CITY OF OCEAN CITY

CAPE MAY COUNTY, NEW JERSEY

RESOLUTION

 # 11

Analysis available in Cty's Clerks office

ADOPTING THE REPETITIVE LOSS AREA ANALYSIS FOR THE CITY OF OCEAN CITY

WHEREAS, areas of concentrated repetitive flood losses as defined by FEMA are located throughout the island of Ocean City; and,

WHEREAS, the City of Ocean City desired to study repetitive loss areas as part of its participation with the Community Rating System (CRS); and,

WHEREAS, the Ocean City Floodplain Management Committee has conducted a Repetitive Loss Area Analysis and has prepared a report of its findings; and,

WHEREAS, the report was posted on the City of Ocean City's website for public review prior to its adoption; and,

WHEREAS, the adoption of the report is required of the City of Ocean City for its CRS participation; and,

NOW, THEREFORE, BE IT RESOLVED, by the Council of the City of Ocean City, New Jersey as follows:

1. The City Council of the City of Ocean City hereby formally adopts the findings of the Repetitive Loss Area Analysis dated August 15, 2018 and instructs the City of Ocean City officials to consider the findings of the Report (attached hereto) for current and future planning and engineering projects taking place in Ocean City.

2. The City of Ocean City Floodplain Manager and/or CRS coordinator is instructed to update the Repetitive Loss Area Analysis annually pursuant to the most recent CRS Coordinator's Manual.

3. The Repetitive Loss Area Analysis shall remain publicly accessible to those wishing to review it.

_____

Peter V. Madden, Council President

10.04.18

Offered by ..... Seconded by .....

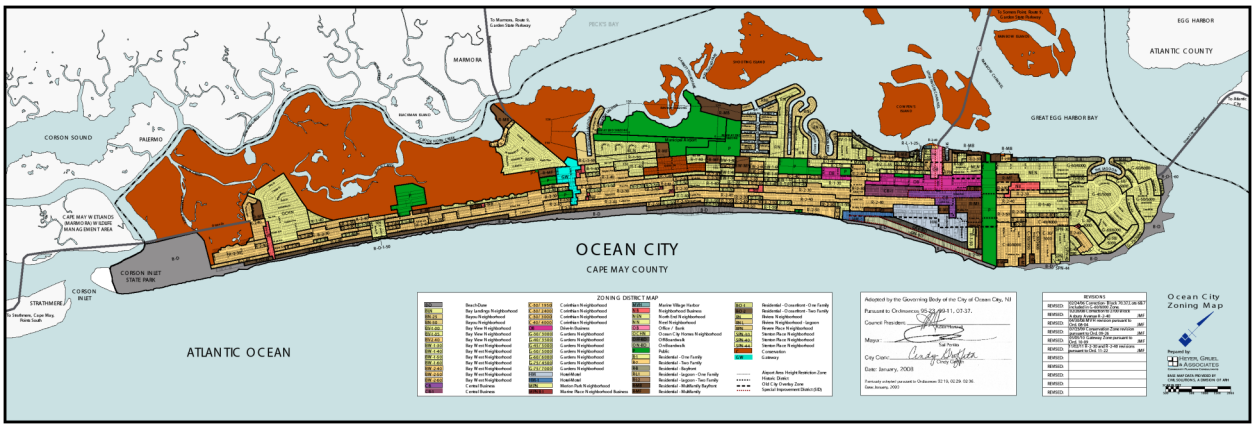
The above resolution was duly adopted by the City Council of the City of Ocean City, New Jersey, at a meeting of said Council duly held on the ..... day of ..... 2018.

.....

City Clerk

NAME	AYE	NAY	ABSENT	ABSTAINED
Barr				
Bergman				
DeVlieger				
Hartzell				
Madden				
McClellan				
Wilson				

Repetitive Loss Area Analysis
Ocean City, New Jersey



August 15, 2018
Ocean City, New Jersey

Repetitive Loss Area Analysis

Ocean City, NJ

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List of Abbreviations / Acronyms

ABFE - Advisory Base Flood Elevation a new Base Flood Elevation for rebuilding when using most federal and state funds other than insurance. It has the same definition that you are familiar with for Base Flood Elevation—the height at which there is a 1 percent chance or greater of flooding in a given year. We may have been working with this concept for many years. An advisory flood elevation is FEMA's up-to-date estimate 1 percent chance height that flood waters could reach in a given year. The new advisory base flood elevations update the existing flood elevations developed over the past 30 years and include tide and storm data collected from Katrina, Rita, and Sandy for the "open Coast".

1% Annual Flood Chance: The flood that has a one percent (1%) chance of being equaled or exceeded each year. Also known as the base flood or regulatory floodplain.

Area Analysis: An approach to identify repeatedly flooded areas, evaluate mitigation approaches, and determine the most appropriate alternatives to reduce future repeated flood losses.

BFE: Base Flood Elevation - The elevation of the crest of the base flood or one percent (1%) annual chance.

Corps - U. S. Army Corps of Engineers

CRS: Community Rating System

DFE - Design Flood Elevation: Three (3) feet above the highest adjacent grade of a structure.

D-FIRM - Digital Flood Insurance Rate Map

FEMA: Federal Emergency Management Agency

FIRM: Flood Insurance Rate Map

Floodway: The channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

Freeboard: A factor of safety usually expressed in feet above the Base Flood Elevation (BFE) for purposes of floodplain management. Also known as the design flood elevation.

GIS: Geographic Information Systems

Hazard Mitigation: Any sustained action taken to reduce or eliminate long-term risk to life and property from a hazardous event.

ICC: Increased Cost of Compliance, a $30,000 rider on flood insurance policies for policy holders located in the special flood hazard area that can be used to bring the structure into compliance in the event that it is substantially damaged by a flood.

NFIP: National Flood Insurance Program

Repetitive Loss property (RL): An NFIP-insured property where two or more claim payments of more than $1,000 have been paid within a 10-year period since 1978.

Severe Repetitive Loss Property (SRL): A 1-4 family residence that is a repetitive loss property that has had four or more claims of more than $5,000 or two claims that cumulatively exceed the reported building's value.

Substantial Improvement: The repair, reconstruction, or improvement of a structure, the cost of which equals or exceeds 50% of the market value of the structure either, (1) before the improvement or repair is started, or (2) if the structure has been damaged and is being restored, before the damage occurred.

City of Ocean City, NJ repetitive loss area analysis Executive Summary

Background

The National Flood Insurance Program (NFIP) is continually faced with the task of paying claims while trying to keep the price of flood insurance at an affordable level. It has a particular problem with repetitive flood loss properties, which are estimated to cost $200 million per year in flood insurance claim payments. Repetitive flood loss properties represent only 1.4% of all flood insurance policies, yet historically they have accounted for nearly one-fourth of the claim payments (over $9 billion to date). Mitigating these repeatedly flooded properties will reduce the overall costs to the NFIP, the communities in which they are located, and the individual homeowners. The Ocean City Floodplain Management Committee conducted an "area analysis" case study in Ocean City, NJ. The area analysis follows FEMA guidelines to determine why an area has repeated flood losses and what alternative flood protection measures would help break the cycle of repetitive flooding.

Study Area

The study area for this report is the entire island of Ocean City, NJ. Ocean city is a barrier island on the Atlantic Coast in Cape May County, NJ and the entire island is a SFHA (Special Flood Hazard Area). There are 19,678 structures in the study area. Of those 19,678 structures, 89 are on FEMA's repetitive loss list, while 65 of those 19,678 (.0033%) properties are severe repetitive loss (SRL) properties.

Problem Statement:

By definition, Ocean City is a Category 3 Community (A community with 10 or more repetitive loss properties that have not been mitigated). There are also Category 1 and Category 2 Repetitive loss communities. The Floodplain Management Committee is aware that these losses will continue unless some type of action is undertaken by the community and the building owners who have experienced RL or SRL Losses. The committee will work on measures to mitigate these losses.

Major Flood Problems facing Ocean City: The history of flooding within Ocean City indicates that major flooding can occur during any season of the year, particularly during the late summer and fall, when high tides are generated in Great Egg Harbor Bay and along the Atlantic Ocean coastline. Flooding occurs from tropical storms, extratropical cyclones, and to a lesser extent severe thunderstorm activity. Most serious tidal flooding problems are attributed to hurricanes; which occur during the late summer and early autumn. In addition to heavy participation, hurricanes produce high tides and strong waves which can result in severe damage to coastal areas. Although extratropical cyclones referred to as northeasters can develop at almost any time of the year, they are more likely to occur during the winter and spring. Thunderstorms are a common occurrence during the summer months. The most recent flooding disasters to cause major flood damage in Ocean City were Hurricane Sandy which came ashore as an immense tropical storm on October 29, 2012 and more recently Blizzard/Noreaster Jonas which struck Ocean City on January 23, 2016. Both storms caused severe damage to Ocean City; much of the New Jersey Coast and beyond.

Problem Extent:

There are 89 properties subject to flooding. Twenty four (24) of the insured properties have been flooded to the extent that they qualify as repetitive loss structures (RL) under the NFIP. In the study area, sixty five (65) of the eighty nine (89) repetitive loss properties are severe repetitive loss properties (SRL).
These 89 repetitive loss properties have made 48 flood insurance claims.
Ocean City has experienced 7,770, Closed Paid Losses since March 29, 1984 thru December 31, 2015 and has mitigated all but 89 of those properties with either RL or SRL designations. The total FEMA payout to these 89 properties totals $11,280,236 00. This a major problem which must be rectified.

Repetitive Loss Area Analysis Recommendations
to
The city of Ocean City and its Residents

Recommendations for the City of Ocean City:

1. Encourage everyone to pursue a mitigation measure.
2. Assist interested property owners in applying for a mitigation grant.
3. Address the issues with the clogged and/or undersized street drains.
4. Institute a maintenance program that encourages homeowners to frequently clear their street drains of debris to ensure open flow for stormwater.
5. Seek out and secure funding for the drainage improvements outlined in this report.
6. Complete these efforts and continue the process to improve the City's CRS classification, Ocean City is currently a Class 5 CRS Community.
7. Pursue all known possibilities to help property owners to mitigate and reduce flood losses.

For the residents of the study area

1. Contact the city of Ocean City for more information about possible funding opportunities.

2. Review alternative mitigation measures discussed in this analysis and implement those that are most appropriate for their situation.

3. Purchase and maintain a flood insurance policy on the home and its contents.

4. Homes with minus rated policies, work with the city CRS Committee to remove themselves from this category.

5. Property owners that are SDF Insured, should do all that they can to remove themselves from this category.

6. Performing detailed study of risks and costs of mitigating properties and identifying the most at risk and most cost effective to mitigate. Also work with the state of New Jersey DEP on Grants and Mitigation measures.

General Introduction

Flooding is a problem far too familiar to many neighborhoods across the United States. Enduring the consequences of flooding over and over again can be quite frustrating. When the water rises, life is disrupted, belongings are ruined, and hard-earned money is spent and lives are lost.

This report has been created in collaboration with the city of Ocean City, and the owners of homes in a repetitively flooded area who have continually suffered the personal losses and stresses associated with living in a flood-prone house. The goal is to help homeowners reduce their flood risk by providing a broader understanding of the flooding problems in their neighborhood, and the potential solutions to the continual suffering that results from repetitive flooding. The availability of possible funding sources for certain mitigation options is also discussed.

Repetitive Loss Area Analysis (RLAA): An approach that identifies repetitive loss areas, evaluates mitigation approaches, and determines the most appropriate alternatives to reduce future losses.

Hazard Mitigation: Any sustained action taken to reduce or eliminate long-term risk to life and property from a hazard event.

Repetitive Loss property (RL): An NFIP-insured property where two or more claim payments of more than $1,000 have been paid within a 10-year period since 1978.

Severe Repetitive Loss Property (SRL): A 1-4 family residence that is a repetitive loss property that has had four or more claims of more than $5,000 or two claims that cumulatively exceed the reported buildings value.

Flooding issues and potential mitigation measures are discussed for homes located in the study area in Ocean City, NJ. While the homes in this study are representative of other homes throughout the neighborhood, not all the mitigation measures reviewed in this report are appropriate for all homes in the study area.

It is understood that there are many stresses associated with repetitive flooding including worry about how high the water may rise, the loss of personal belongings, the possibility of mold, and whether or not neighbors will return after the next event. Adding to this worry is the uncertainty related to the potential solutions. Should I elevate and if so, how high? How much will mitigation projects cost? What will my neighborhood look like if I am the only one to mitigate, or the only one not to mitigate? Is there a solution that might work for the entire neighborhood?

These questions are common, and this report attempts to answer them according to the specific situation faced by homeowners in the area. Informed homeowners can become even stronger advocates for policy change at the neighborhood, city, county, state and even federal levels. Overall, it is hoped that by gaining a better understanding of the flooding issues, neighborhoods can become safer and homeowners better able to confront the hazard of flooding.

Repetitive Loss Area Analysis

Repetitive Loss Properties in

Ocean City, NJ

Background

The National Flood Insurance Program (NFIP) is constantly faced with the task of paying claims while trying to keep the cost of flood insurance at an affordable level. It has a particular problem with repetitive loss properties, repetitive loss properties comprise approximately one percent of currently insured properties but account for 25 to 30 % of flood claims. They constitute a significant expense to the National Flood Insurance Program (NFIP), costing in excess of $200 million annually (2010 figures). The Severe Repetitive Loss (SRL) Grant Program's purpose is to provide funding to reduce or eliminate claims under the NFIP through project activities that will result in the greatest savings to the National Flood Insurance Fund (NFIF).

Mitigating severe repetitive loss properties through buyouts, elevations, relocations, or Flood-proofing will save money for NFIP policy holders and for Federal taxpayers by reducing the number of properties affected by floods and reduced Federal disaster assistance. These kinds of mitigation solutions shift the burden of recovery costs to property owners who choose to remain vulnerable to repetitive flood damage and encourages property owners to take appropriate actions that reduce the loss of life and property damage and also benefits the financial soundness of the NFIP.

The Area: The Ocean City repetitive loss study area comprises the entire city of Ocean City, NJ, the city is barrier island and as can be expected of a barrier island Ocean City is subject to Coastal Flooding as the entire island is a SFHA (Special Flood Hazard Area). By definition, Ocean City is a Category 3 Community (A community with 10 or more repetitive loss properties that have not been mitigated). There are also Category 1 and Category 2 Repetitive loss communities.

The City of Ocean City is located along the Atlantic Ocean coastline within the northeastern

portion of Cape May County, New Jersey. It is bounded on the north by Atlantic County, New Jersey and the Great Egg Harbor Bay, on the east by the Atlantic Ocean, on the south-southwest by the Township of Upper and the City of Sea Isle City and the west by the Township of Upper. It is the principal city of the Ocean City Metropolitan Statistical Area which encompasses all of Cape May County.
The City of Ocean City is a barrier island with bridge connections to Marmora (Township of Upper) via the 34th Street (Roosevelt Boulevard) Bridge , Egg Harbor Township via the Ocean City-Longport Bridge, Somers Point via the 9th Street Bridge (NJ 52), and Strathmere (Township of Upper) via the Corson's Inlet Bridge. The Eastern side of Ocean City borders the Atlantic Ocean, while the Western side faces the Great Egg Harbor Bay, Beach Thoroughfare.

Ocean City is the county's largest city by area and is the principal city of the Ocean City Metropolitan Statistical Area which encompasses all of Cape May County. As of the 2010 United States Census, the city's population was 11,701,[10] reflecting a decline of 3,677 (-23.9%) from the 15,378 counted in the 2000 Census, which had in turn declined by 134 (-0.9%) from the 15,512 counted in the 1990 Census.[20]

In summer months, with an influx of tourists and second homeowners, there are estimated to be 115,000 to 130,000 within the city's borders.[21][22]
Ocean City originated as a borough by an act of the New Jersey Legislature on May 3, 1884, from portions of Upper Township, based on results from a referendum on April 30, 1884, and was reincorporated as a borough on March 31, 1890. Ocean City was incorporated as a city, its current government form, on March 25, 1897.[23][24] The city is named for its location on the Atlantic Ocean.[25][26]
Known as a family-oriented seaside resort, Ocean City has prohibited the sale of alcoholic beverages within its limits since its founding in 1879,[27][28] offering miles of guarded beaches, a boardwalk that stretches for 2.5 miles (4.0 km), and a downtown shopping and dining district.[29]
The Travel Channel rated Ocean City as the *Best Family Beach of 2005*.[30] It was ranked the third-best beach in New Jersey in the 2008 Top 10 Beaches Contest sponsored by the New Jersey Marine Sciences Consortium.[31] In the 2009 Top 10 Beaches Contest, Ocean City ranked first.[32]
From early June through Labor Day, Ocean City requires individuals age 12 and up to purchase a beach tag to access its beaches.[33] For the 2015 season, a one-day pass cost $5, a weekly pass was $10, and a seasonal pass for the full summer season was $25 (though, if purchased before June 1, seasonal tags were $20.)[34]

History

The island, a stretch of dunes and swamps running for seven miles, had been used by local Native Americans who were brought there by its abundance of fish during the summer months. Originally purchased by the Somers family, the island had once been named Peck's Beach, believed to have been given the name for a whaler named John Peck who had a camp on the island.[35]
In 1700, whaler John Peck began using the barrier island as a storage place for freshly caught whales. Eventually known as Peck's Beach, the island had several purposes: it was an Indian summer fishing camp, cattle-grazing area, and sometimes mainlanders would boat over for a picnic or to hunt.[36]
On September 10, 1879, four Methodist ministers, Ezra B. Lake, James Lake, S. Wesley Lake,

and William Burrell, chose the island as a suitable spot to establish a Christian retreat and camp meeting on the order of Ocean Grove.[37] They met under a tall cedar tree, which stands today in the lobby of the Ocean City Tabernacle. Having chosen the name "Ocean City", the founders incorporated the Ocean City Association, laid out street and lots for cottages, hotel and businesses. The Ocean City Tabernacle was built between Wesley and Asbury Avenues and between 5th and 6th Streets. Camp meetings were held by the following summer. As a result of its religious origins, the sale or public drinking of alcoholic beverages in Ocean City was prohibited.[38]

The first bridge was built to the island in 1883, and the first railroad soon followed. The first school began in 1881. The boardwalk grew and was relocated several times. The ship *Sindia* joined other shipwrecks on the beach on December 15, 1901, on its way to New York City from Kobe, Japan, but has since sunk below the sand. A salvage attempt to retrieve treasures believed to have been on the ship was most recently launched in the 1970s, all of which have been unsuccessful.[39] A large fire in 1927 changed the city significantly, causing $1.5 million in damage and leading the city to move the boardwalk closer to the ocean, which resulted in the greater potential for damage from saltwater.[40]

Boardwalk

Ocean City Boardwalk, looking south

The Ocean City boardwalk is one of the most recognizable landmarks in the resort. It is also one of the most well-known boardwalks in the world.[*citation needed*] It is 2.5-mile (4.0 km) long and runs north from 23rd Street to St. James Place, with mile markers for people who are exercising.[41]

The boardwalk was first built in 1880 from the Second Street wharf to Fourth Street and West Avenue. In 1885, plans to extend the boardwalk along the entire beach were made as the city's first amusement house, a pavilion on the beach at 11th street called "The Excursion" opened. A second amusement park, the "I.G. Adams pavilion", at Ninth Street and the boardwalk, opened soon after but was destroyed by fire in 1893. Following a second catastrophic fire in 1927, the boardwalk and its businesses were rebuilt 300 feet (91 m) closer to the ocean on concrete pilings, with parking created for cars in the space where the buildings and boardwalk once stood.

