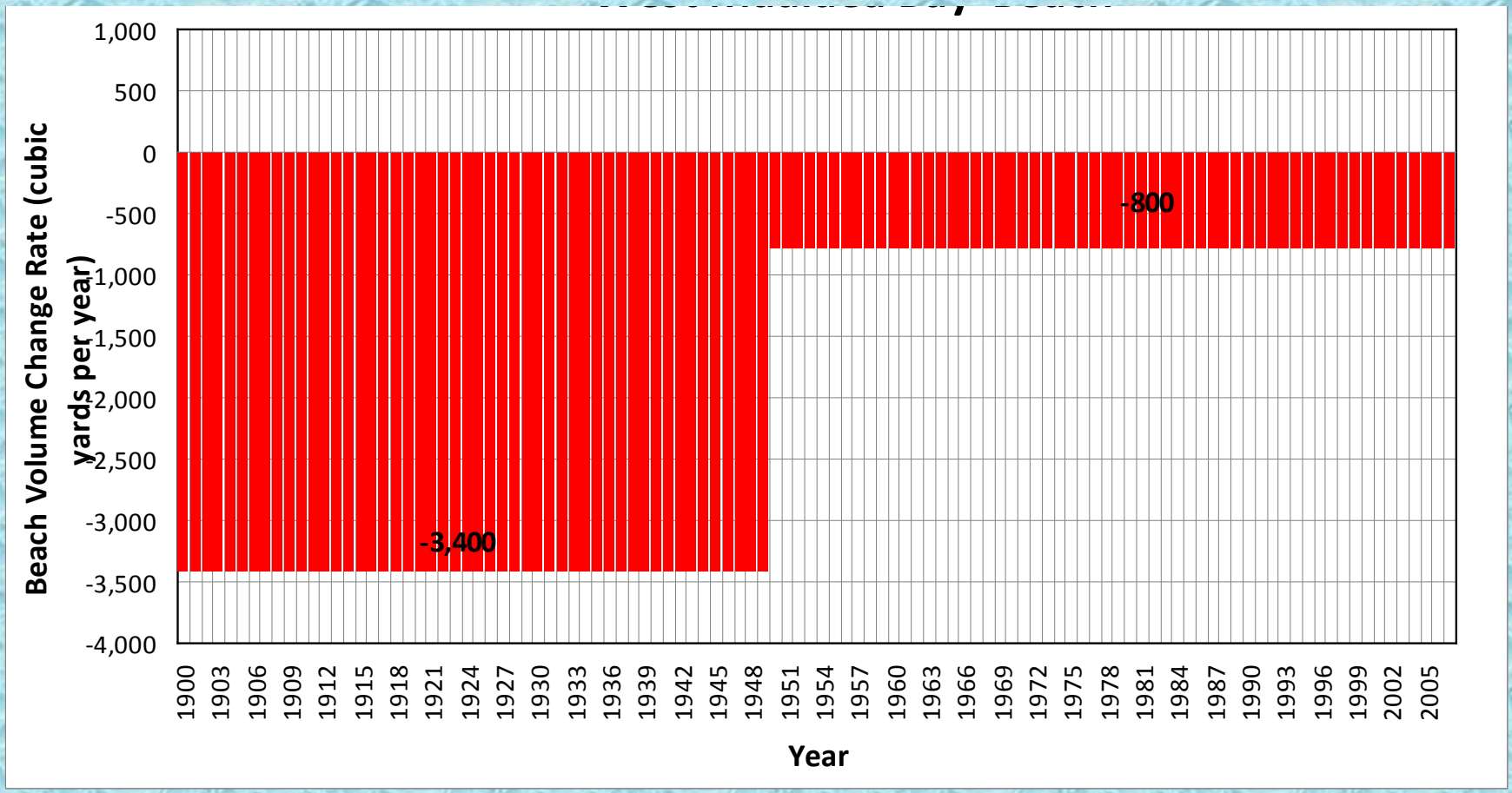
Maalaea Bay Beach Cell – Shoreline Features

Maalaea Bay Beach – Beach Volume History



Maalaea Bay Beach Cell – Beach Volume Change Rate History



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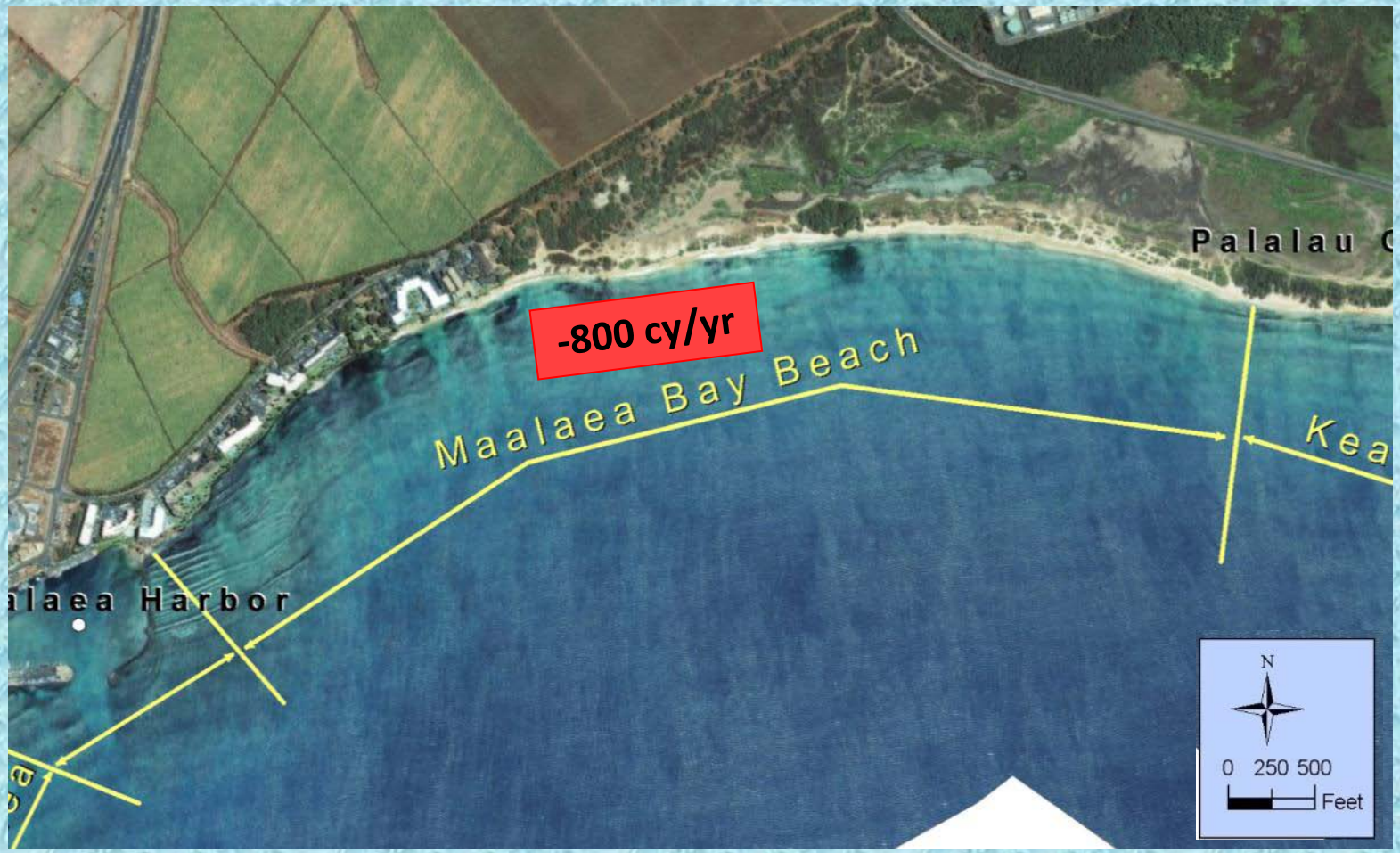
Maalaea Bay Beach –Volume Change Rate