The Ocean City Music Pier partially opened one year later, with work completed in time for the 1929 season.
In 1965, the Wonderland Amusement Park opened on the boardwalk at 6th Street, which is now known as "Gillian's Wonderland Pier". *Runaway Train*, a steel twister, is the only major coaster that operates there. Playland's Castaway Cove, is located on the boardwalk at 10th Street. Two major roller coasters operate there, which are the *Python*, a looping coaster, and the *Flitzer*, a wild mouse coaster. A new major shuttle coaster at Castaway Cove, *Storm*, was planned to be finished in summer 2013. For the 2015 summer season, a new ride called "GaleForce" will be constructed, which will be a roller coaster with a 125-foot (38 m) drop that will replace Python and Flitzer. There is also a water park located on the boardwalk called "OC Waterpark", open during the summer months. In 2007 controversy emerged about the city's proposed use of ipê, a type of wood, to re-deck parts of the boardwalk. Environmental activists protested against the city's use of the wood, but the plan went ahead.[1]
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Government

Local government

The City of Ocean City was incorporated on March 25, 1897. Since July 1, 1978, the city has operated within the Faulkner Act, formally known as the Optional Municipal Charter Law, under the Mayor-Council system of municipal government. The mayor, the chief executive of the community, is chosen at-large for a four-year term at the municipal election in May and serves part-time for a yearly salary. The mayor neither presides over, nor has a vote on the council. The mayor has veto power over ordinances, but any veto can be overridden by a vote of two-thirds of the Council. The City council is the legislative body and has seven members. Four members represent individual wards and three are elected at-large. Each council person serves a staggered four-year term. The three at-large seat and the mayoral seat are up for election together, followed by the four ward seats which are voted upon two years later.
As of 2015 the mayor of Ocean City is Jay Gillian, whose term of office ends June 30, 2018. Members of the city council are Keith Hartzell (2018; At Large), Council President Peter Madden (2018; At Large), Karen Bergman (2018; At Large), Michael DeVlieger (2020; First Ward), Bobby Barr (2020; Fourth Ward), Antwan L. McClellan (2020; Second Ward) and Tony Wilson (2020; Third Ward), with a vacancy in the at-large seat that had been held by Michael Allegretto.
In September 2015, Councilman Michael Allegretto resigned from his seat expiring in December 2018 to take a position as the city's Director of Community Services. Karen Bergman was appointed by council to serve the balance of Allegretto's term, in the May 2016 election Bergman was elected to serve the balance of the term of office.

Federal, state and county representation

Ocean City is located in the 2nd Congressional District and is part of New Jersey's 1st state legislative district.

SRLAA 5 Step Process

Process: The Ocean City, NJ Repetitive Loss Area Analysis follows a FEMA-

prescribed five step process, however, the Ocean City analysis will also be conducted in conjunction with the Cape May County Hazard Mitigation Program. The repetitive loss area analysis will use studies, documents and notifications generated by the County Hazard Mitigation Program which is conducting a repetitive Loss Analysis for the entire County with team members from each municipality reporting for their respective areas. The city is working with the county in order to move forward with a cohesive program for mitigating Repetitive Loss and Severe Repetitive Loss Properties.

Step 1. Neighborhood Notification

The first step in of the FEMA five-step process is to advise the neighborhood about the project. On July 6, 2015 the Ocean City project team sent out notification to home owners in the affected neighborhoods advising of and introducing them to the project. Copies of the letter and notice appear in the Appendices of this document. There will be a follow-up set of notification documents sent out on March 29th 2016. The notification included a form to be completed by the property owner and after completion returned to the city, documents describing the FEMA Flood Mitigation Assistance Program opportunities For Invited RL & SRL Property Owners in the City.

Step 2 Data Collection

The second step of the process was to collect relevant data on the problem, i.e., the properties exposed to flooding and the cause (s) of the repetitive damage. Five sources of information were used for this step in the process: flood studies, flood insurance data, drainage information, property owners and on-site data collection. The data was collected thru the cooperation of several of the municipality departments. Data was collected by Frank Donato, who is the city's CFO and also the Emergency Management Officer, Mathew von der Hayden, Manager Capital Planning, Arthur Chew, Assistant City Engineer and Benny R. Tafoya, CFM, CMfgE, GIS/CRS Applications Specialist.

SRL Data: There are currently seven primary sources of data and information:

Community Flood Plans and Studies
Flood Insurance Data
Drainage Information
Data Sheets
On-Site Data Collection
Ocean City FEMA RL_SRL Properties Report (03/16/16)
Cape May County Hazard Mitigation Report (Section 9 Ocean City)

Community Flood Plans and Studies

The Ocean City RLAA Team has collected and reviewed the following reports:

City of Ocean City Master Plan (Adopted October 17,2012
City of Ocean City Flood Ordinance

drainage system for Ocean City, NJ and used the following data that had been collected by the city Engineering Department and the Hazard Mitigation Team, these studies included:

POSSIBLE FUNDING SOURCES

There are several possible sources of funding for mitigation projects:

Step 3. Visit each building in the repetitive loss area and collect basic data.

- The site visit will be used to collect data sufficient to do a preliminary assessment of the cause of the repetitive flooding and of any mitigation measures that would be appropriate for each property. This will include a review of drainage patterns around the building, the condition of the structure and the condition and type of foundation.
- The team member conducting the visit should not have to enter the property adequate information can be collected from observations from the street.
- Floor elevations or historical flood levels are not required but can be very helpful when available and this information is available for most buildings and flooding in the city.
- FEMA reports on flood losses will be used to determine the cause and type of storm that caused the flooding and the amount of the claim can help determine the extent of damage. **Note** that every year , each repetitive loss community is provided with a list of its historic claims. This includes single-claim properties.
- Information on appropriate data to be utilized will be taken from **FEMA-551 "Selecting Appropriate Mitigation Measures for Floodprone Structures".**
- This step will be accomplished using the "limited data view" of the National Flood Mitigation Data Collection Tool.

Step 4. Review alternative approaches and determine whether any property protection measures or drainage improvements are feasible. The review will look at all property measures in FEMA figures 360-1 and 510-4 of the Coordinators Manual that are appropriate for the type of structures being affected. The review will look at more than just drainage or structural flood control project alternatives as these measures are not sufficient for mitigation of flood prone buildings.

Step 5. Document all of the RLAA study findings. Although in most cases a separate report would be required for each area being analyzed, in the case of Ocean City and similar coastal communities where the areas and buildings are very much alike, therefore similar mitigation measures will be appropriate, the analysis will be assembled into a single report. This should be the case for most , if not all barrier islands. The analysis will include

- A summary of the process that was followed, including how many property owners were involved in the process.
- The problem statement with a map or maps of the affected areas. This statement and the mapping will protect the privacy rights of the owners.
- Tables and lists of basic information on the affected buildings such as foundation type, condition of the building and appropriate mitigation measures for the buildings will be included in the analysis, no private insurance information for individual buildings will be included.
- Any alternative approached that were considered; and

  Action items that include:

  Who is responsible for implementing the action,
  When will it be done, and
  How will it be funded.

  "When it will be done" will be expressed in terms of a schedule which has to consider funding availability and grants that will be used for mitigation."

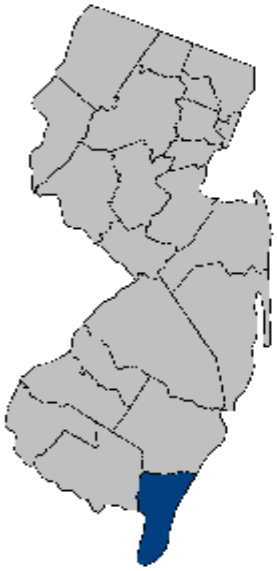
Flood Insurance Study (FIS)
Ocean City CRS Community 345310
Pending FIS Effective Date
October 5, 2017

Ocean City has adopted the Preliminary Maps which will become effective in October 2017 these maps are based upon the FIS which follows. The effective date of the attached FIS is October 5, 2017. This FIS will be the base for the SRAA

FLOOD INSURANCE STUDY

FEDERAL EMERGENCY MANAGEMENT AGENCY

VOLUME 1 OF 1



CAPE MAY COUNTY, NEW JERSEY

(ALL JURISDICTIONS)

COMMUNITY NAME	COMMUNITY NUMBER
AVALON, BOROUGH OF	345279
CAPE MAY, CITY OF	345288
CAPE MAY POINT, BOROUGH OF	345289
DENNIS, TOWNSHIP OF	340552
MIDDLE, TOWNSHIP OF	340154
NORTH WILDWOOD, CITY OF	345308
OCEAN CITY, CITY OF	345310
SEA ISLE CITY, CITY OF	345318
STONE HARBOR, BOROUGH OF	345323
UPPER, TOWNSHIP OF	340159
WEST CAPE MAY, BOROUGH OF	340160
WEST WILDWOOD, BOROUGH OF	345328
WILDWOOD, CITY OF	345329
WILDWOOD CREST, BOROUGH OF	345330
WOODBINE, BOROUGH OF	340164

FEMA

Effective:

OCTOBER 5, 2017

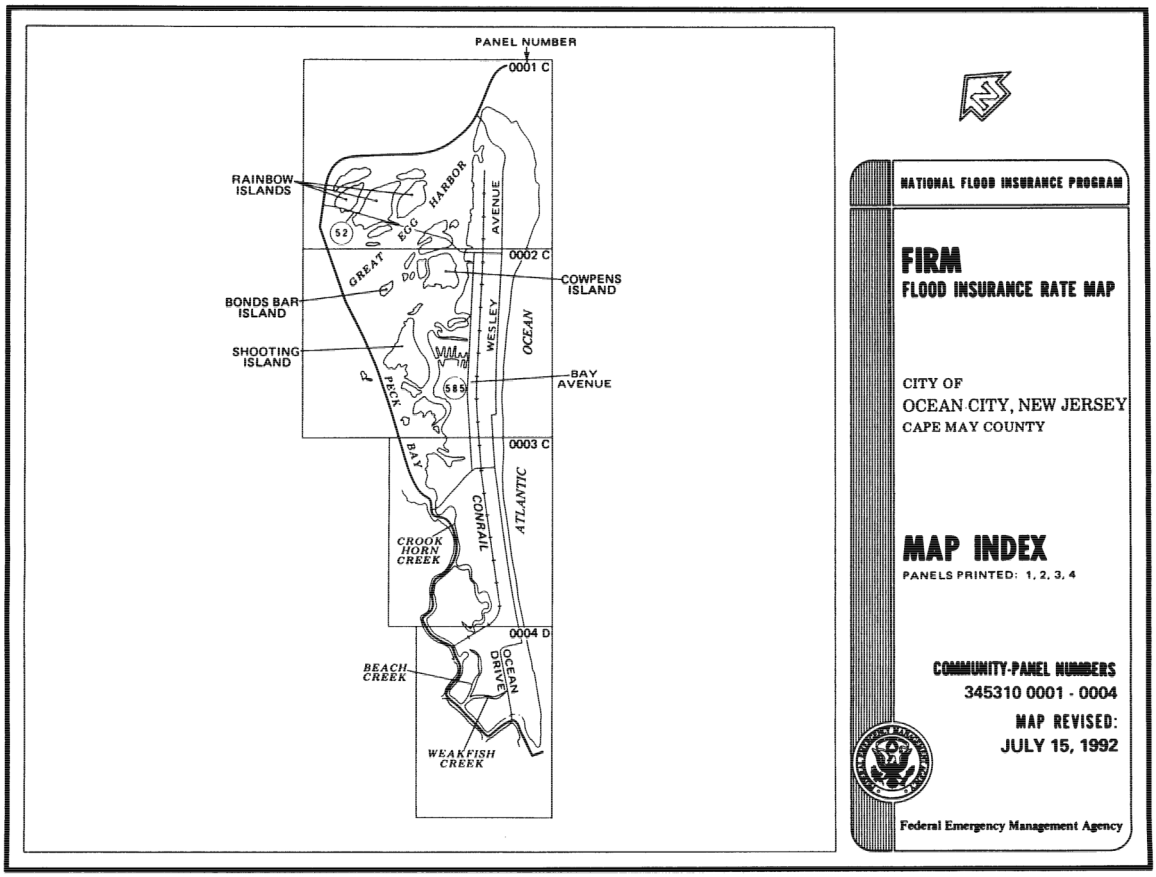
FLOOD INSURANCE STUDY NUMBER
34009CV000A
Version Number 2.1.3.0

Ocean City, NJ Community Number (345310)
Current FIRM, Map Revised July 15, 1992

Ocean City is considering adopting the Preliminary Maps which were issued on 6-30-2014 as the new FIRMs for Ocean City. The city has notified the Region LL Executive Director of its intend to adopt the preliminary maps and is awaiting further instructions from the Region LL Director as to how to proceed.
The Preliminary Maps 10 Panels are a part of this document as they will be used to complete the Repetitive Loss Area Analysis for the community. The Preliminary Maps follow the current FIRM Map Panels.

The Preliminary Maps became effective on October 5, 2017, they are now the current FIRM's & will be used for Flood Insurance purposes. The previous FIRM Index is shown below and the panels are on the following 5 pages.

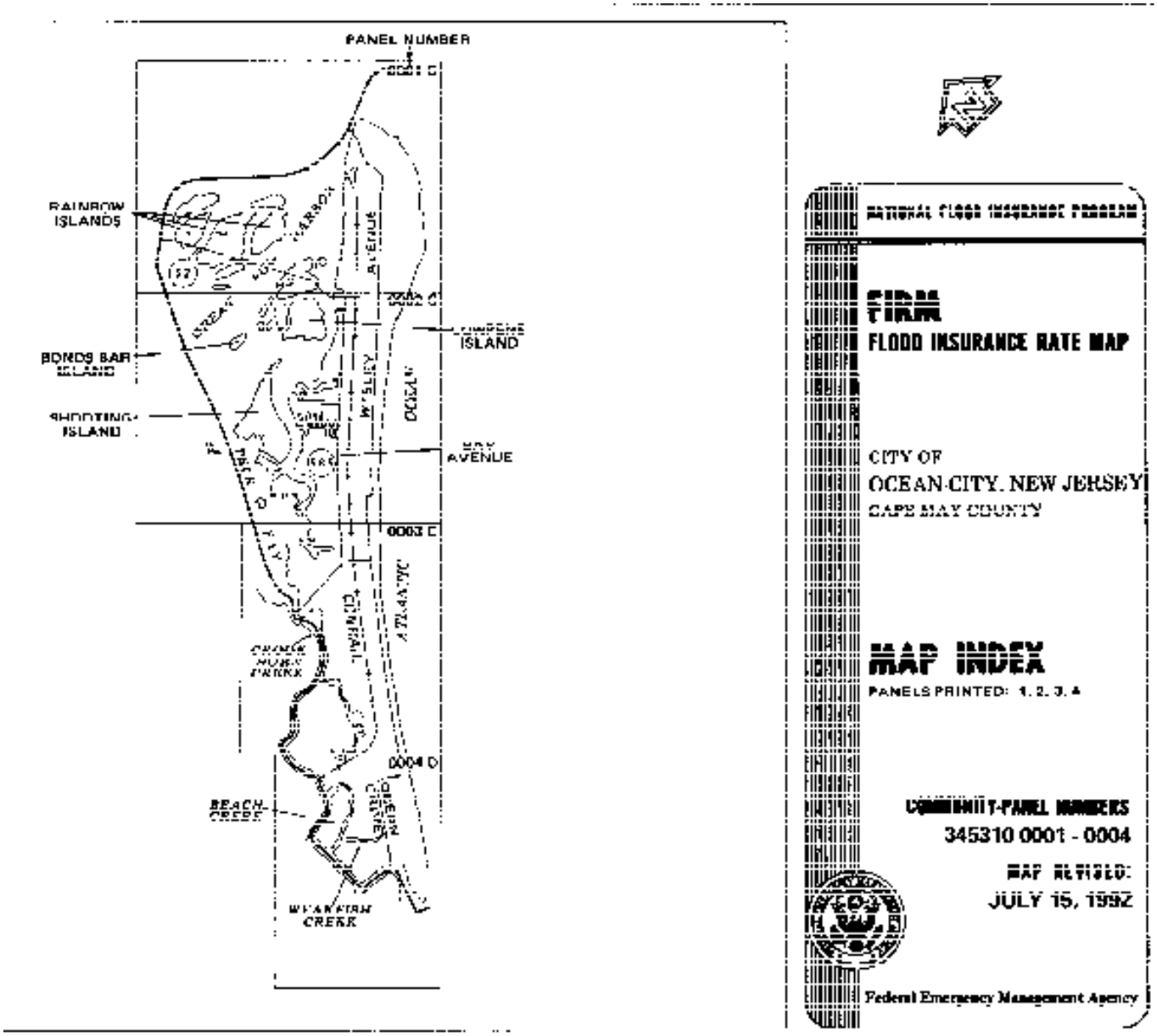
1. Flood Insurance Rate Map 345310 0001– 0004 Map Revised July 15, 1992
2. Flood Hazard Mitigation Plan Cape May County, NJ, Section 9.9 Ocean City.
3. Flood Insurance Rate Map (Preliminary June 30, 2014) 10 Panels for Ocean City they are 345310 (0069 F) (0086 F) (0087 F) (0088 F) (0089 F) (0091 F) (0093 F) (0157 F) (0159 F) and (0176 F).



FIRM
Flood Insurance Rate Map

City of Ocean City, NJ
Cape May County
Community # 345310
FIRM Map Revision 7/15/1992

MAP INDEX
(4) Panels

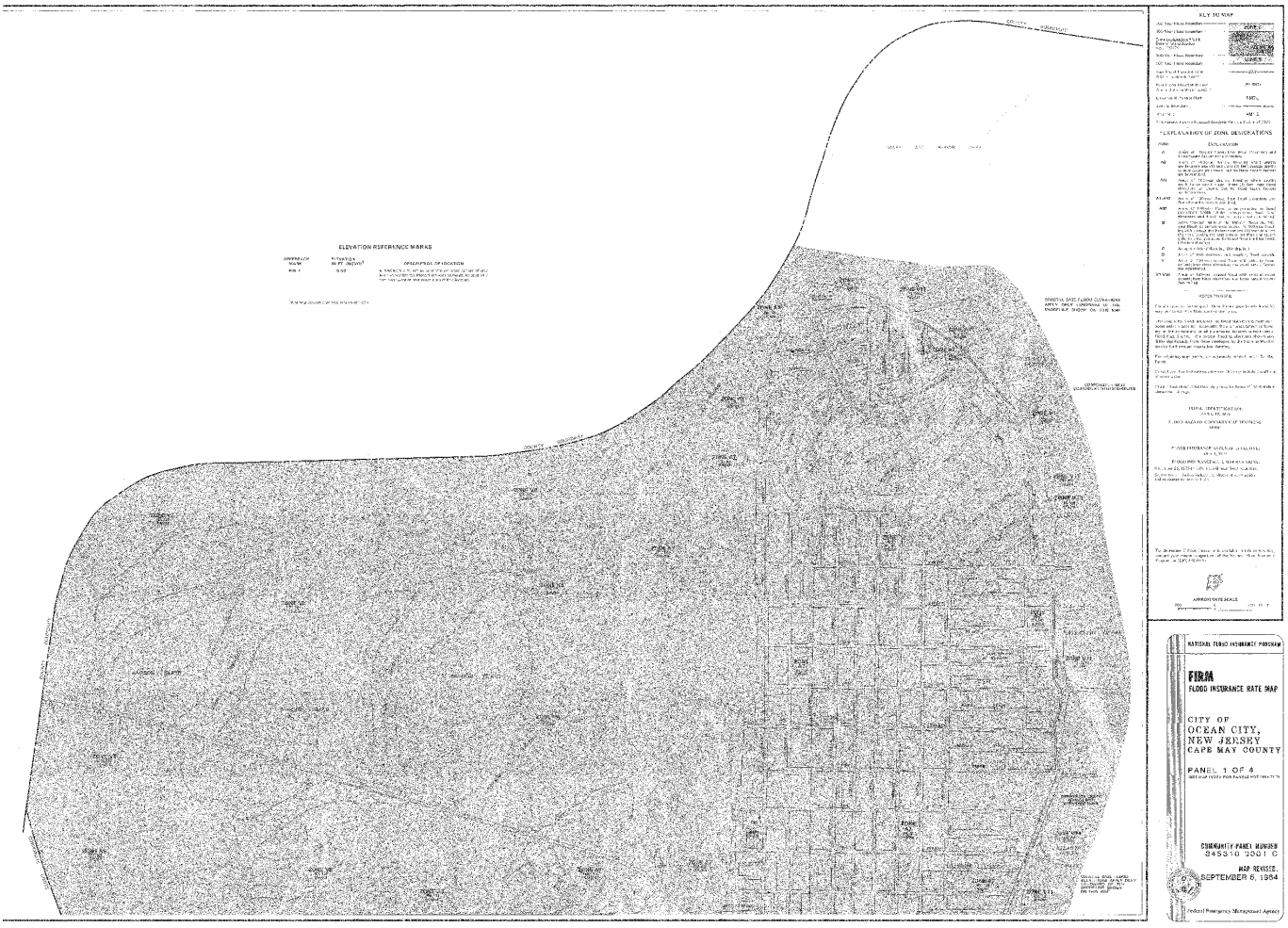


The Map Panels on the next 4 pages are the current FIRMs for Ocean City, NJ and are used to determine the rates for flood insurance in the community. These FIRMs will remain in use for insurance purposes until the preliminary maps become effective.

FIRM
Flood Insurance Rate Map

City of Ocean City, NJ
Cape May County
Community # 345310
FIRM Map Revision 7/15/1992

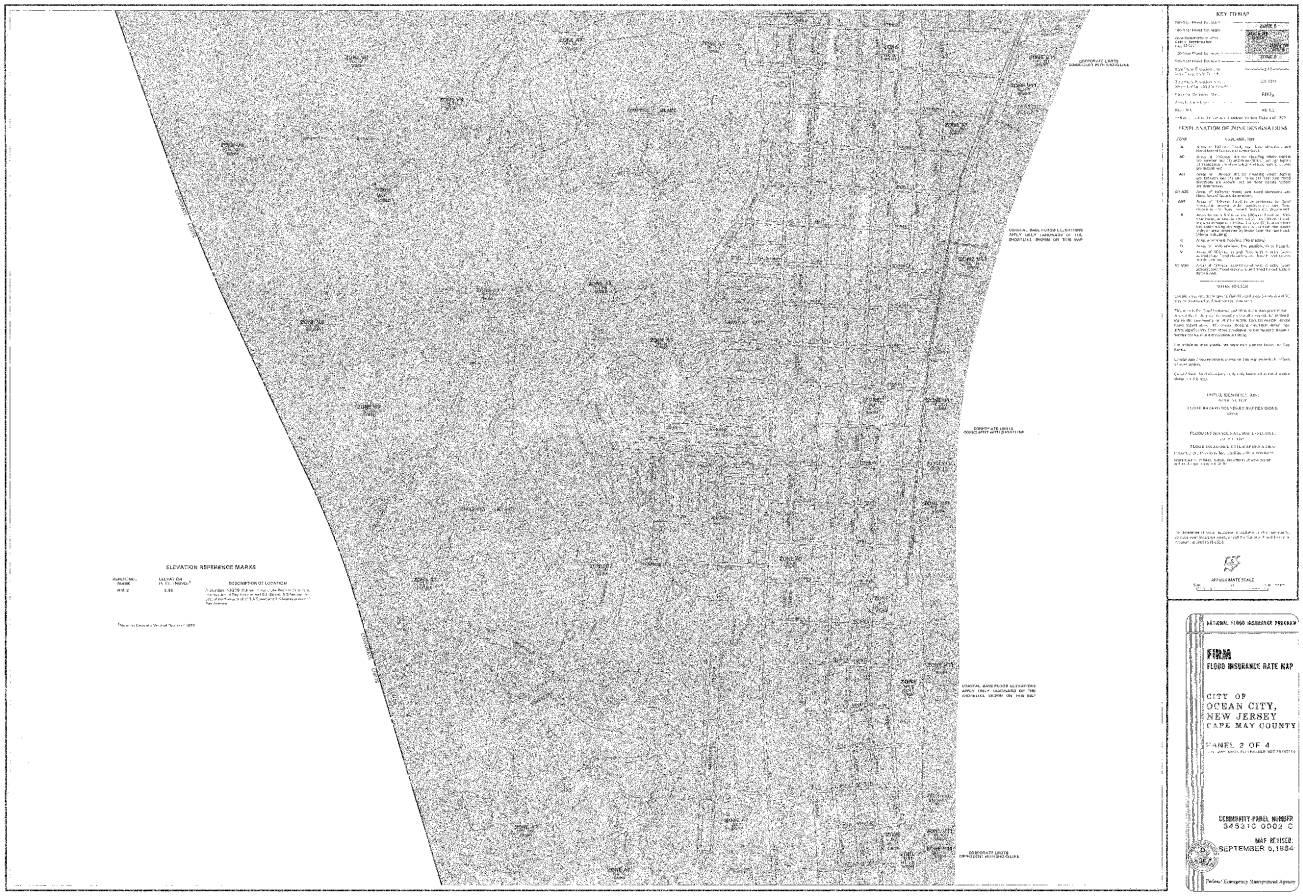
MAP PANEL 1 of (4) Panels



This Map Panel 1of 4 are the current FIRMs for Ocean City, NJ
and are used to determine the rates for flood insurance in the community. These FIRMs will remain in use for insurance purposes until the preliminary maps become effective.

City of Ocean City, NJ
Cape May County
Community # 345310
FIRM Map Revision 7/15/1992

MAP PANEL 2 of (4) Panels



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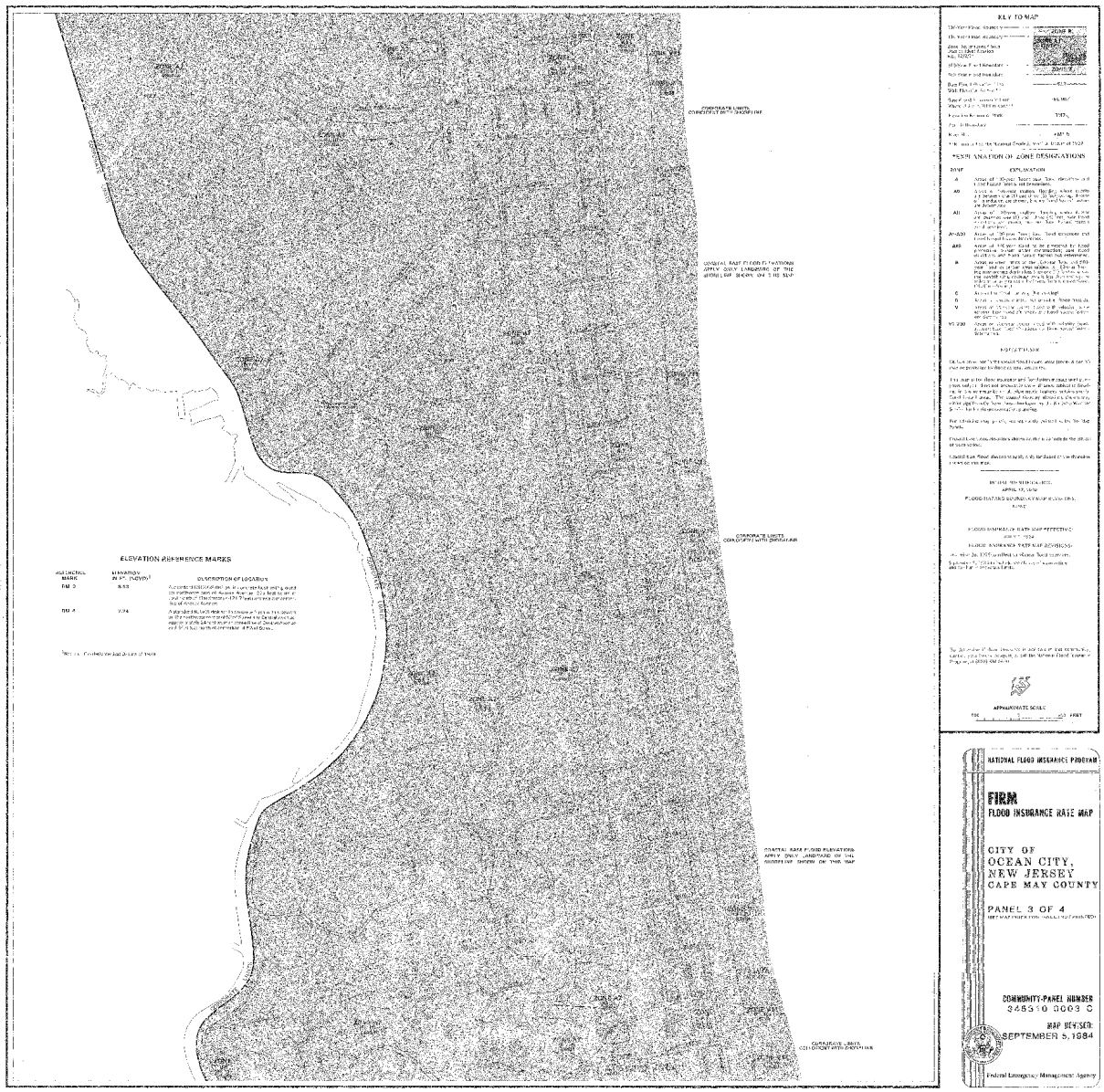
City of Ocean City, NJ
Cape May County
Community # 345310
FIRM Map Revision 7/15/1992

MAP PANEL 3 of (4) Panels



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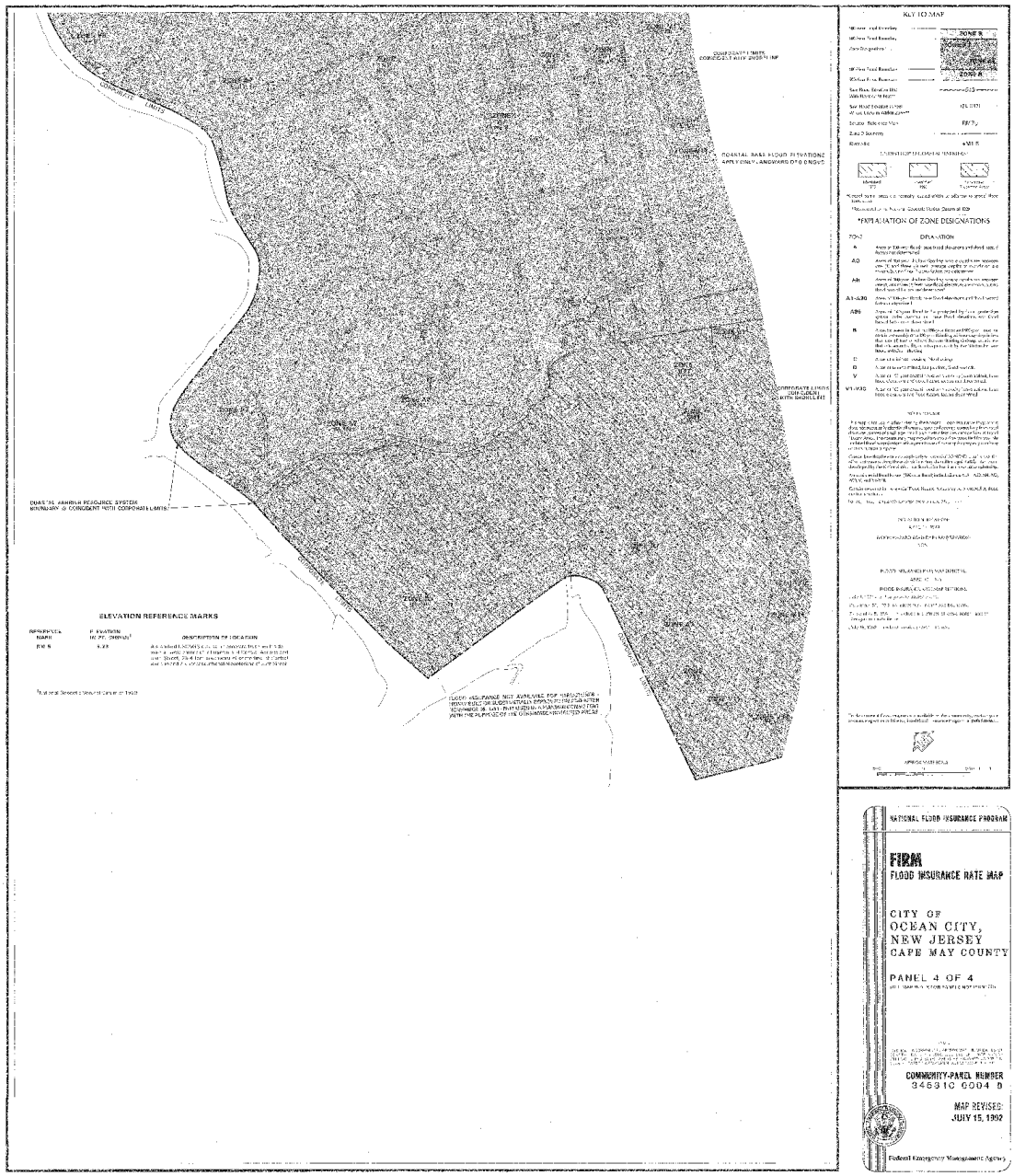
City of Ocean City, NJ
Cape May County
Community # 345310
FIRM Map Revision 7/15/1992

MAP PANEL 4 of 4



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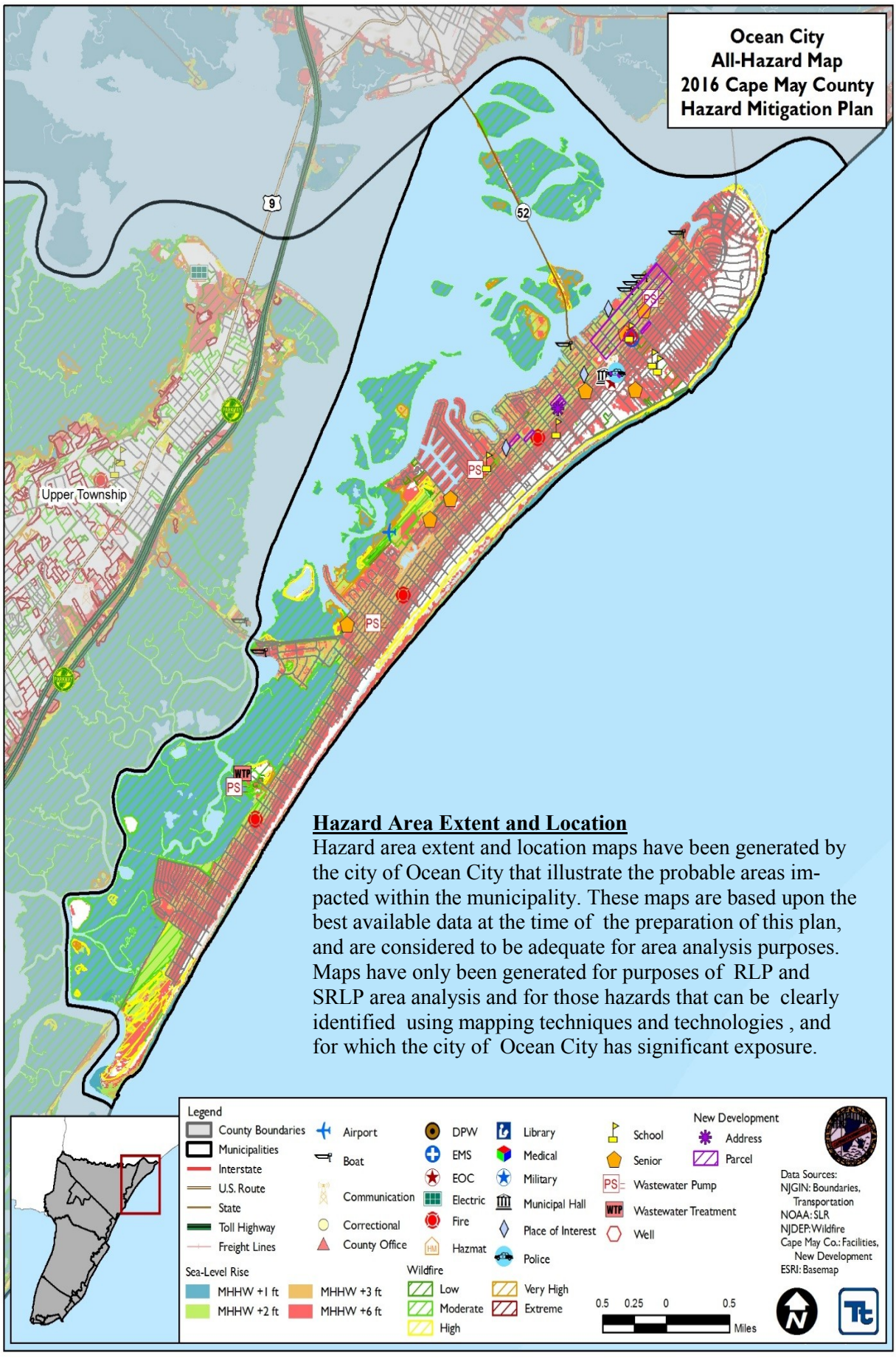
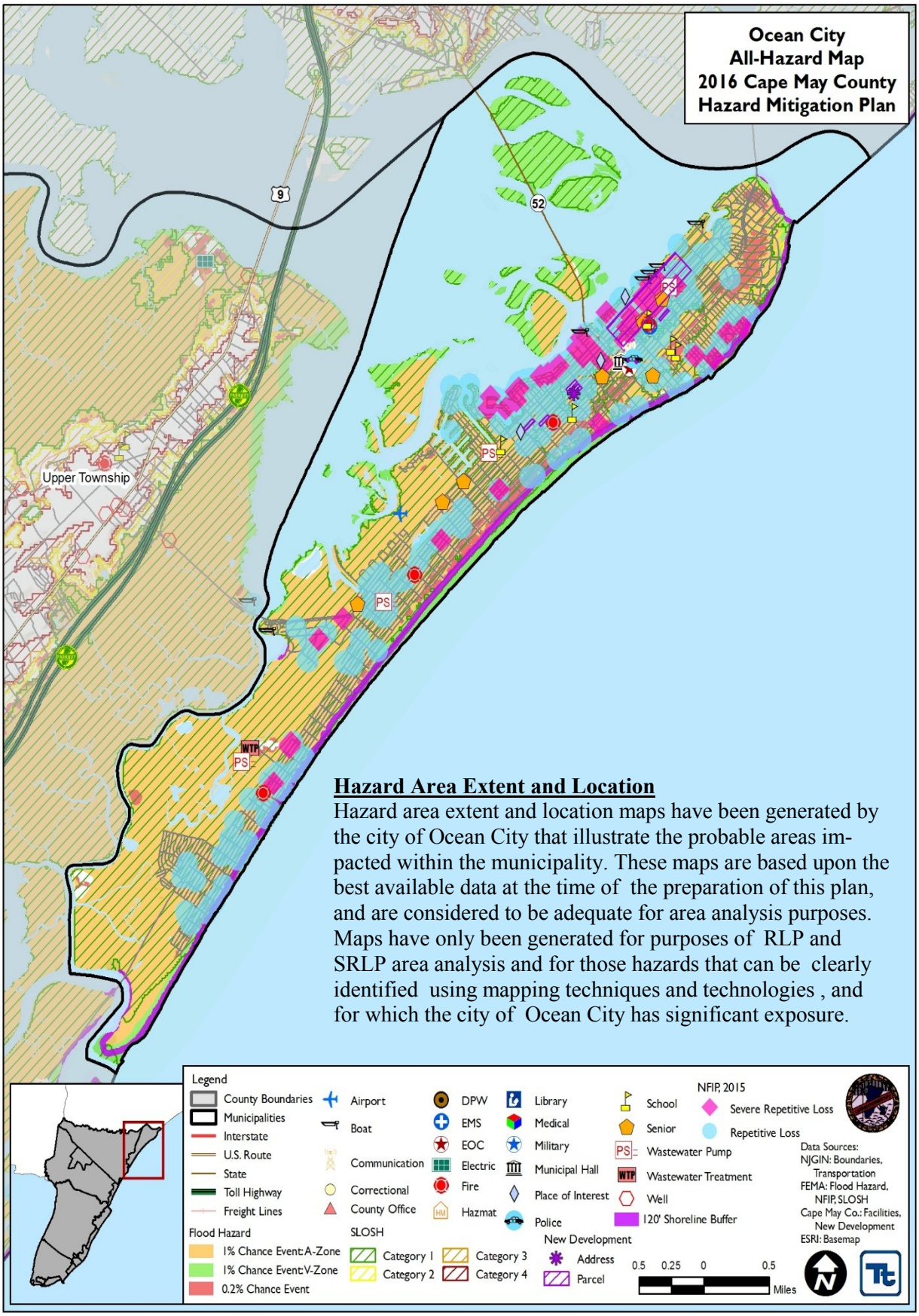