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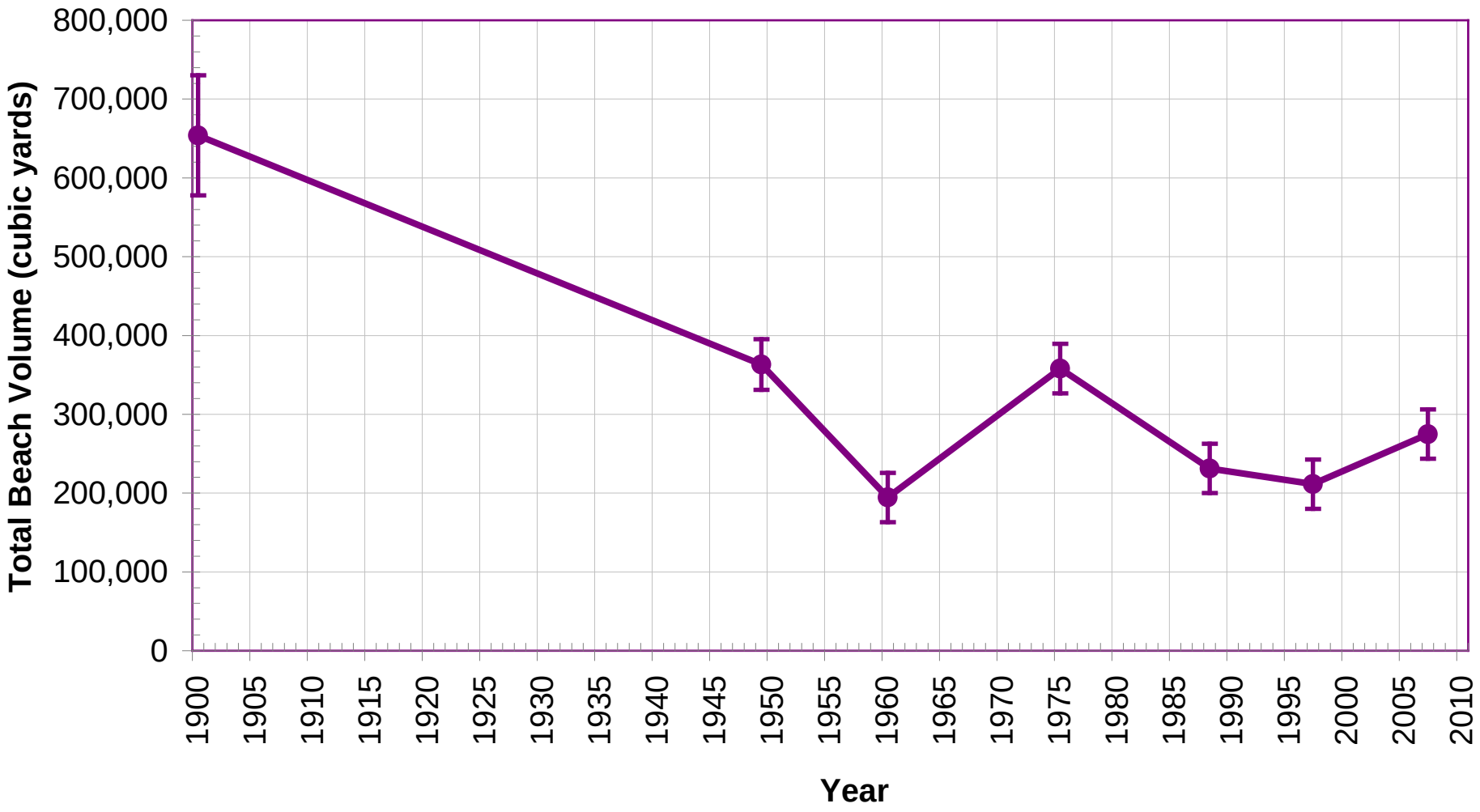
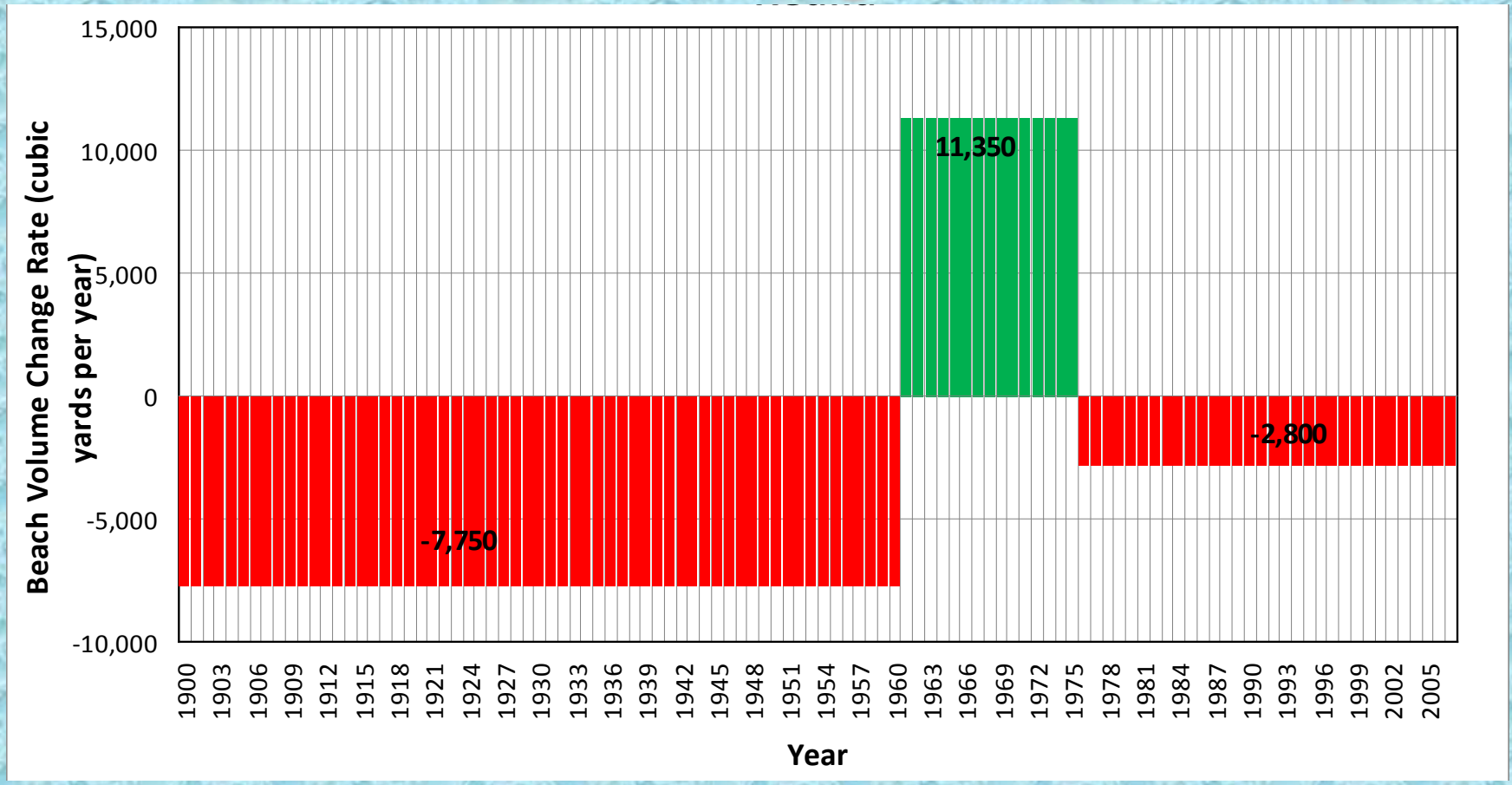
Kealia Cell – Shoreline Features

Kealia Cell – Beach Volume History



Kealia Cell – Beach Volume Change Rate History



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Kealia Cell– Beach Volume Change Rate

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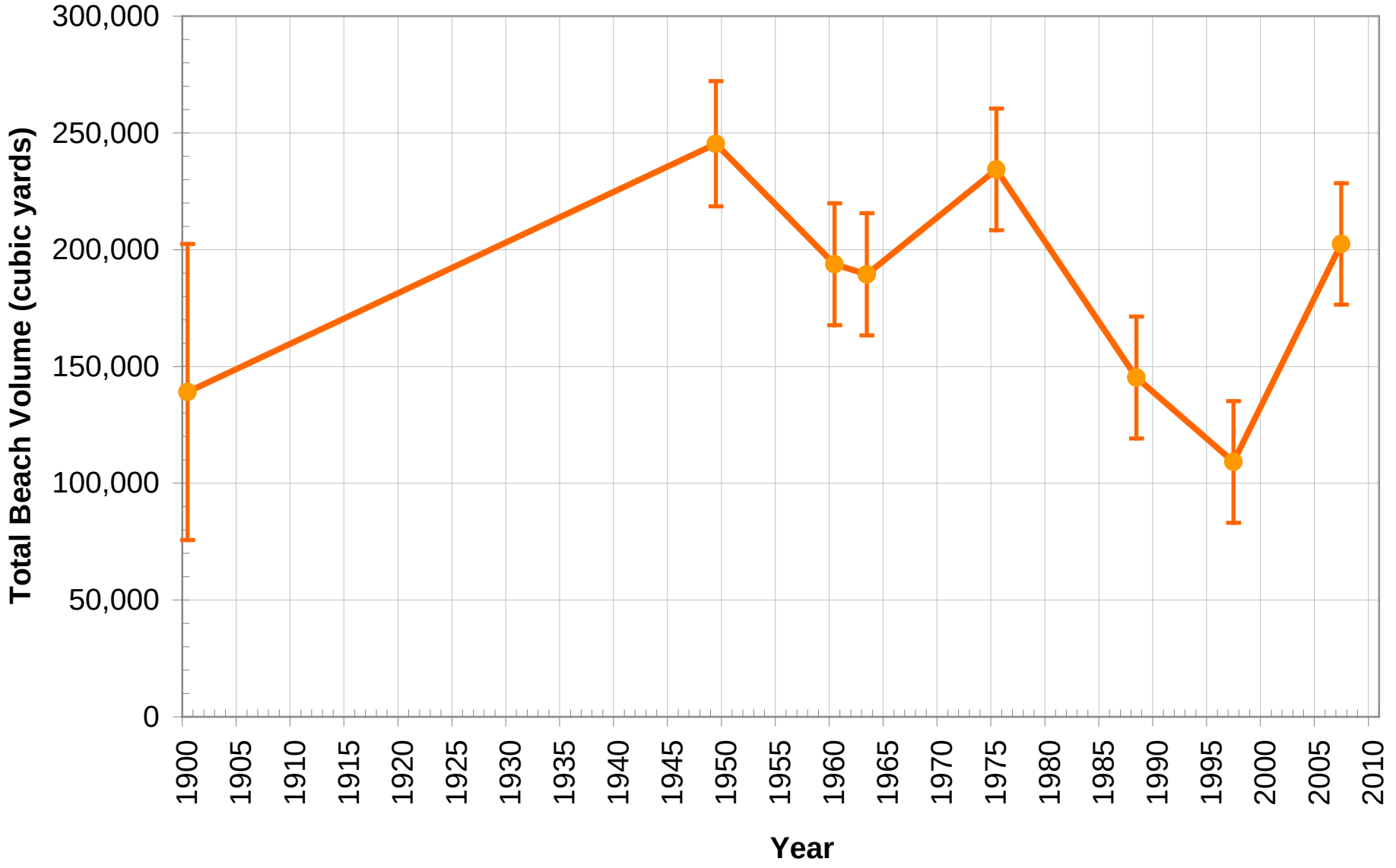
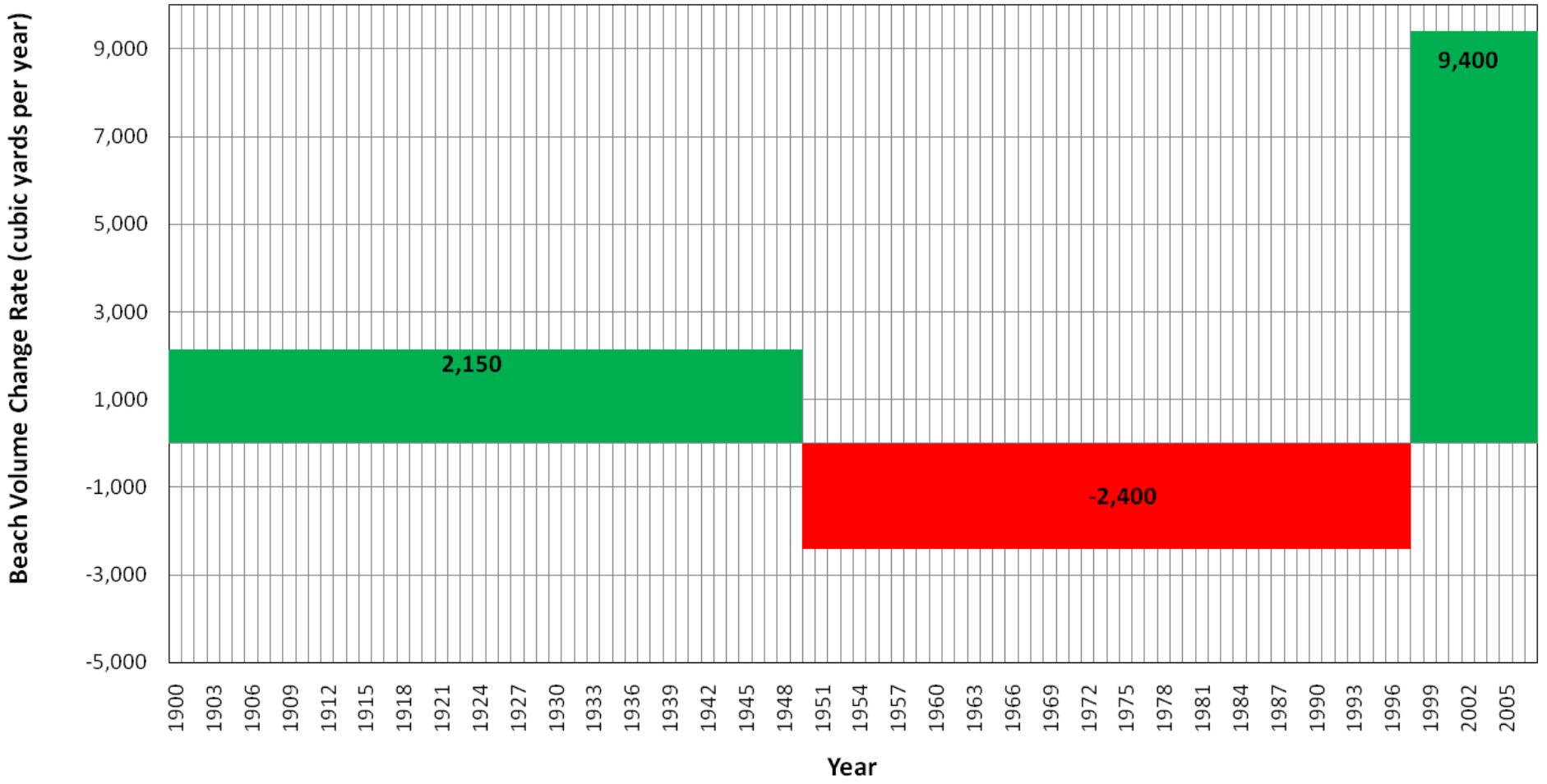
North Kihei Cell – Shoreline Features

North Kihei – Beach Volume History



North Kihei – Volume Change Rates



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North Kihei – Beach Volume Change Rate