Ocean City
All-Hazard Map
2016 Cape May County
Hazard Mitigation Plan
9
52
Upper Township
PS
WTP
Hazard Area Extent and Location
Hazard area extent and location maps have been generated by the city of Ocean City that illustrate the probable areas impacted within the municipality. These maps are based upon the best available data at the time of the preparation of this plan, and are considered to be adequate for area analysis purposes. Maps have only been generated for purposes of RLP and SRLP area analysis and for those hazards that can be clearly identified using mapping techniques and technologies , and for which the city of Ocean City has significant exposure.
Legend
County Boundaries
Municipalities
Interstate
U.S. Route
State
Toll Highway
Freight Lines
Airport
Boat
Communication
Correctional
County Office
DPW
EMS
EOC
Electric
Fire
Hazmat
Library
Medical
Military
Municipal Hall
Place of Interest
Police
School
Senior
Wastewater Pump
Wastewater Treatment
Well
New Development
Address
Parcel
Sea-Level Rise
MHHW +1 ft
MHHW +2 ft
MHHW +3 ft
MHHW +6 ft
Wildfire
Low
Moderate
High
Very High
Extreme
0.5 0.25 0 0.5
Miles
Data Sources:
NJGIN: Boundaries, Transportation
NOAA: SLR
NJDEP: Wildfire
Cape May Co.: Facilities, New Development
ESRI: Basemap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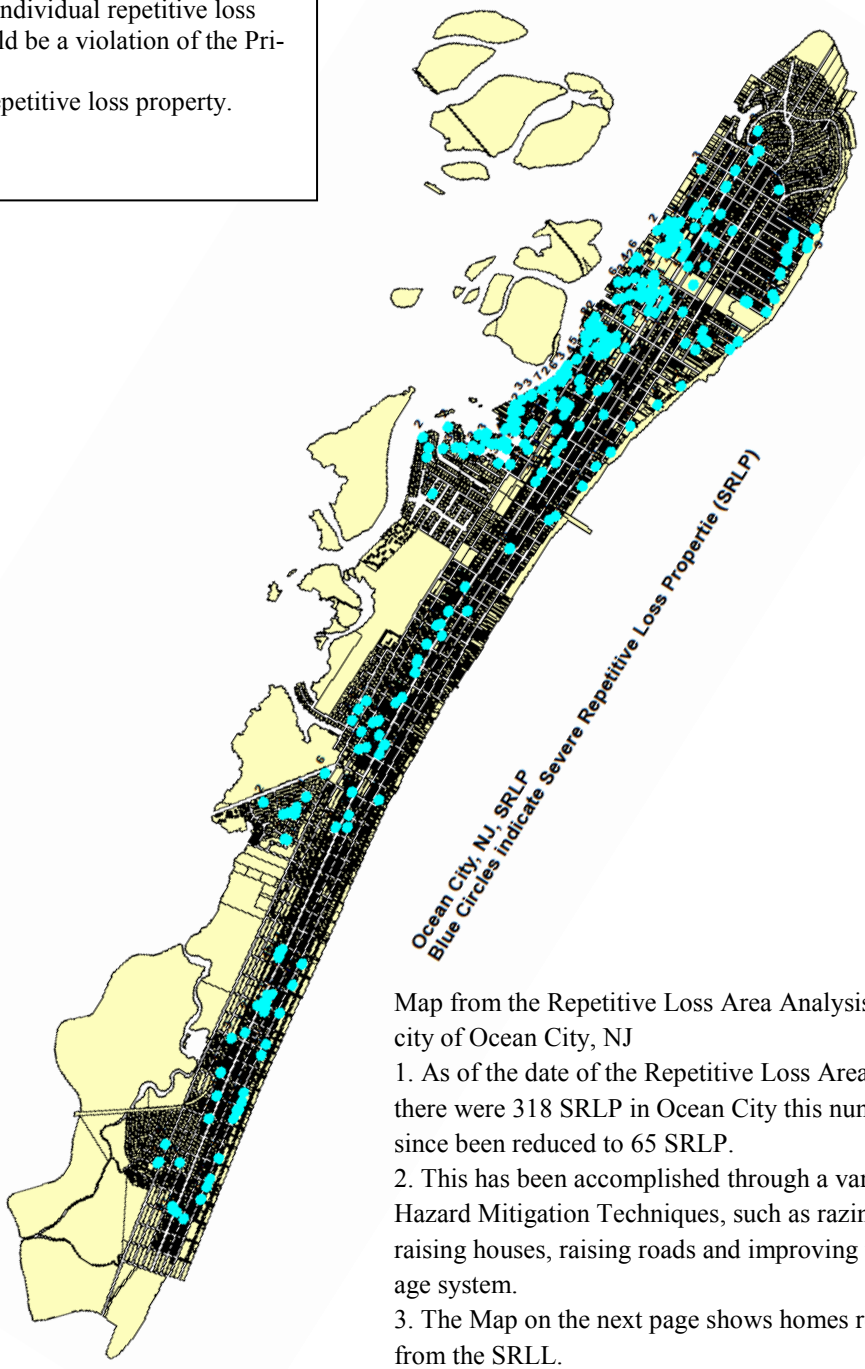
Legend
County Boundaries
Municipalities
Interstate
U.S. Route
State
Toll Highway
Freight Lines
Flood Hazard
1% Chance Event:A-Zone
1% Chance Event:V-Zone
0.2% Chance Event
Airport
Boat
Communication
Correctional
County Office
SLOSH
Category 1
Category 2
Category 3
Category 4
DPW
EMS
EOC
Electric
Fire
Hazmat
Library
Medical
Military
Municipal Hall
Place of Interest
Police
New Development
Address
Parcel
School
Senior
Wastewater Pump
Wastewater Treatment
Well
120' Shoreline Buffer
NFIP, 2015
Severe Repetitive Loss
Repetitive Loss
Data Sources:
NJGIN: Boundaries, Transportation
FEMA: Flood Hazard, NFIP, SLOSH
Cape May Co.: Facilities, New Development
ESRI: Basemap
0.5 0.25 0 0.5
Miles

This map of Ocean City has been reduced
CRS note: The map is intentionally set to a scale that does not identify individual repetitive loss properties, which would be a violation of the Privacy Act.
Blue Circles show a repetitive loss property.

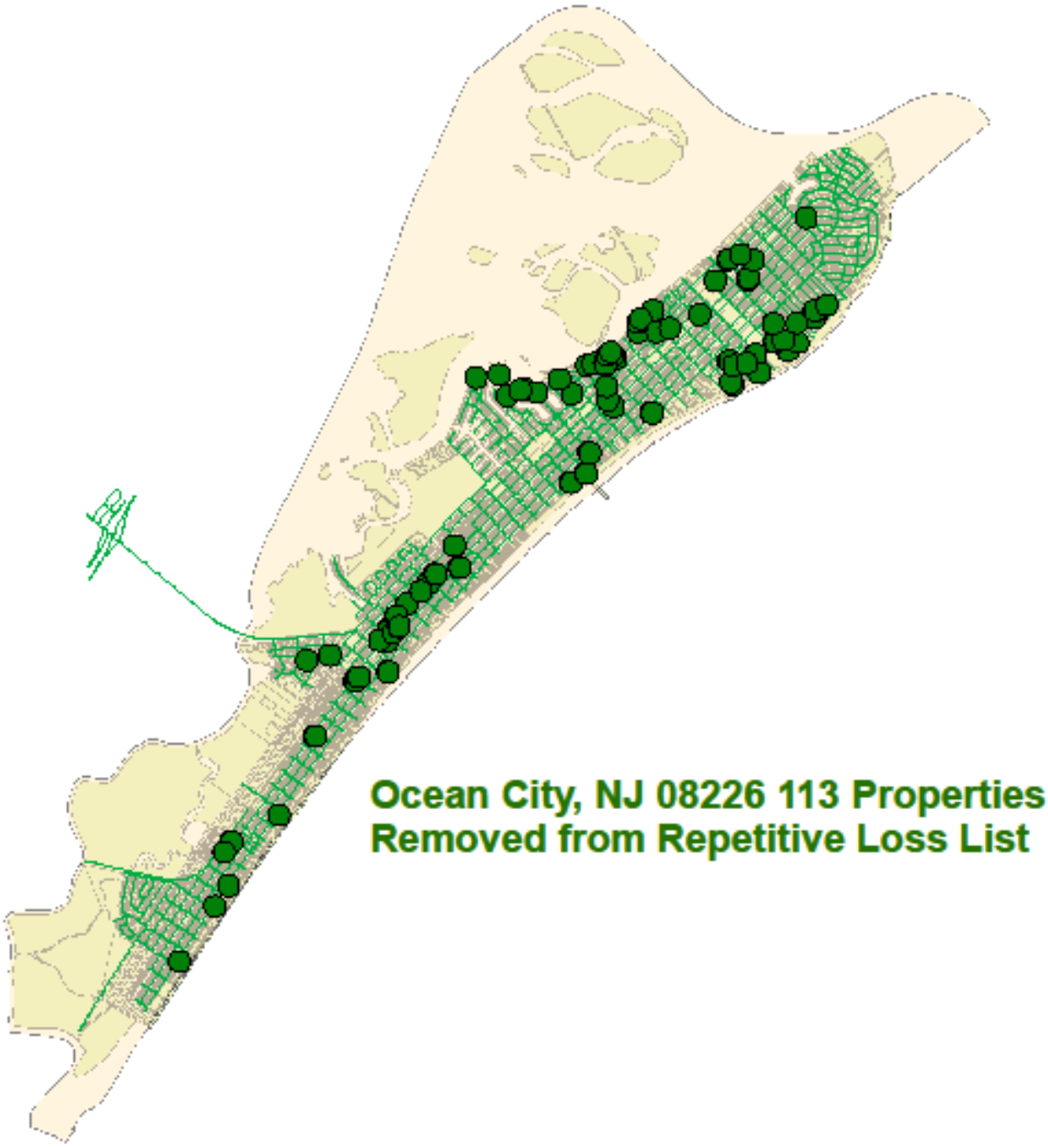


Map from the Repetitive Loss Area Analysis for the city of Ocean City, NJ

1. As of the date of the Repetitive Loss Area Analysis there were 318 SRLP in Ocean City this number has since been reduced to 65 SRLP.
2. This has been accomplished through a variety of Hazard Mitigation Techniques, such as razing houses, raising houses, raising roads and improving the drainage system.
3. The Map on the next page shows homes removed from the SRLL.

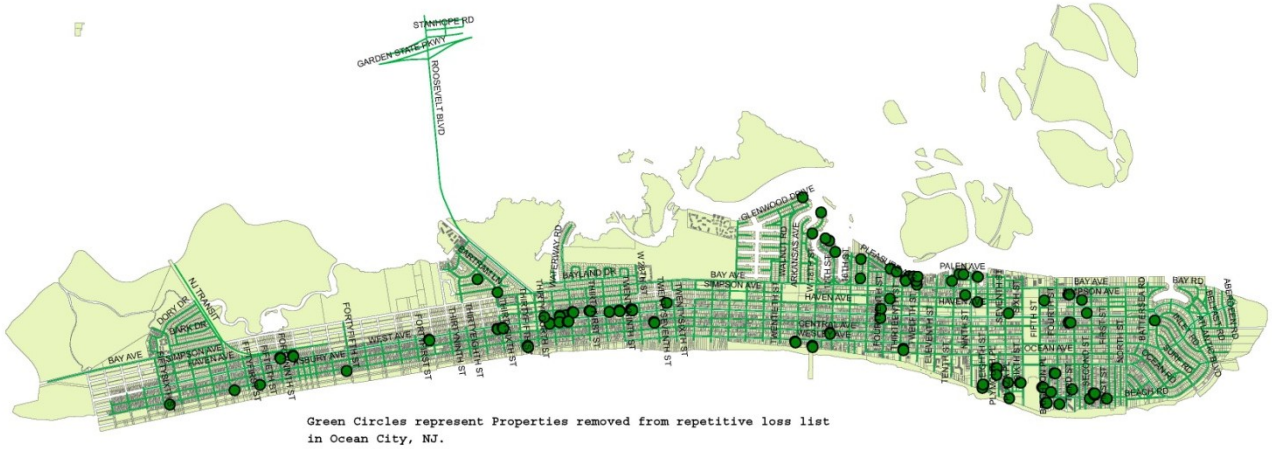
Repetitive Loss Area Analysis for the city of Ocean City, NJ

Ocean city is working aggressively to remove properties from the SRLL and has successfully reduced the number of SRL properties from 318 SRLP after Hurricane Sandy to 65 SRLP. This has been accomplished using a variety of HMG Techniques, such as razing houses, raising houses, raising roads and improving the drainage system.



Properties shown above are properties that have been removed from the Ocean City Repetitive Loss List. The 113 properties were removed from the RLL and residents notified, Elevation Certificates for these properties are on file with the city.

This map of Ocean City has been reduced
CRS note: The map is intentionally set to a scale that does not identify individual repetitive loss properties, which would be a violation of the privacy act.
of the Privacy Act.
Green Circles show repetitive loss properties



Properties Removed from the Repetitive Loss List

1. The green circles on the map represent properties that have been removed from the repetitive loss list.
2. The PPI Committee is dedicated to helping property owners to remove their properties from the repetitive loss list.
3. There are many ways the committee can help to accomplish the removal of properties from the repetitive list and to the extent that the committee can provided assistance or make recommendations it will do so.
4. Currently 114 Properties have been removed from the repetitive list and a look at the above map will show that these properties are spread throughout the city.
5. The current status of RL_ SRL Properties in Ocean City is;
    a. RL _SRL total is 89 Properties
    b. RL = 24 Properties
    c. SRL = 65 Properties

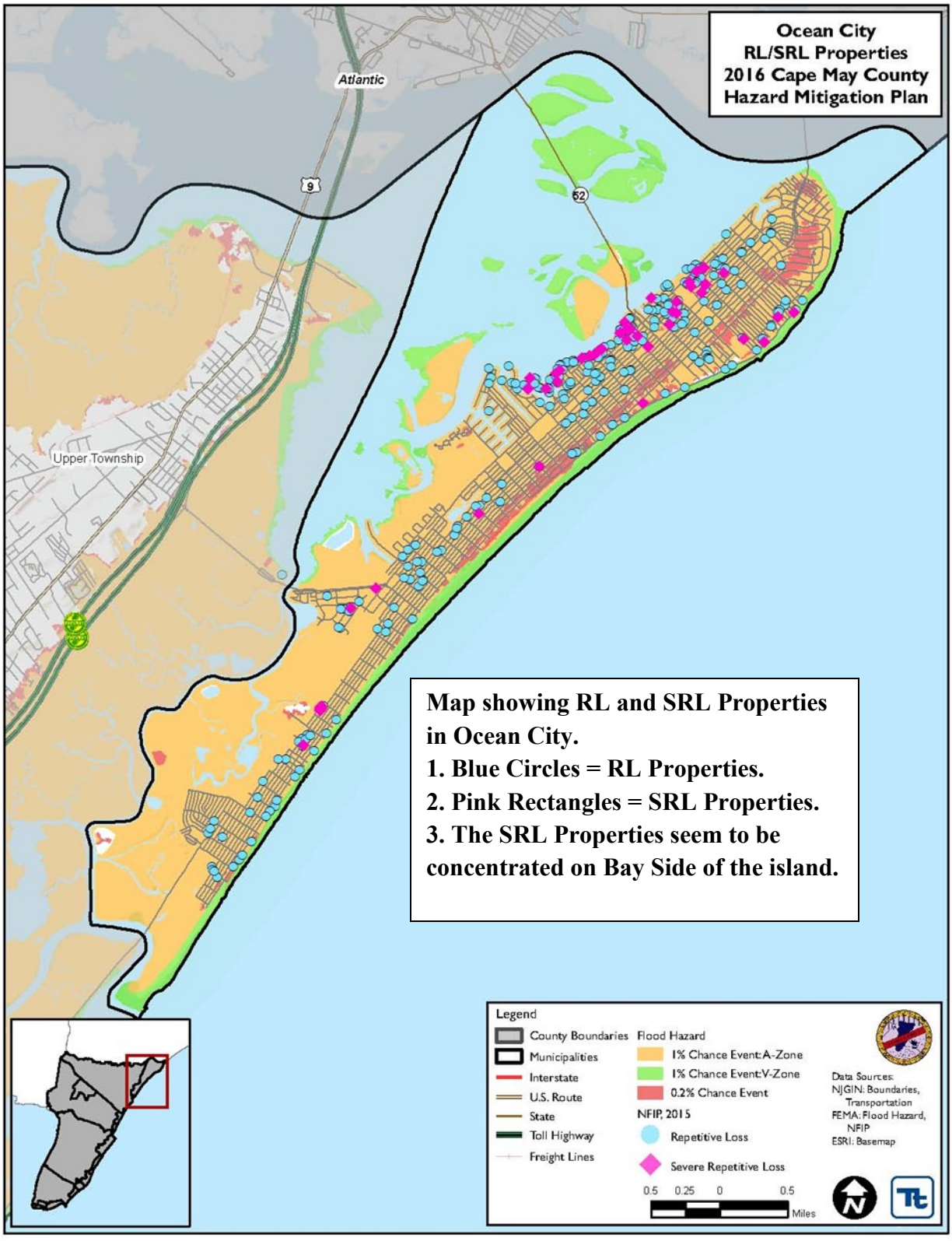
Losses

1. The paid losses in Ocean City currently total 434.
2. The breakdown of paid losses by property is: from 14 paid to 2 paid.

A. Properties with 14 paid losses	1	
B. Properties with 12 paid losses	1	
C. Properties with 10 paid losses	2	
D. Properties with 9 paid losses		1
E. Properties with 8 paid losses		8
F. Properties with 7 paid losses		8
G. Properties with 6 paid losses	11	
H. Properties with 5 paid losses		17
I. Properties with 4 paid losses		12
J. Properties with 3 paid losses		4
K. Properties with 2 paid losses	24	

Total 89 RL_ SRL Properties

A question to be investigated by the Analysis Team is why people, who have continued losses, seemingly take no action to mitigate flooding problems.



Flood Insurance Data: **One readily available source of information on flood hazards is flood insurance data. Two statistics from the National Flood Insurance Program (NFIP) tell a lot about flooding in a community.**

1. **Where do people have flood insurance policies?**
2. **Where have flood insurance claims been paid?**
3. **How many policies are in the community?**

Community Information System

Release 4.08.01.01, 02/19/2016 – Build 004, Skip Navigation Logged in as: garrettb [Session expires in 20 mins]

Insurance Overview

As of 06/30/2016

Community:	OCEAN CITY, CITY OF	**State:**	NEW JERSEY
County:	CAPE MAY COUNTY	**CID:**	345310

Overview | Occupancy | Zone | Pre/Post FIRM

Total by Community

Total Number of Policies:	17,019
Total Premiums:	$11,251,325
Insurance in Force:	$4,007,686,600
Total Number of Closed Paid Losses:	7,770
$ of Closed Paid Losses:	$176,799,753

Group Flood Insurance

Total Number of Policies:	0
Total Premiums:	$0
Insurance in Force:	$0
Total Number of Closed Paid Losses:	4
$ of Closed Paid Losses:	$100,903

Post Firm Minus Rated Policies

Total Number of Minus Rated Policies:	2,066
A Zone Minus Rated Policies:	2,050
V Zone Minus Rated Policies:	16

Manufactured Homes

Total Number of Policies:	0
Total Number of Closed Paid Losses:	0
$ of Closed Paid Losses:	$0

ICC

Total Number of ICC Closed Paid Losses:	162
$ of ICC CLosed Paid Losses:	$4,477,657

1316

Number of Properties by Community:	0

Substantial Damage Losses

Number of Substantial Damage Closed Paid Losses:	468

As of May 1, 2016 the city of Ocean City achieved a CRS rating of Class 5 and as such all citizens not in a minus rated property receive a 25% discount on Flood Insurance.