Kawililipoa Cell – Shoreline Features

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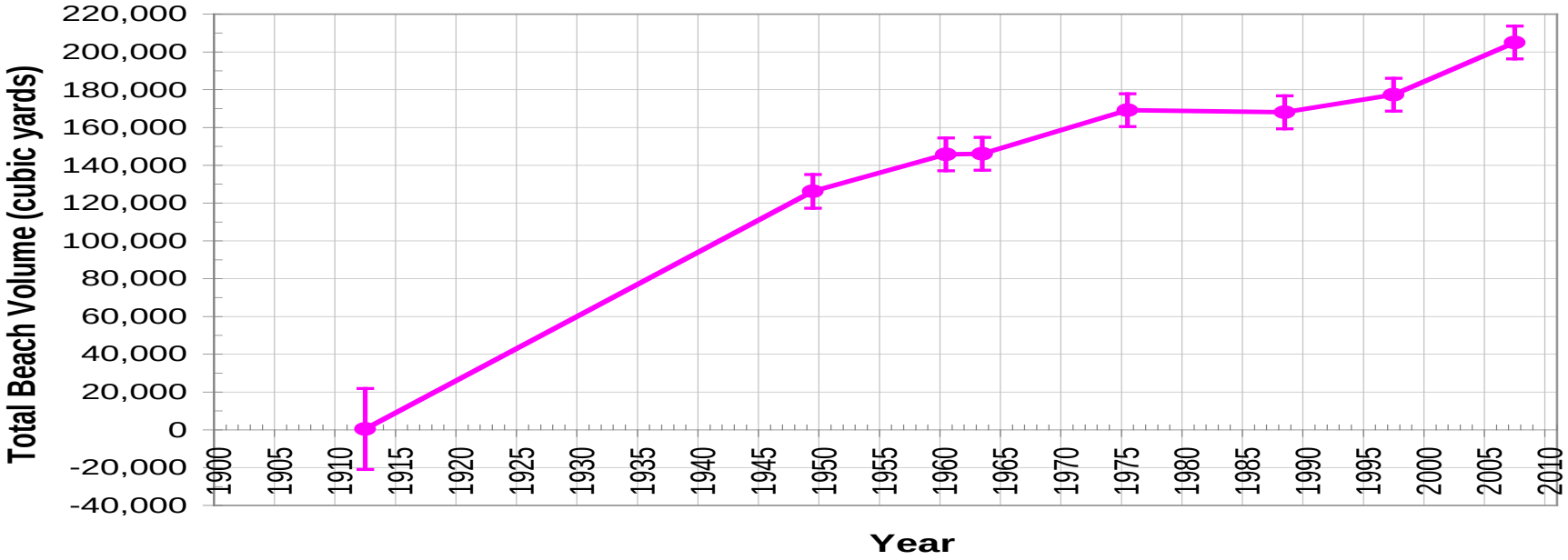
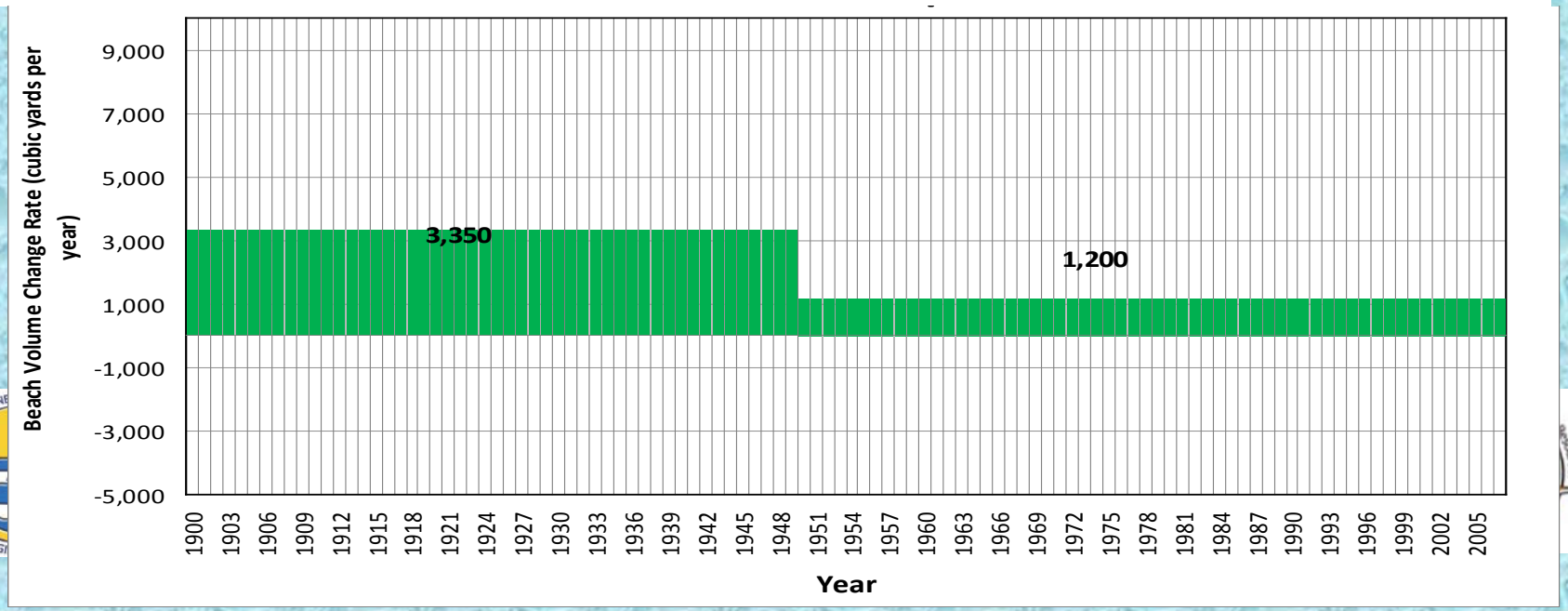
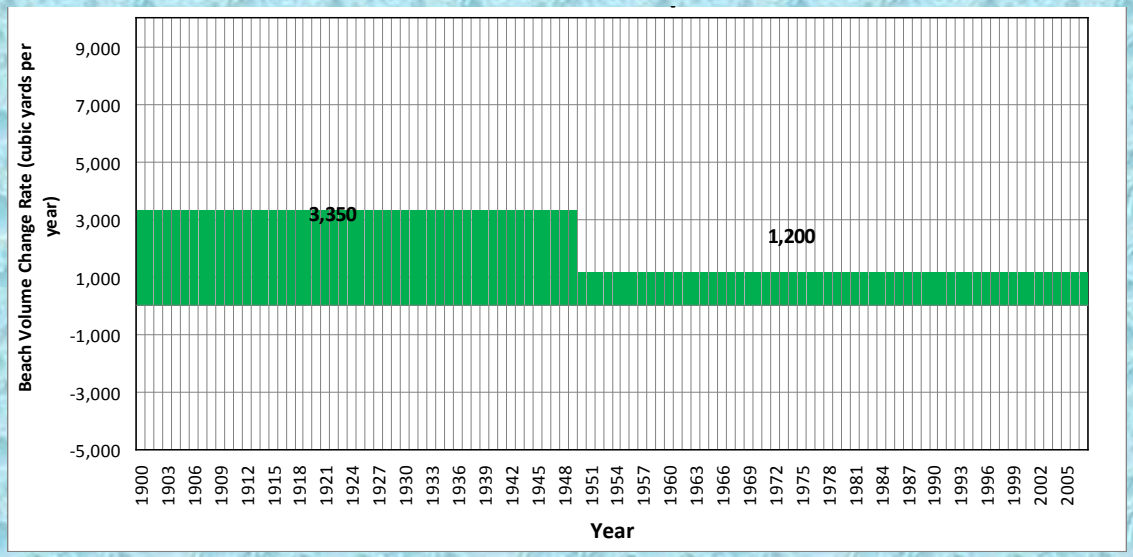
Kawililipoa – Beach Volume History