Community Information System

Release 4.08.01.01, 02/19/2016 – Build 004, Skip Navigation Logged in as: garrettb [Session expires in 20 mins]

CRS What-If

Application | CRS Coord. | 2ndPOC | Activity Points | Chronology | Comments | What If | GTA

Community:	OCEAN CITY, CITY OF	**State:**	NEW JERSEY
County:	CAPE MAY COUNTY	**CID:**	345310

Current CRS Class = 6 *[Printable Version]*

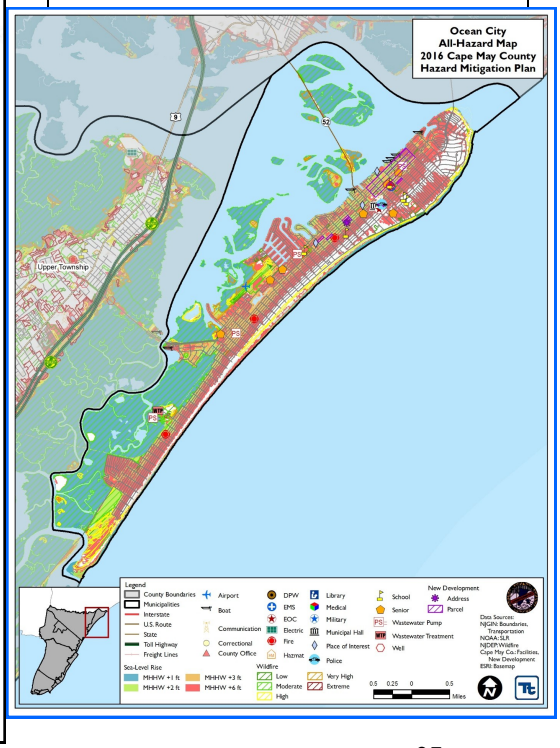
		TOTAL	SFHA *	X-STD/AR/A99 **	PRP ***
	PIF	17,019	17,013	3	3
	PREMIUM	$11,251,325	$11,246,315	$3,858	$1,152
	AVERAGE PREMIUM	$661	$661	$1,286	$384
CRS Class					
09	Per Policy	$41	$41	$71	$0
	Per Community	$703,106	$702,892	$214	$0
08	Per Policy	$83	$83	$71	$0
	Per Community	$1,405,999	$1,405,784	$214	$0
07	Per Policy	$124	$124	$71	$0
	Per Community	$2,108,891	$2,108,676	$214	$0
06	Per Policy	$165	$165	$143	$0
	Per Community	$2,811,997	$2,811,568	$429	$0
05	Per Policy	$207	$207	$143	$0
	Per Community	$3,514,889	$3,514,460	$429	$0
04	Per Policy	$248	$248	$143	$0
	Per Community	$4,217,781	$4,217,353	$429	$0
03	Per Policy	$289	$289	$143	$0
	Per Community	$4,920,673	$4,920,245	$429	$0
02	Per Policy	$330	$331	$143	$0
	Per Community	$5,623,565	$5,623,137	$429	$0
01	Per Policy	$372	$372	$143	$0
	Per Community	$6,326,458	$6,326,029	$429	$0

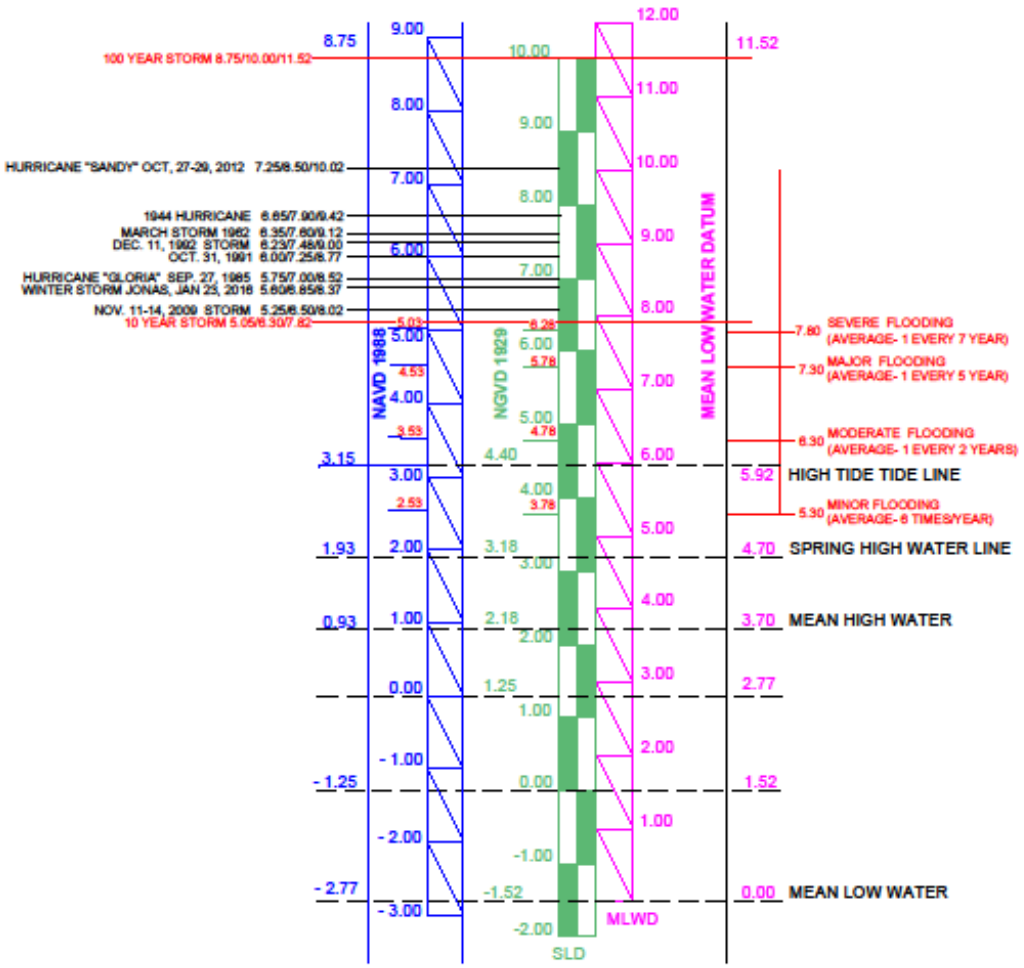
* SHFA (Zones A, AE, A1-A30, V, V1-V30, AO, and AH): Discount varies depending on class.

** SFHA (Zones A99, AR, AR/A, AR/AE, AR/A1-A30, AR/AH, and AR/AO): 10% discount for Classes 1-6; 5% discount for Classes 7-9.

*** Preferred Risk Policies are not eligible for CRS Premium Discounts.

A map of this scale can be used in a public document because it does not identify individual properties or policy holders.





TIDE HEIGHTS

RELATIVE TO NAVD 88, NGVD 29 & MLW DATUM

OCEAN CITY, NJ

HISTORIC TIDE INFORMATION FROM 520 BAY AVENUE TIDE STATION AND WALLACE HARDWARE STORE

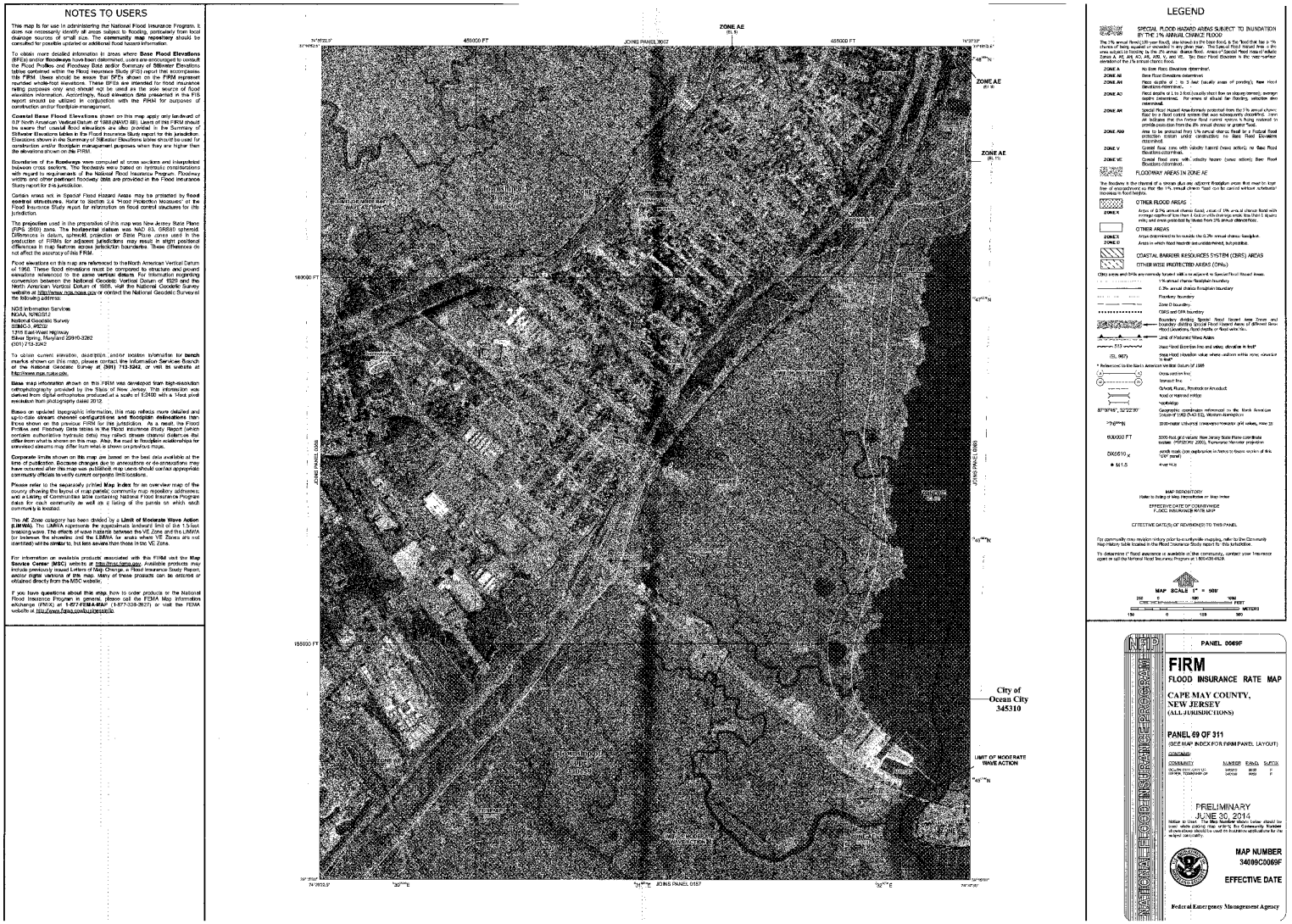
NAVD 88: NORTH AMERICAN VERTICAL DATUM OF 1988

NGVD 29: NATIONAL GEODETIC VERTICAL DATUM OF 1929 (ORIGINALLY CALLED SEA LEVEL DATUM (SLD) OF 1929)

MLW DATUM: MEAN LOW WATER DATUM

Ocean City Preliminary Map Panels
There are 10 map panels for the city of Ocean City
Preliminary Map Panels issued 6-30-2014

The Map Panels on the next 10 Pages are the Current FIRMs
These Maps were adopted by Ocean City on 10/5/17



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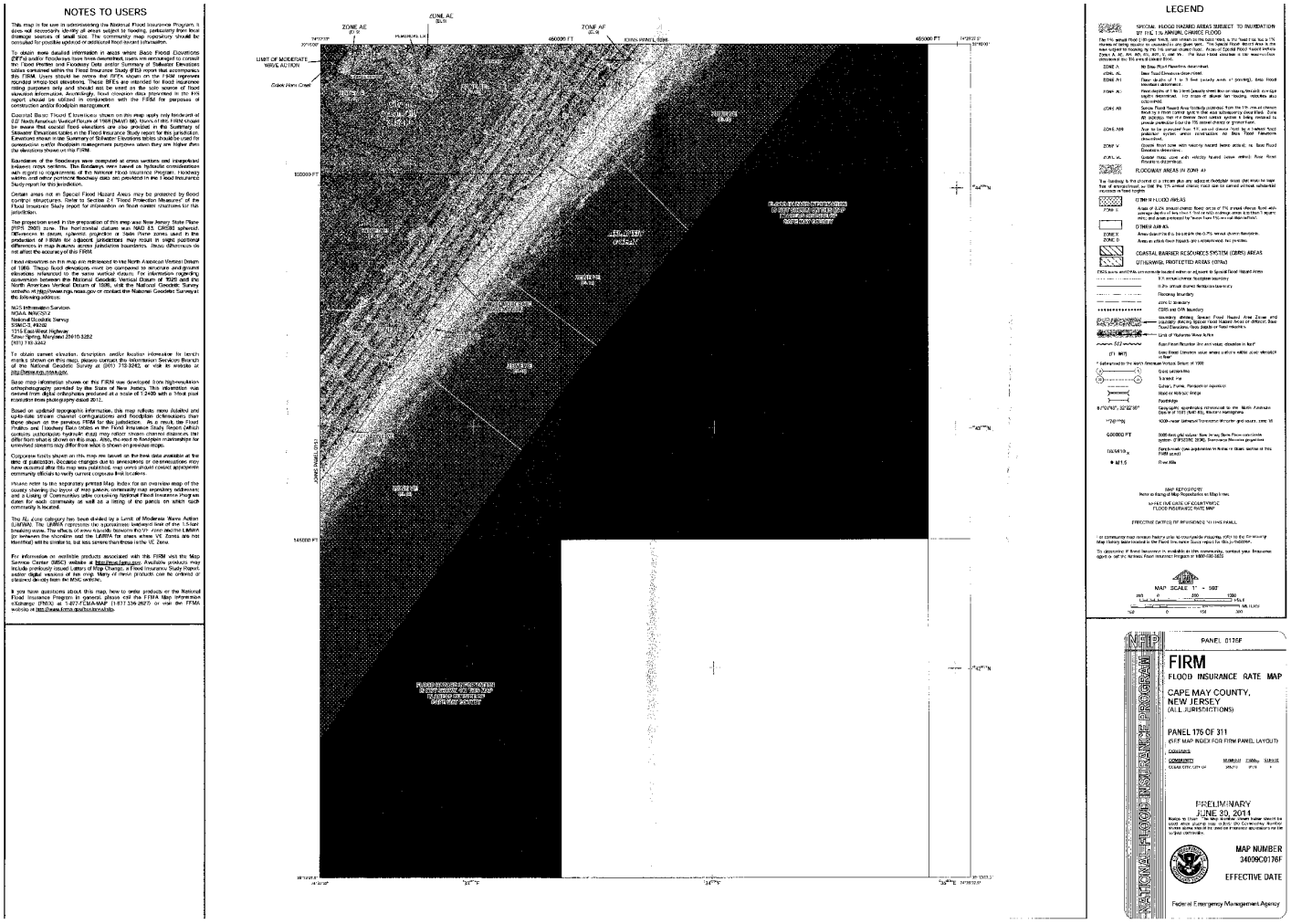

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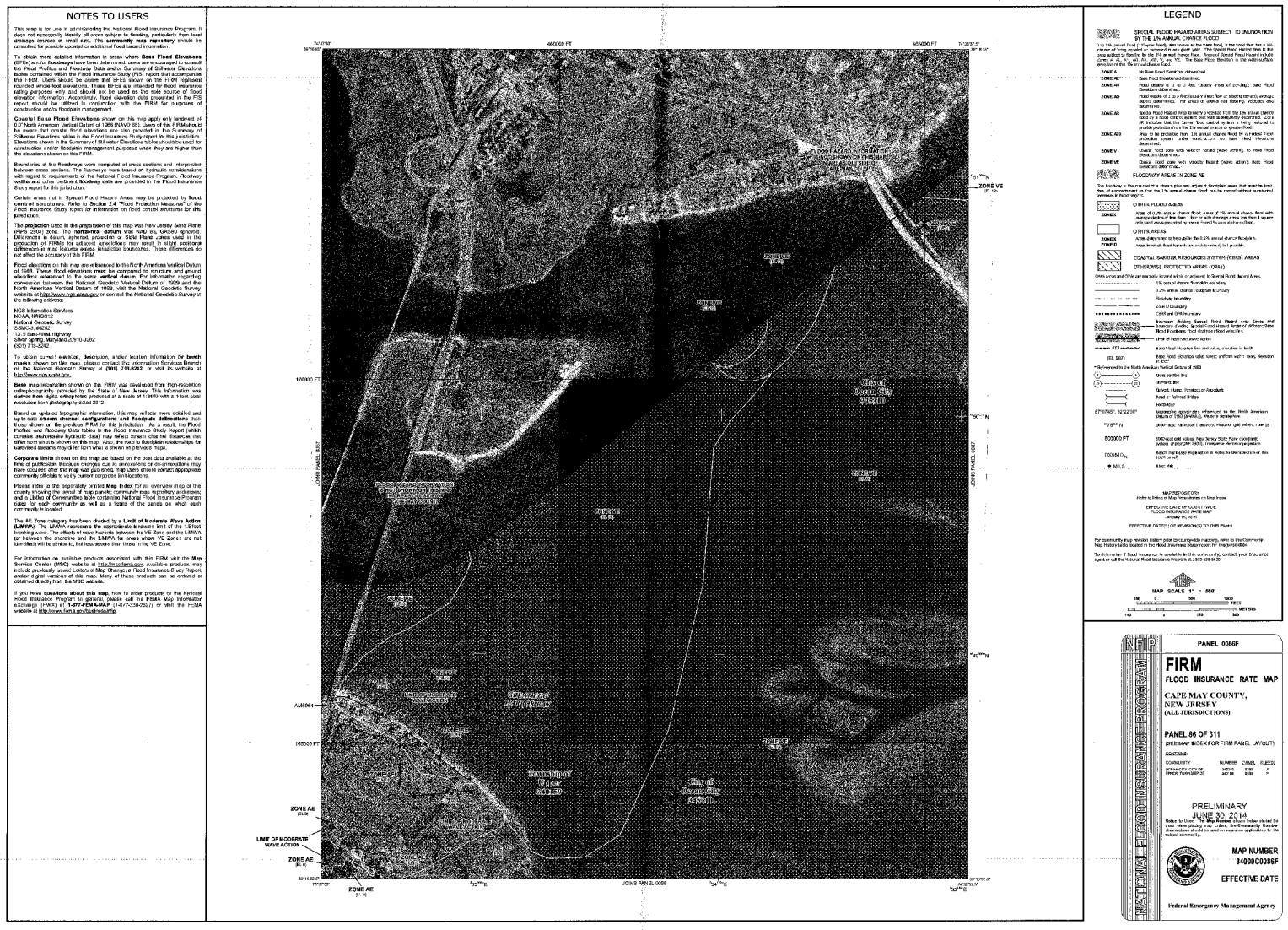

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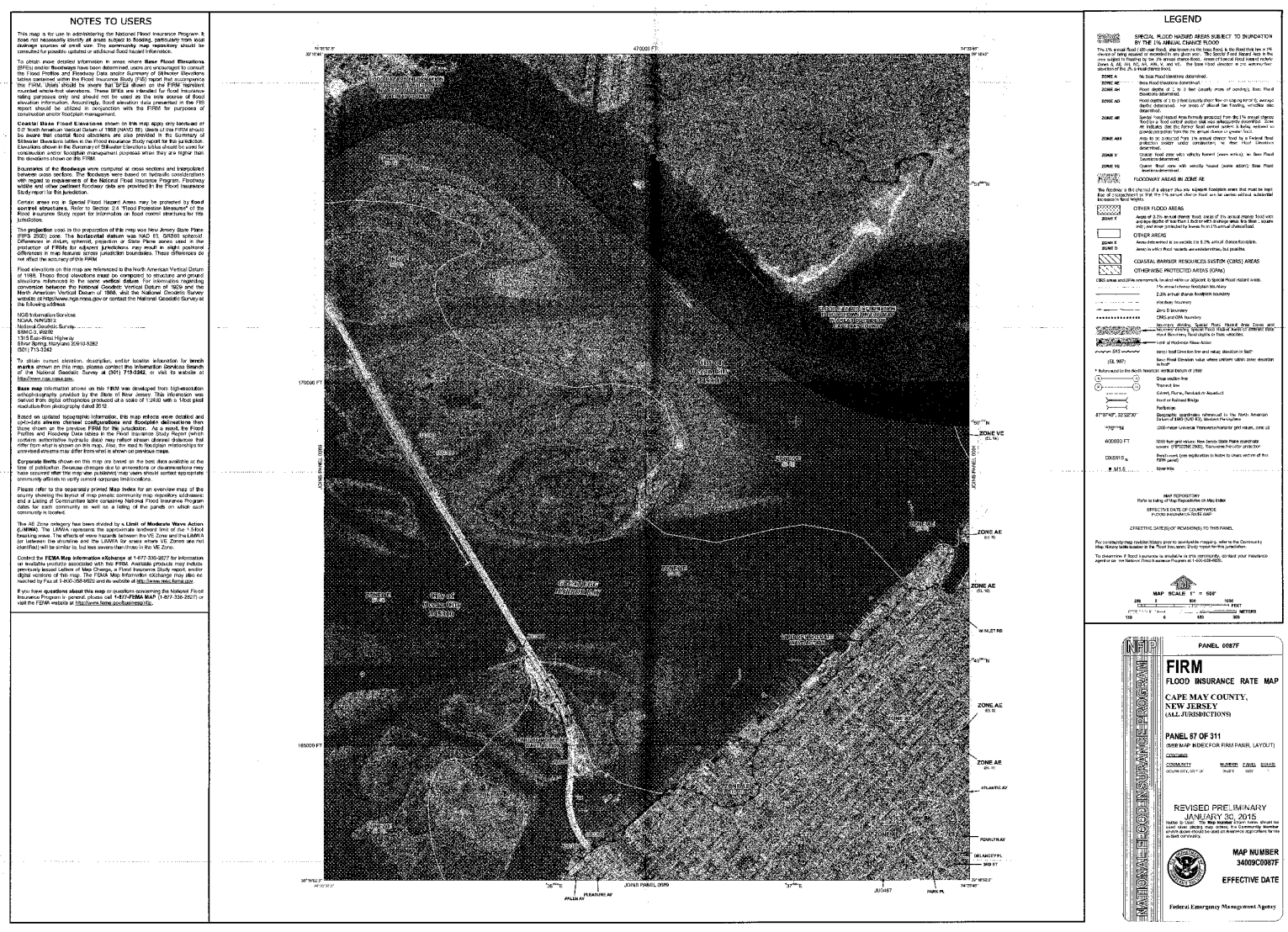