Kawililipoa Cell – Beach Volume Change Rate History



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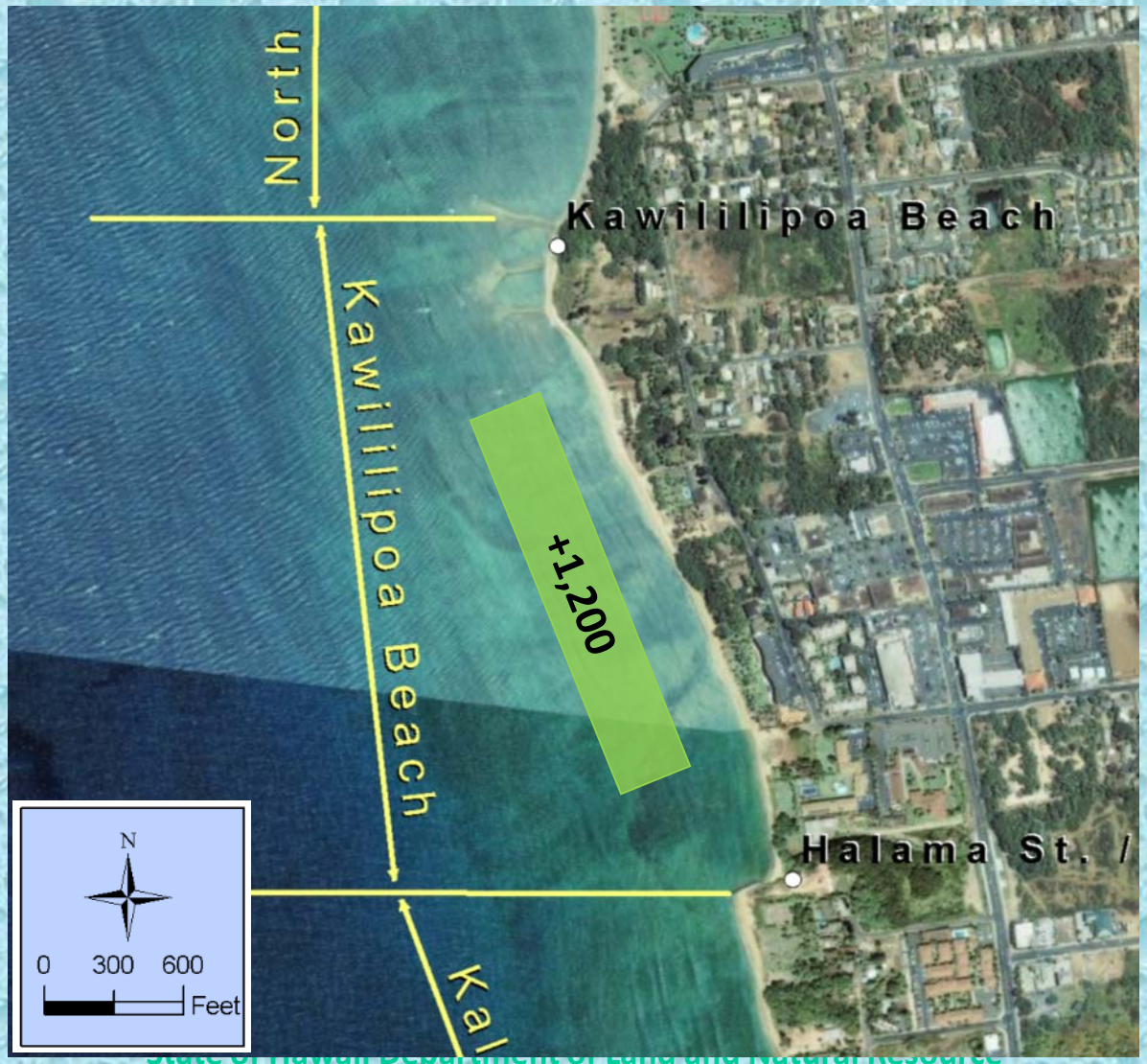
Kawililipoa– Beach Volume Change Rate



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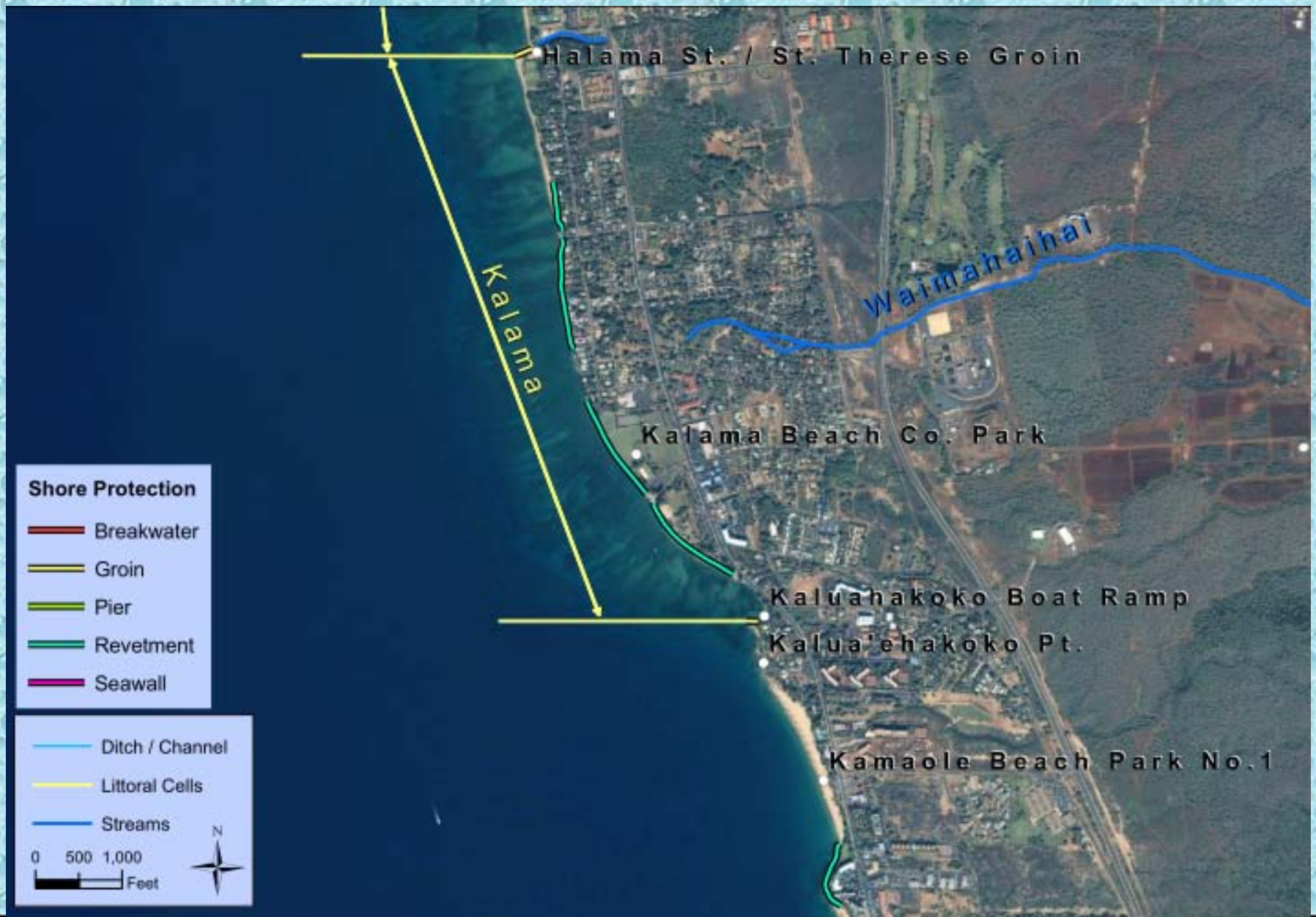