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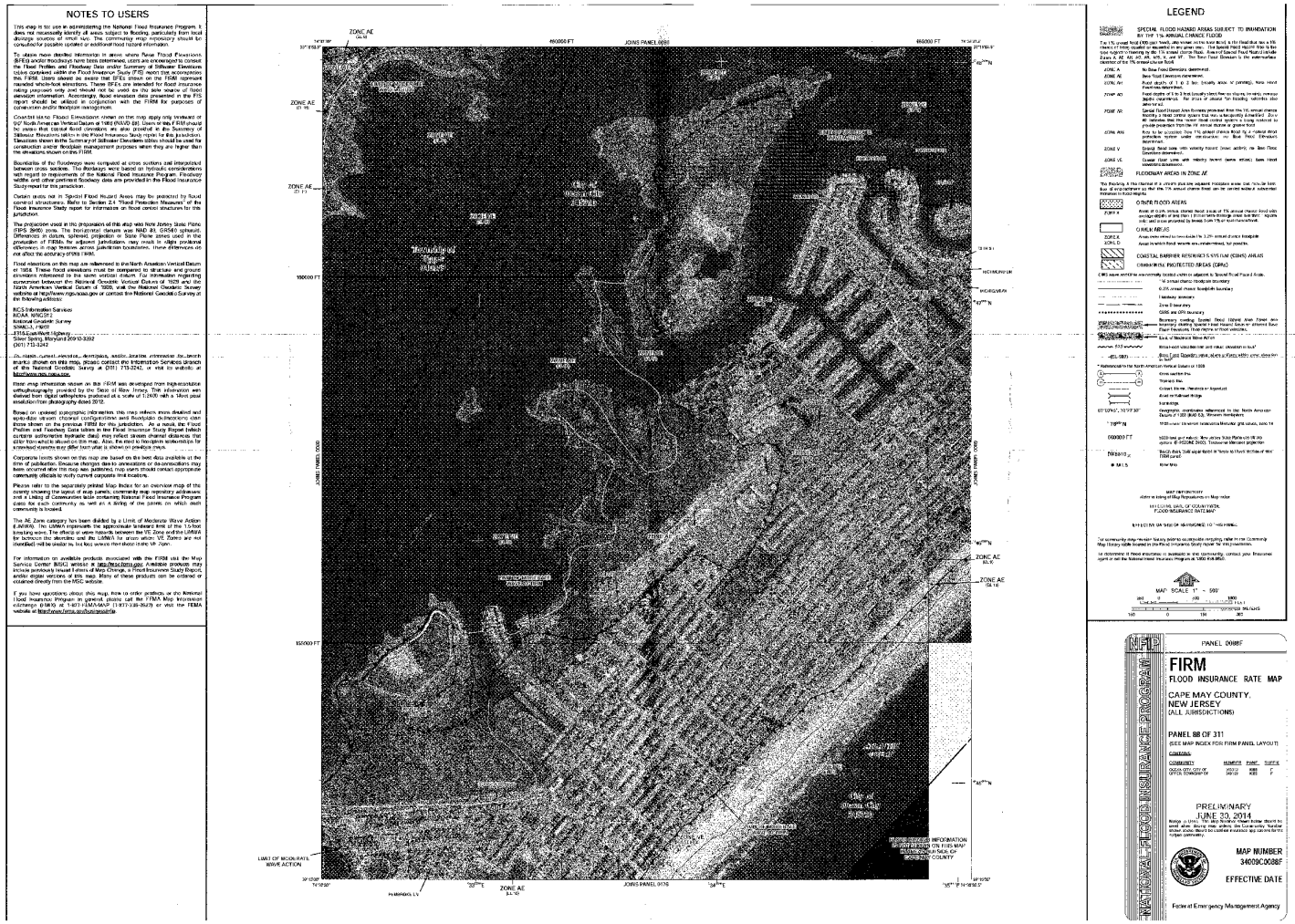

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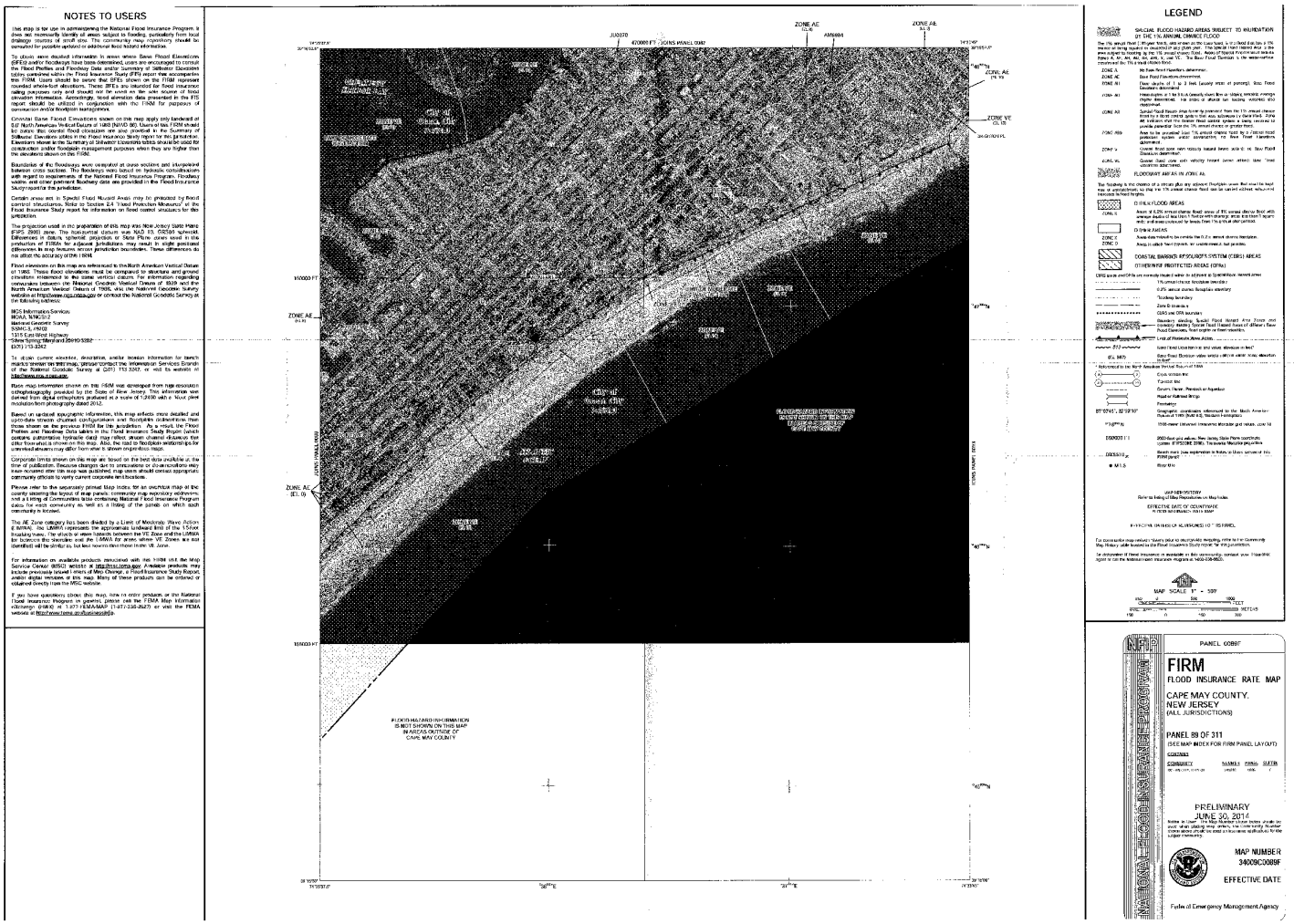

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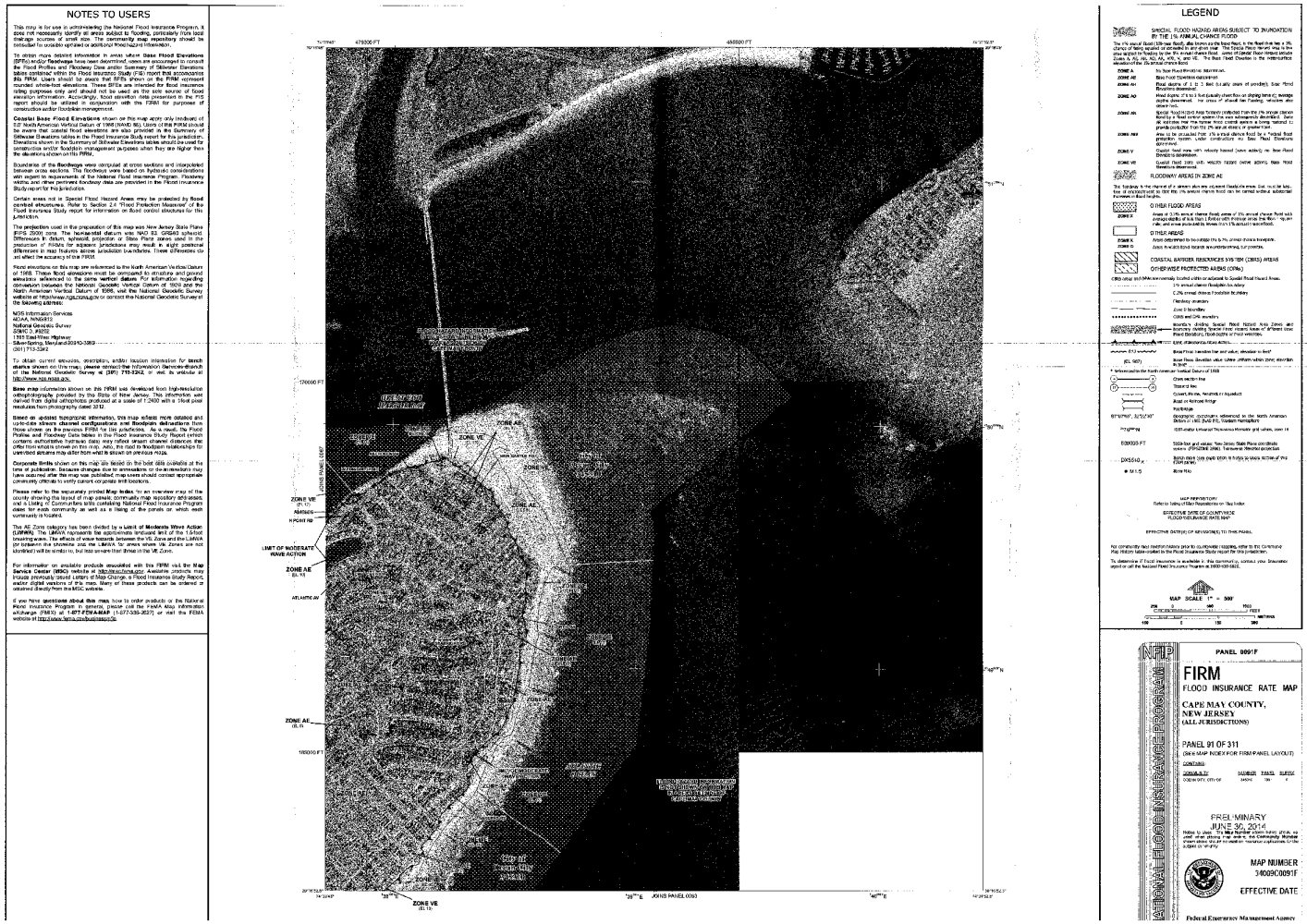

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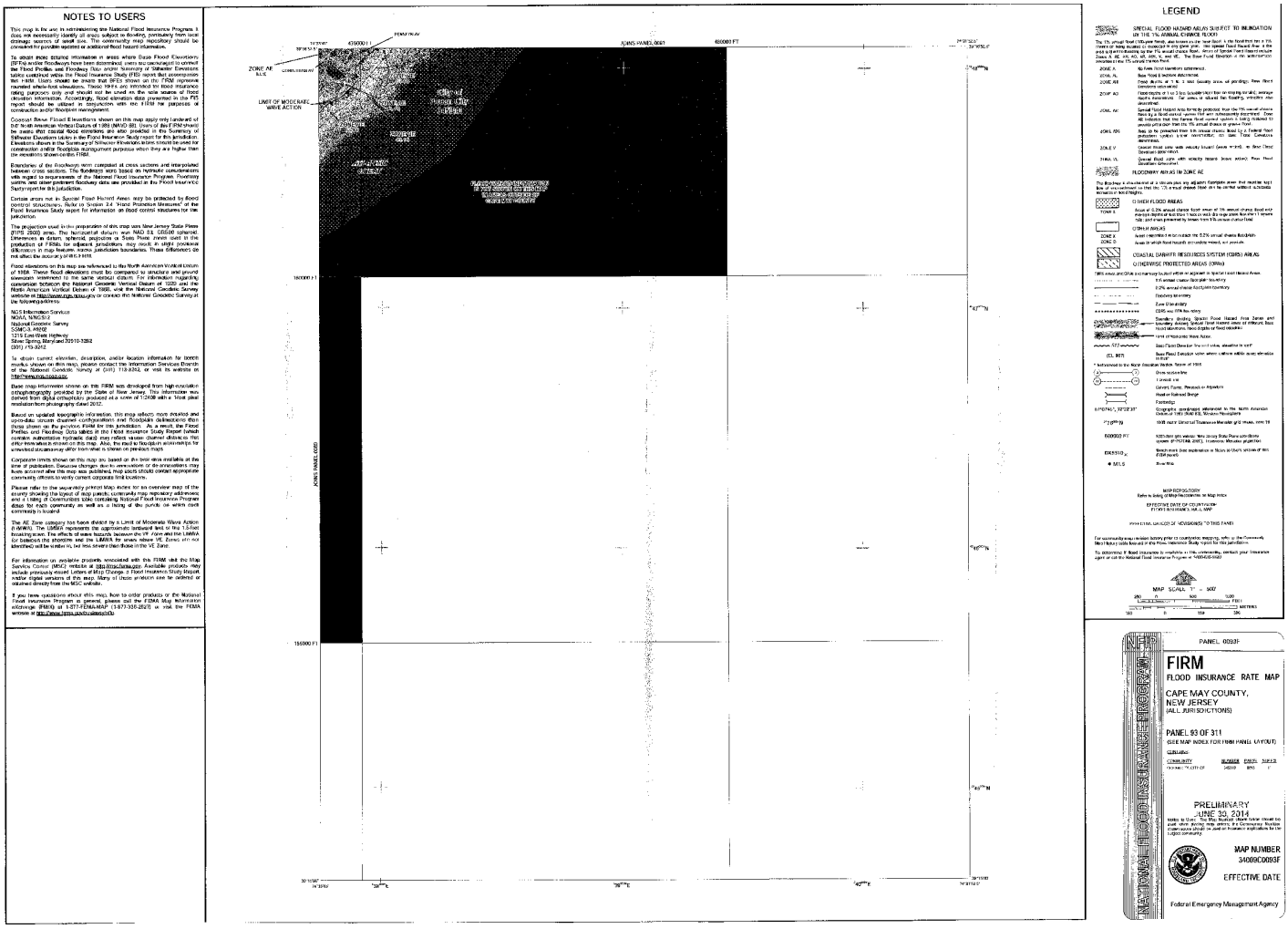

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Ocean City Preliminary Map Panels
There are 10 map panels for the city of Ocean City
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Severe Repetitive Area Analysis, Ocean City NJ;
Attached are photos of twenty five (25) SRL Properties which have been mitigated by either raising the home or razing the structure and rebuilding the home. These photos were take on March 29, 2016.

Severe Repetitive Loss (SRL) Homes in Ocean City which have been Mitigated, since Hurricane Sandy.

SRL Homes Mitigated in Ocean City, NJ since Hurricane Sandy

Funding Sources RLAA;
A. FEMA grants: Most of the FEMA programs provide 75% of the cost of a project. In most communities, the 25% non-FEMA share is paid by the benefitting property owner. Each program has different Congressional authorization and slightly different rules.
1. The Hazard Mitigation Grant Program (HMGP): The HMGP provides grants to States and local governments to implement long-term hazard mitigation measures after a major disaster declaration. Projects must provide a long-term solution to a problem (e.g., elevation of a home to reduce the risk of flood damages as opposed to buying sandbags and pumps to fight the flood). Examples of eligible projects include acquisition and elevation, as well as local drainage projects.
2. The Severe Repetitive Loss Program (SRL): The Severe Repetitive Loss (SRL) grant program funds mitigation projects for properties on the severe repetitive loss list. Eligible flood mitigation projects include: Acquisition and demolition or relocation of structures that are listed on FEMA's severe repetitive loss list and conversion of the property to open space Elevation of existing SRL structures to at least the Base Flood Elevation (BFE). There is a new SRL ICC Program that can be used to cover the non-FEMA share of the cost. That program is discussed further in bullet C below.

B. The Flood Mitigation Assistance Program (FMA): FMA funds assist States and communities in implementing measures that reduce or eliminate the long-term risk of flood damage to structures insured under the NFIP. Project Grants to implement measures to reduce flood losses, such as elevation, acquisition, or relocation of NFIP-insured structures. States are encouraged to prioritize FMA funds for applications that include repetitive loss properties; these include structures with 2 or more losses each with a claim of at least $1,000 within any ten-year period since 1978.
1. Pre-Disaster Mitigation Program (PDM): The Pre-Disaster Mitigation (PDM) program provides funds to states, territories, Indian tribal governments, communities, and universities for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event. For more information visit http://www.fema.gov/government/grant/pdm/index.shtm.

C. Flood insurance: There is a special funding provision in the National Flood Insurance Program (NFIP) for insured buildings that have been substantially damaged by a flood, "Increased Cost of Compliance." ICC coverage pays for the cost to comply with floodplain management regulations after a flood if the building has been declared substantially damaged. ICC will pay up to $30,000 to help cover elevation, relocation, demolition, and (for nonresidential buildings) floodproofing. It can also be used to help pay the 25% owner's share of a FEMA funded mitigation project.
The building's flood insurance policy must have been in effect during the flood. This payment is in addition to the damage claim payment that would be made under the regular policy coverage, as long as the total claim does not exceed $250,000. Claims must be accompanied by a substantial or repetitive damage determination made by the local floodplain administrator. For more information, contact your insurance agent or visit: www.fema.gov/plan/prevent/floodplain/ICC.shtm.
Coverage under the ICC does have limitations: It covers only damage caused by a flood, as opposed to wind or fire damage The building's flood insurance policy must have been in effect during the flood ICC payments are limited to $30,000 per structure Claims must be accompanied by a substantial or repetitive damage determination made by the local floodplain administrator and the structure must be in an A zone.

For example mitigation loans made following a flood can only be used for a measure to protect against future flooding, not a tornado. If the measure existed prior to the declared disaster, an SBA mitigation loan will cover the replacement cost. If the measure did not exist prior to the declared disaster the mitigation loan will only cover the cost of the measure if it is deemed absolutely necessary for repairing the property by a professional third-party, such as an engineer.

Severe Repetitive Loss ICC Pilot Program: While the conventional ICC only covers buildings that are located in the Special Flood Hazard Areas (SFHA), there is a new pilot program that is aiming to target buildings not in the SFHA. Focusing specifically on Severe Repetitive Loss (SRL) buildings, this pilot program will offer ICC benefits to those SRL properties that are located in X zones and will include those SRL buildings that have grandfathered X zone rates.

The average claims payment in the study area is $16,511.58. With an average claim of that amount, it is not likely that many homes in the study area would sustain substantial damage from a flood event. Homeowners should make themselves aware of the approximate value of their homes, and in the case of incurring flood damage, be aware of the need for a substantial damage declaration in order to receive the ICC coverage.