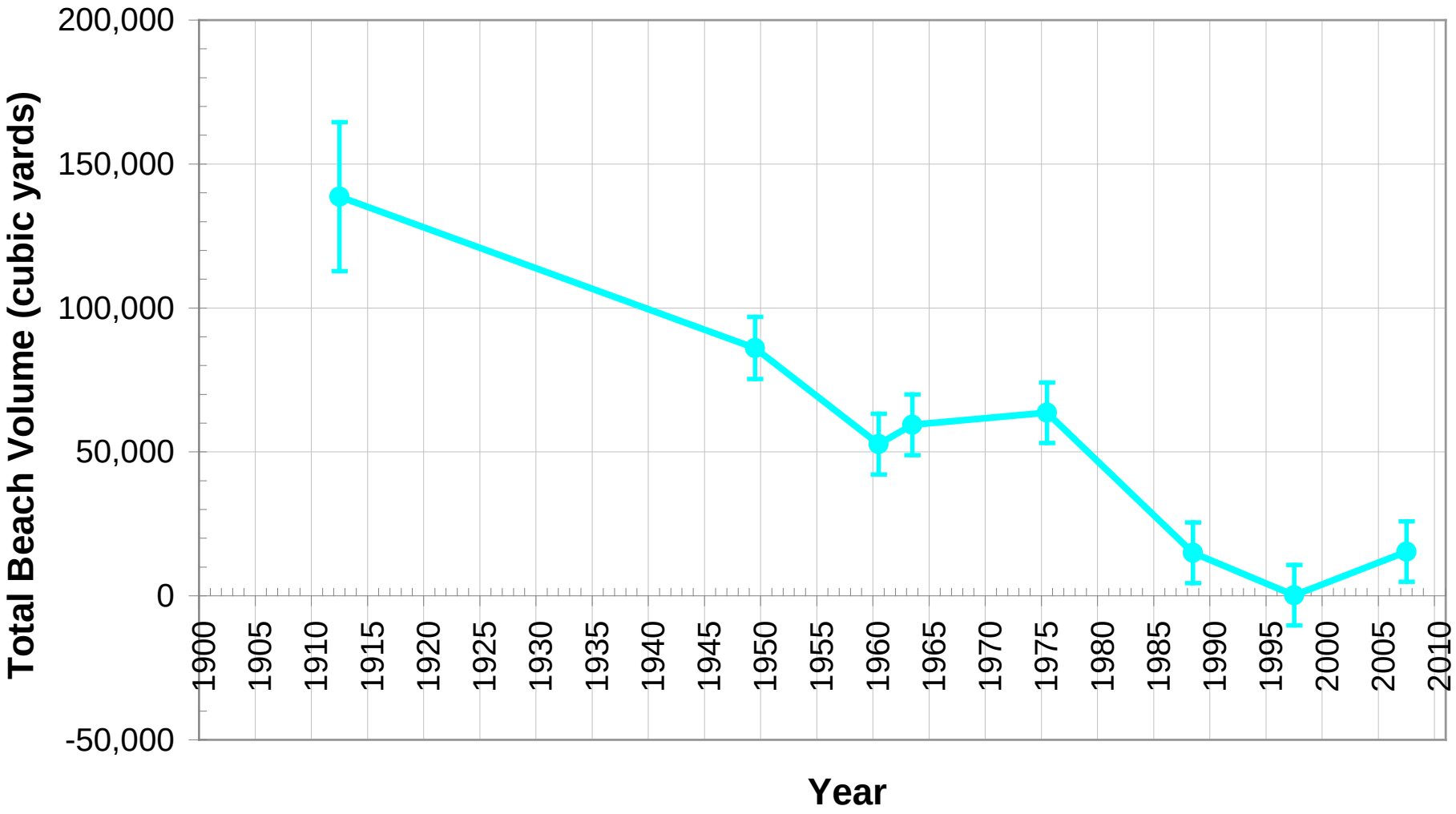
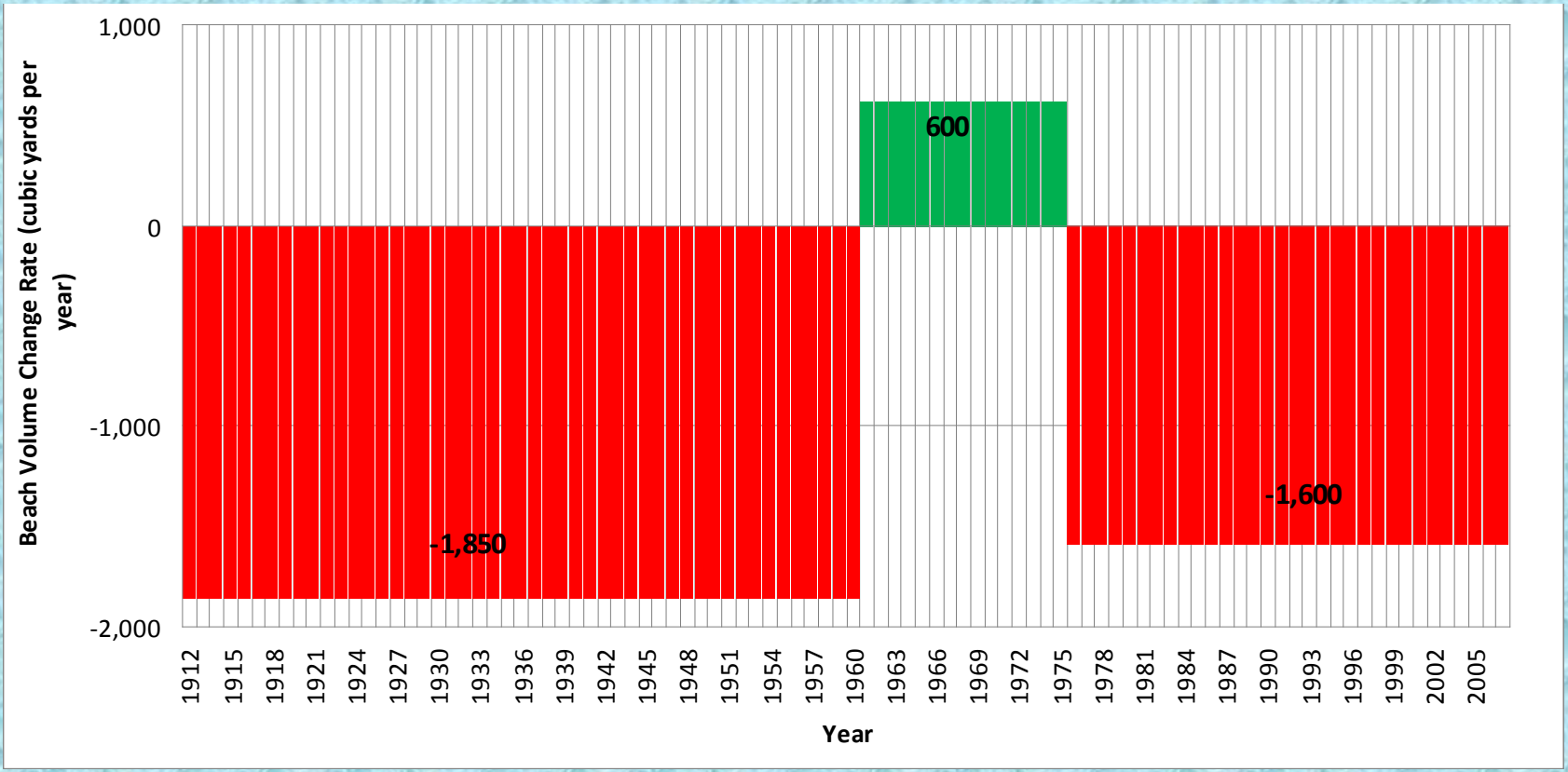
Kalama Cell – Shoreline Features