Severe Repetitive Loss ICC Pilot Program: While the conventional ICC only covers buildings that are located in the Special Flood Hazard Areas (SFHA), there is a new pilot program that is aiming to target buildings not in the SFHA. Focusing specifically on Severe Repetitive Loss (SRL) buildings, this pilot program will offer ICC benefits to those SRL properties that are located in X zones and will include those SRL buildings that have grandfathered X zone rates. Under this new pilot program, the ICC benefits could be used to cover the homeowner's 10% match in a SRL grant. Alternative language adopted into the local floodplain management ordinance would enable residents with shallower flooding to access ICC funding. Since local ordinances determine the threshold at which substantial damage and/or repetitive claims are reached, adopting language that would lower these thresholds would benefit the homeowners of repetitive loss properties. Adopting alternative language allows for cumulative damages to reach the threshold for federal mitigation resources more quickly, meaning that some of the properties in St. Petersburg that sustain minor damage regularly would qualify for mitigation assistance through ICC.

D. Rebates: A rebate is a grant in which the costs are shared by the homeowner and another source, such as the local government, usually given to a property owner after a project has been completed. Many communities favor it because the owner handles all the design details, contracting, and payment before the community makes a final commitment. The owner ensures that the project meets all of the program's criteria, has the project constructed, and then goes to the community for the rebate after the completed project passes inspection.

Rebates are more successful where the cost of the project is relatively small, e.g., under $5,000, because the owner is more likely to be able to afford the bulk of the cost. The rebate acts more as an incentive, rather than as needed financial support.

E. Small Business Administration Mitigation Loans: The Small Business Administration (SBA) offers mitigation loans to SBA disaster loan applicants who have not yet closed on their disaster loan. Applicants who have already closed must demonstrate that the delay in application was beyond their control.

For example mitigation loans made following a flood can only be used for a measure to protect against future flooding, not a tornado. If the measure existed prior to the declared disaster, an SBA mitigation loan will cover the replacement cost. If the measure did not exist prior to the declared disaster the mitigation loan will only cover the cost of the measure if it is deemed absolutely necessary for repairing the property by a professional third-party, such as an engineer.

CITY OF OCEAN CITY

AMERICA'S GREATEST FAMILY RESORT

ENGINEERING DIVISION

July 6, 2015

City of Ocean City Resident
Ocean City, NJ 08226
RE: Repetitive Loss and Severe Repetitive Loss Flooding Project

Dear Ocean City Resident,

The city of Ocean City "CRS Team" is reviewing ways to reduce our repetitive loss flooding problems in the city and to this end will be conducting a study which will try to determine why certain properties in the city are more prone to flooding than others and possible solutions to the problem. The type of study the city will be conducting is termed a "Severe Repetitive Loss Area Analysis". Your property is on the FEMA Repetitive Loss Property List and will be a part of the study.

As part of this project the RLAA Team is preparing a "local area analysis" for the Repetitive Loss Areas in the city. The approach which they will take includes taking some data specific to your property such as its past flooding experiences.

The RLAA Team reviewed all homes designated as Repetitive Loss Properties in the city during the month of June 2016 collecting general information from the street such as the type of foundation and approximate height of the house above the street. They will return during the The spring of 2017 finishing the work they started in July 2016.

This work would be greatly improved with additional data that you might be able to provide. You will be sent a data sheet which we hope you will complete and return to the city RLAA Team. The sheet that you will be sent is from the National Flood Tool (NT) and specifically the Limited Data View document.

The Limited Data View ("Limited Data"). This view enables the user to enter data from a brief visual inspection of the property; limited communications with the property owner, occupant, or neighbor; and basic flood risk data from the Flood Insurance Rate Map (FIRM) or Flood Insurance Study (FIS).

After the analysis is completed some preliminary recommendations will be developed. You will be invited to a meeting with the RLAA Team to review the findings.
The meeting time and location will be advertised once the analysis is completed. I you have any questions about this project, please feel free to call Benny R. Tafoya at 609 399-6111 ext. 9720 or Arthur Chew at 609 399-9715.

Thank you for your assistance in helping us to complete this project.
Benny R. Tafoya, CFM, CMfgE
Engineering Department, City of Ocean City

ENGINEERING DIVISION 115 12th Street, OCEAN CITY, NJ 08226
609-399-6111 FAX: 609-525-0831

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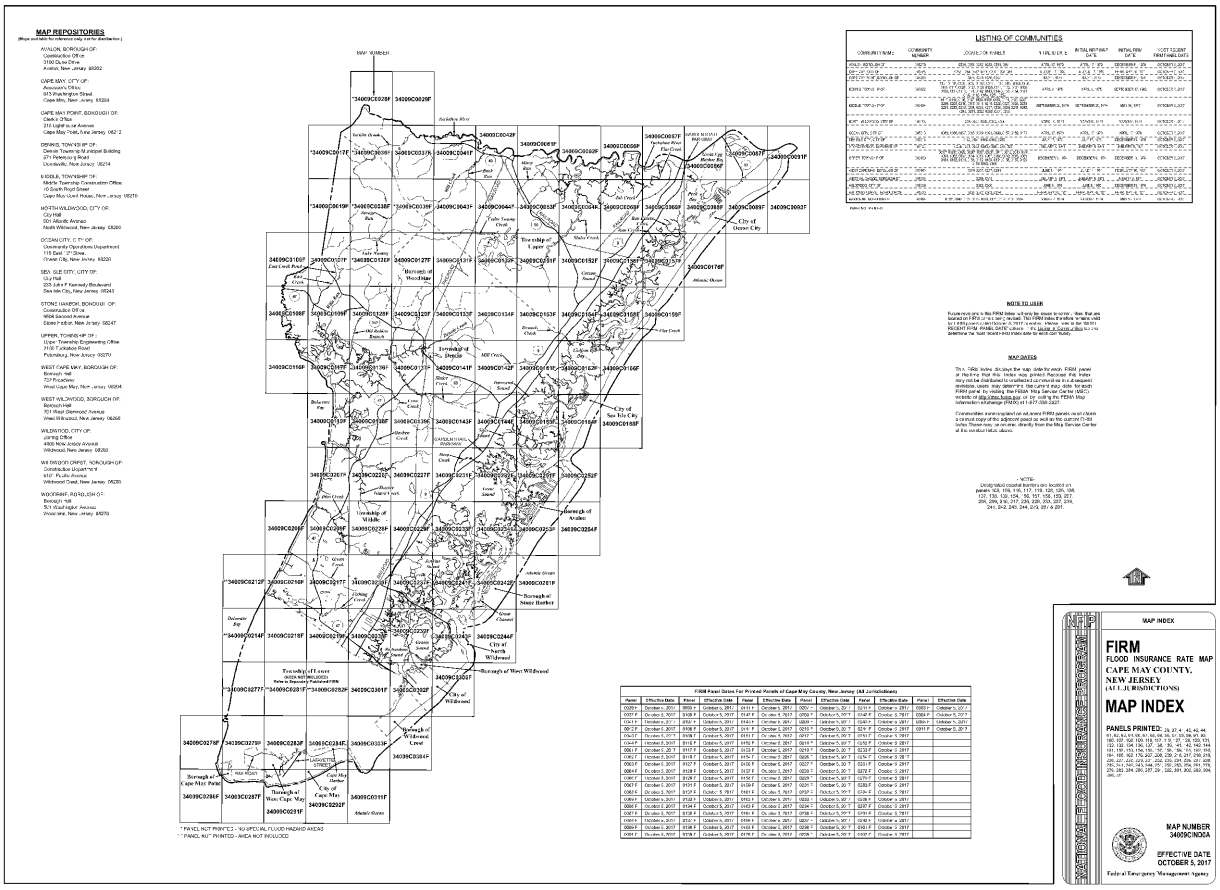
This is the Map Index of the new FIRMs for the State of New Jersey. Ocean City adopted the new FIRMs as of 10/5/2017 and they are shown on the next 10 pages.



MAP INDEX FOR THE STATE OF NEW JERSEY
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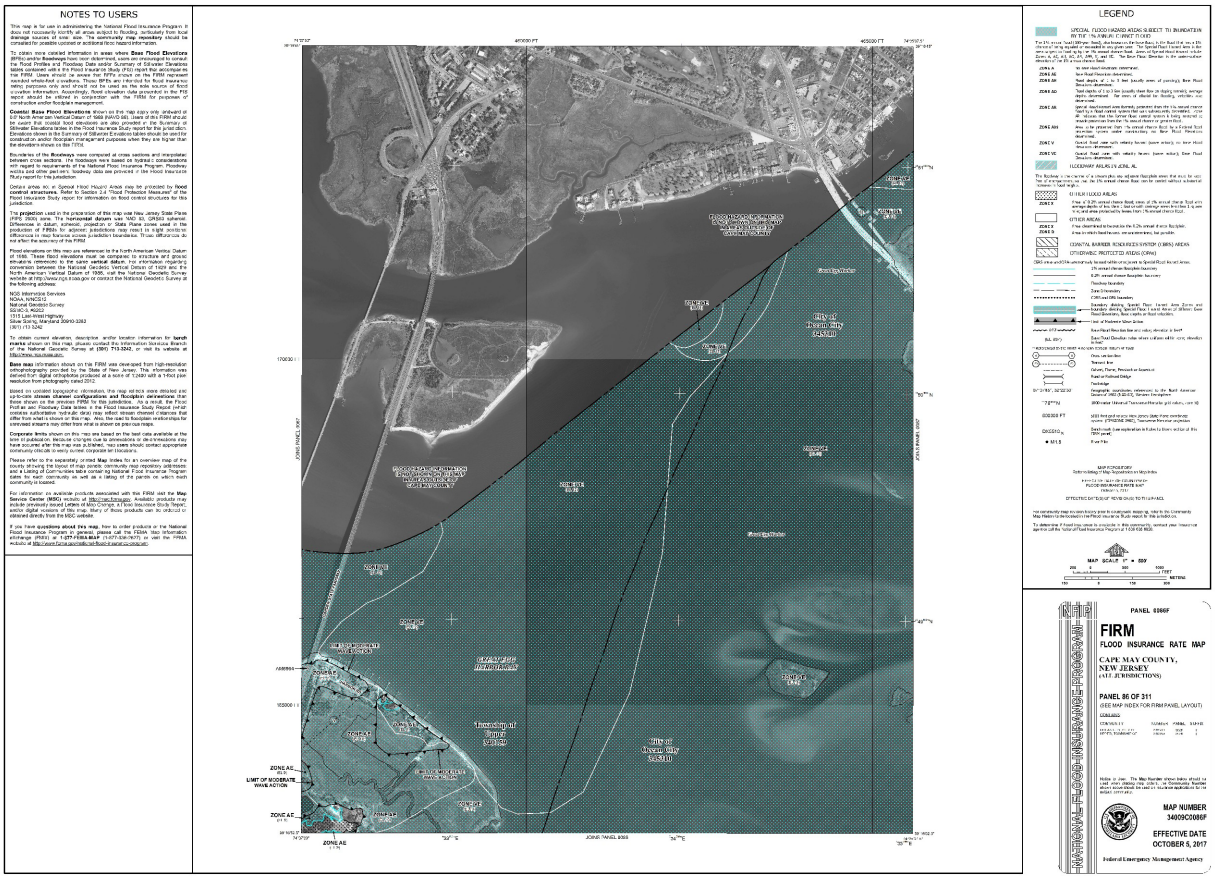

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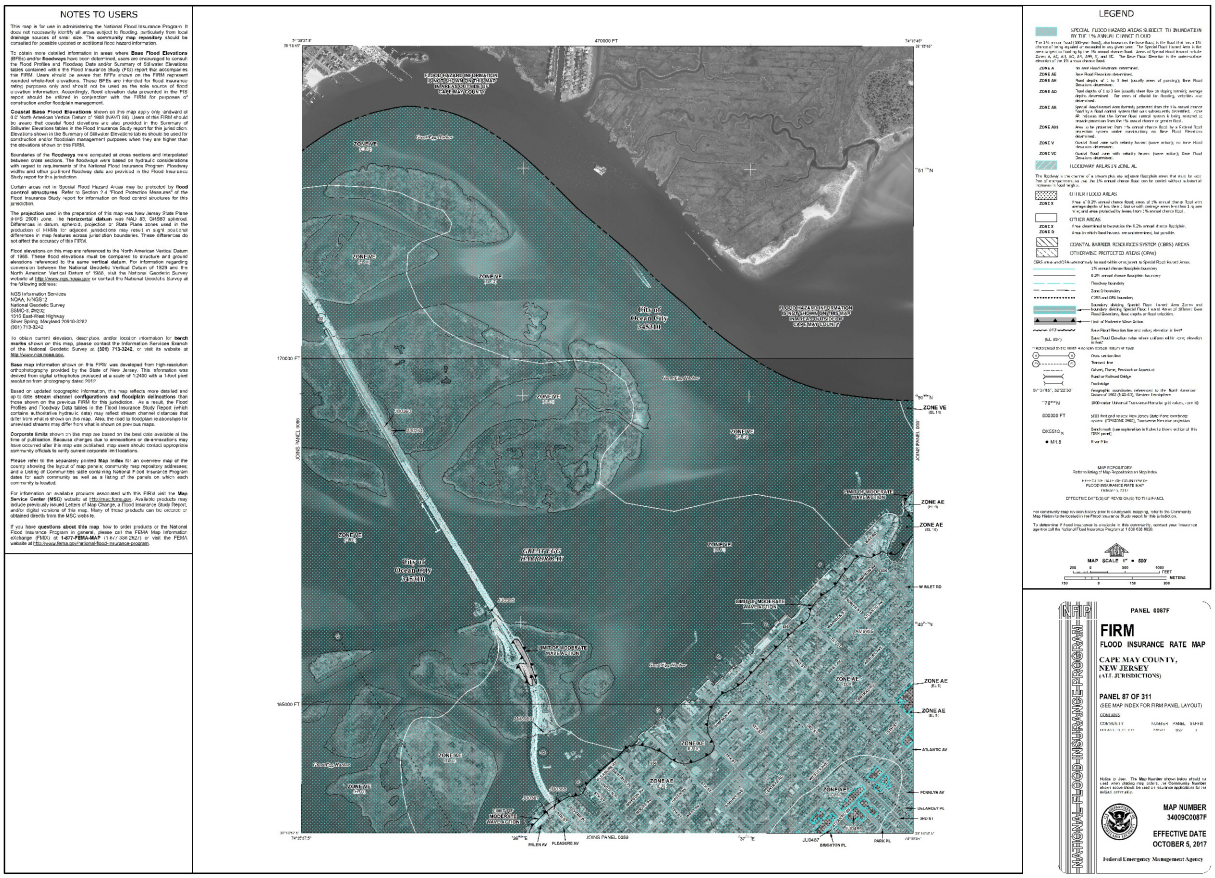

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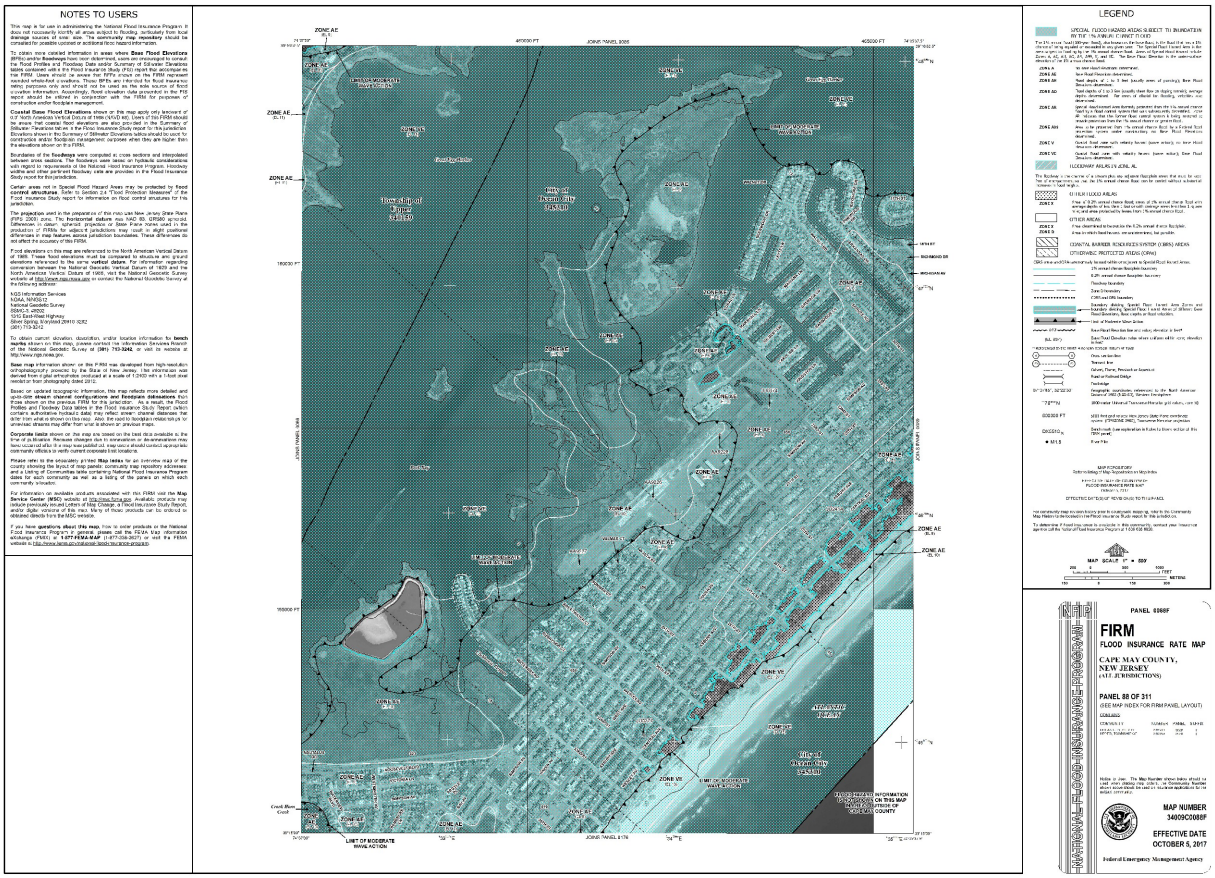

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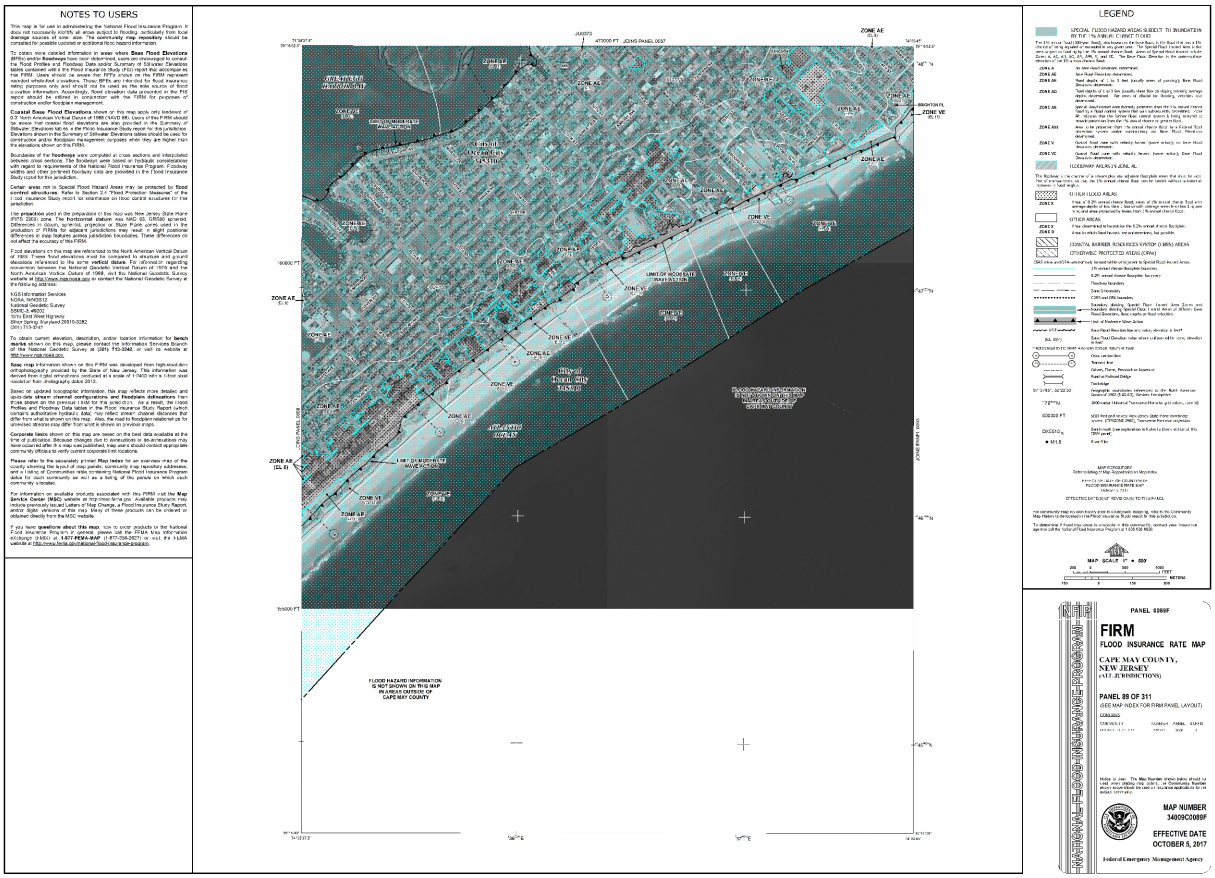