Kalama Cell – Beach Volume History



Kalama Cell – Beach Volume Change Rate History



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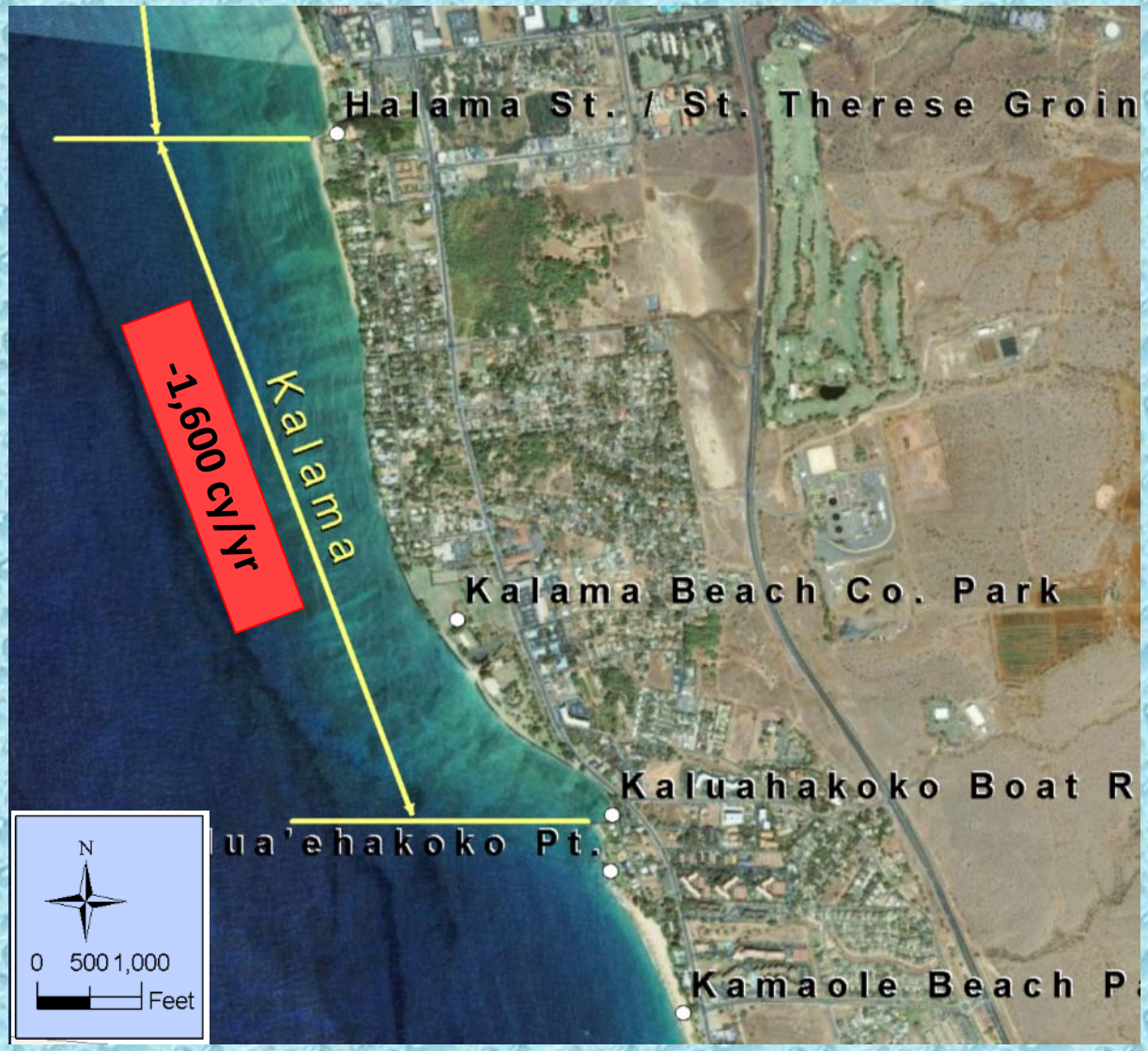
Kalama – Beach Volume Change Rate



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