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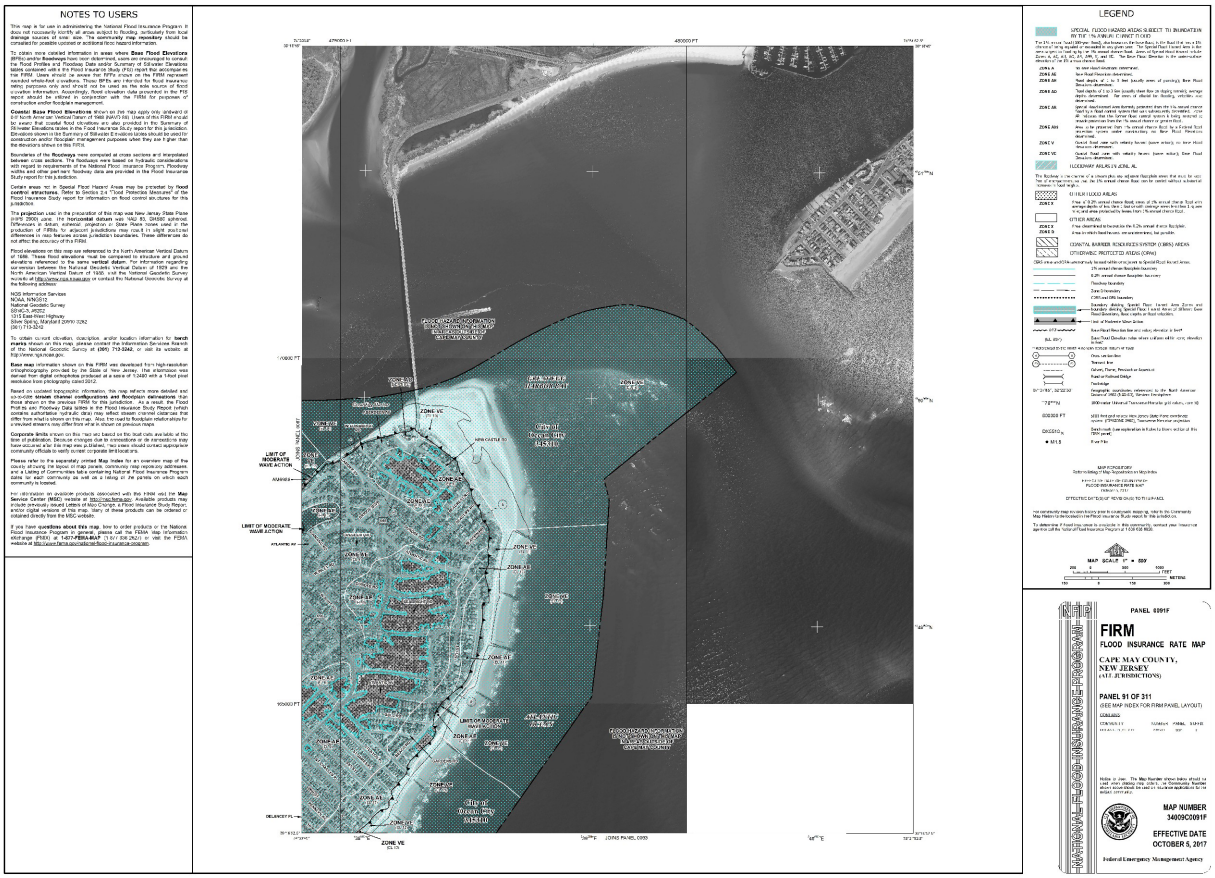

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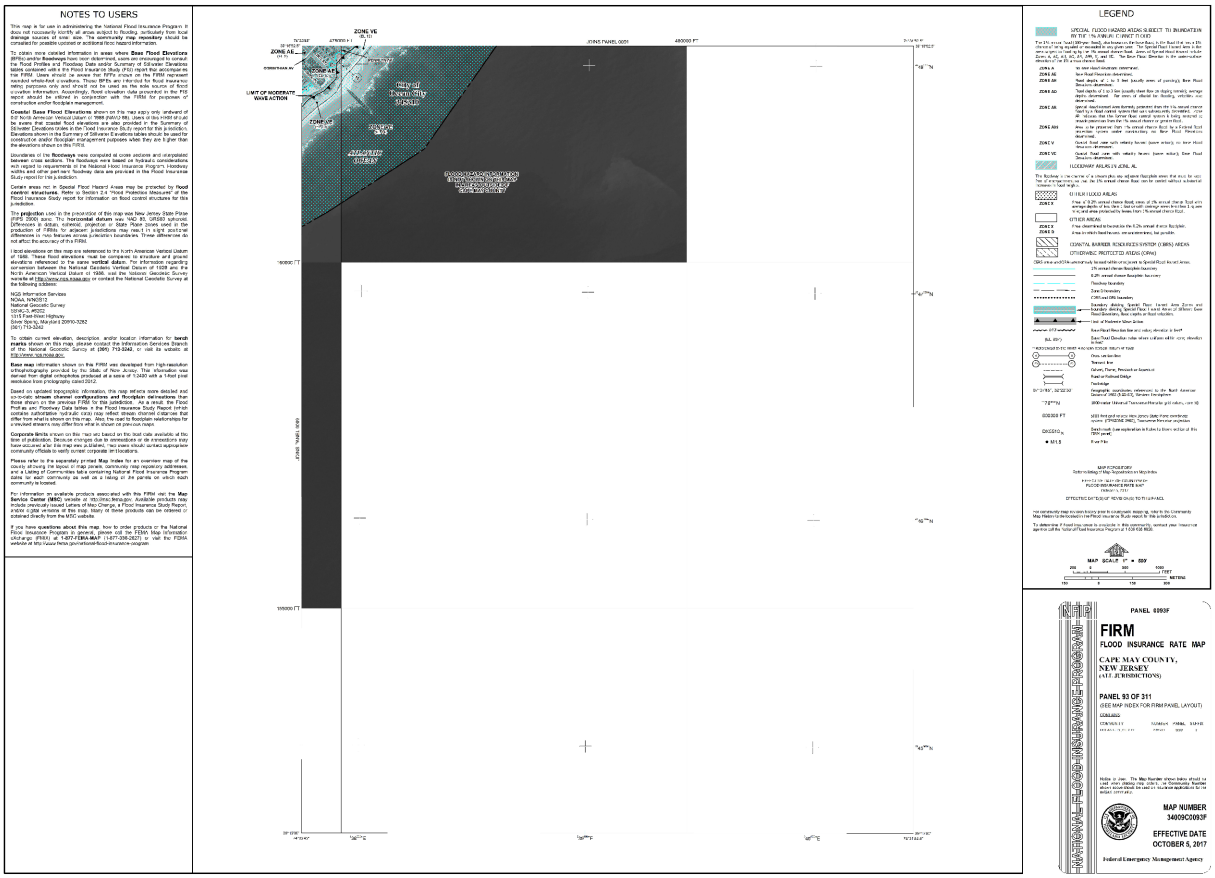

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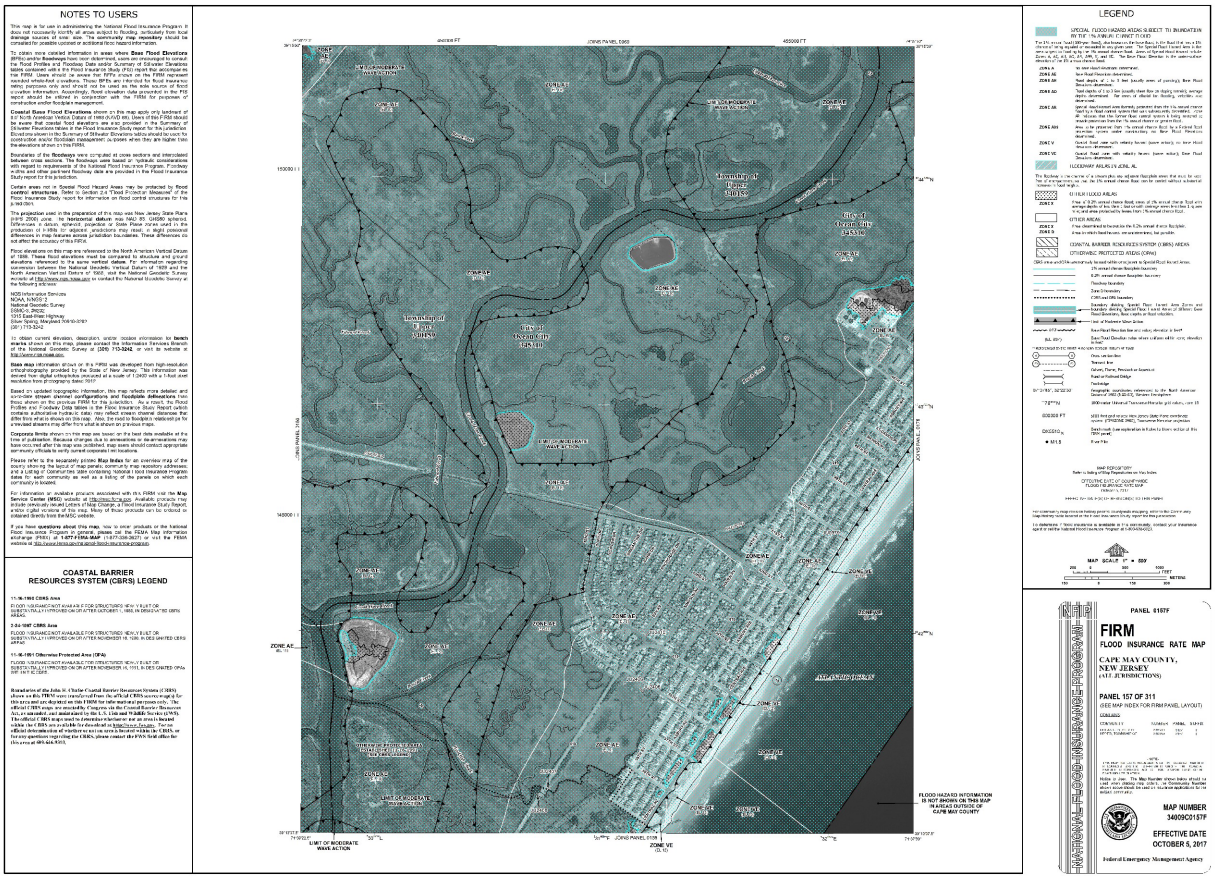

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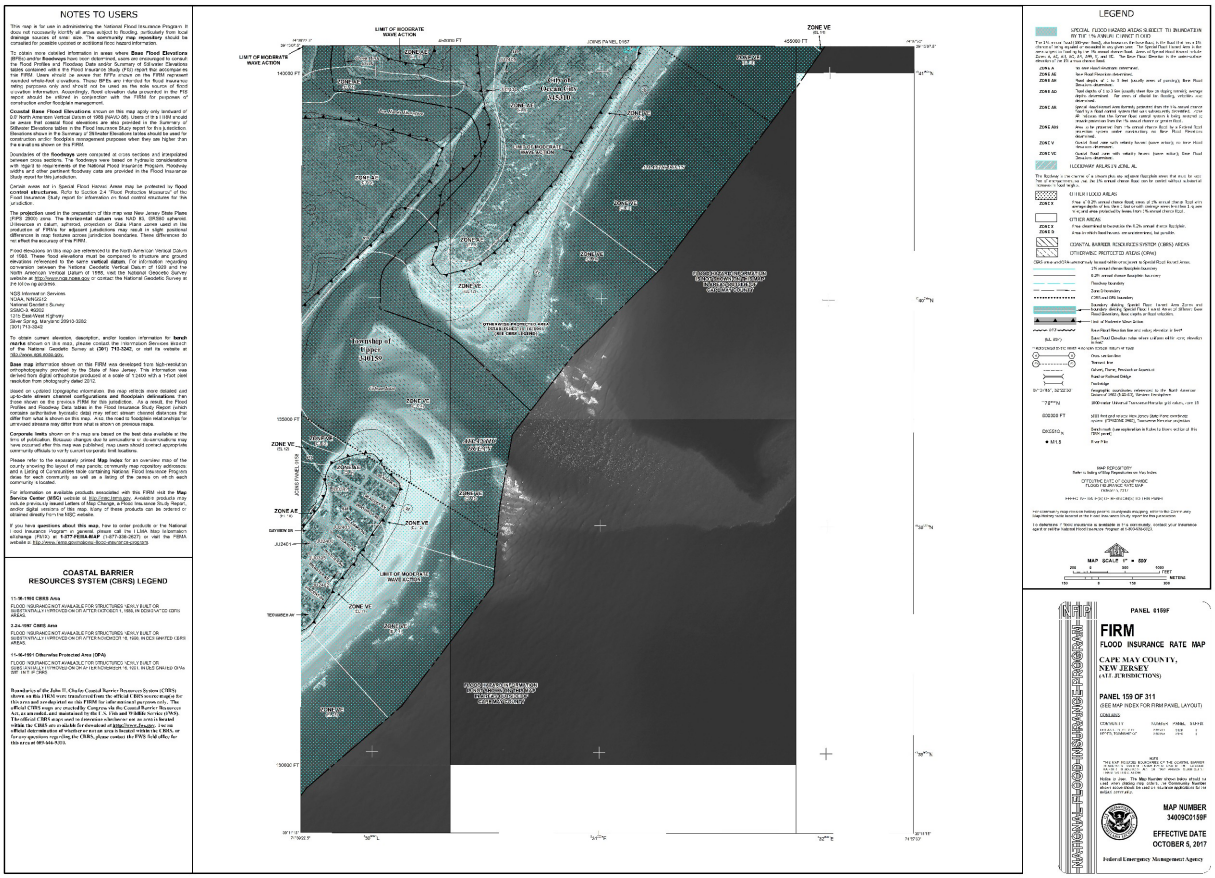
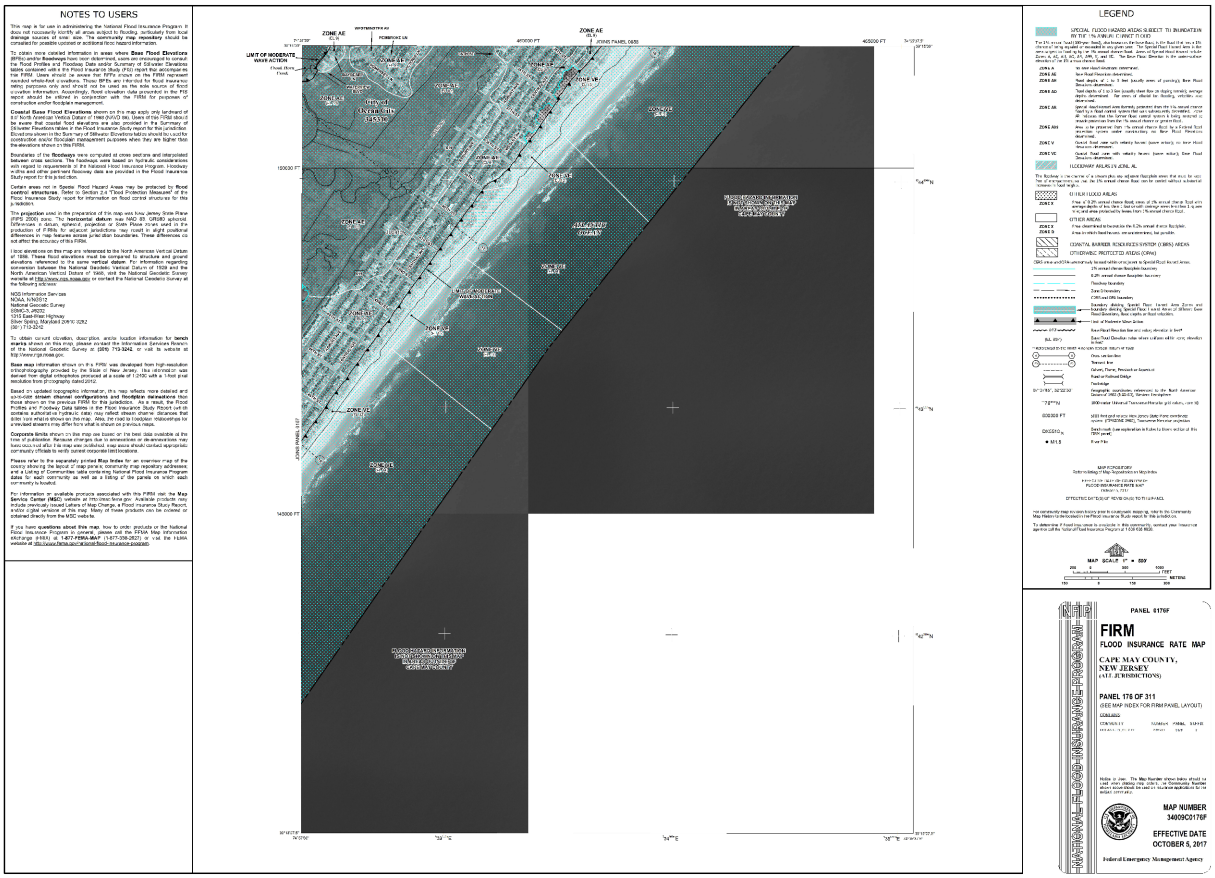


OCEAN CITY MAP NUMBER 34009C00159F 10 of 11



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The following Flood Study and subsequent Drainage Project was worked on by Michael Baker International;

The Flood Study:

26th to 34th Streets, West Avenue to Bay Avenue, Flood Mitigation Study.

The Drainage Project ; the drainage project is currently being worked on as a result of the Flood Study & is expected to be completed by:

The other major Drainage Improvement Project Designed to Eliminate Flooding on the North End of the Island is being worked on.

North End Drainage Improvements

Three storm water pumping stations and a new network of storm pipes will be used to enhance drainage in the north end neighborhood between First Street and Eighth Street, from West Avenue to the bay. The estimated $8 million project will use a $5 million FEMA grant, the largest Ocean City has ever received. Work is expected to take about a year to a year and a half.

26th to 34th Streets Improvements

The plan includes replacing and increasing the capacity of storm drain pipes (many of which are damaged), upgrading check valves, reconfiguring roads to make sure water flows into the storm drain system and using four pumping stations to increase the rate of drainage. The project went out to bid on Dec. 28, 2016. Bids were opened on Jan. 31, 2017, and City Council awarded a $6.5 million contract to A.E. Stone on Feb. 9, 2017. Work began in April 2017.

Any question to anything in this RLAA Document should be directed to;

Benny R. Tafoya, CFM/CRS Applications Specialist
Or
Arthur Chew, CFM, Assistant City Engineer

26th to 34th Streets, West Avenue to Bay Avenue

Flood Mitigation Study

September, 2015

Prepared for City of Ocean City

Prepared by Michael Baker International

Michael Baker
INTERNATIONAL

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Executive Summary

The City of Ocean City (Ocean City) requested Michael Baker International (Michael Baker) to complete a flood mitigation study for the roughly 250 acres between 26th and 34th Streets and West and Bay Avenues. This area suffers repetitive flooding and lies nearly entirely below the Federal Emergency Management Agency (FEMA)'s base flood elevation. While the study area is subject to 1% annual chance (otherwise known as 100 year) flooding from the ocean, the city hopes to mitigate the more common rainfall events that have caused routine or nuisance flooding throughout the study area.

The goal of the study was to quantify the amount of rainfall throughout the study area, determine the amount of rainfall entering the storm sewers (runoff), and understand the performance of the existing system. To complete this goal, Michael Baker performed a watershed analysis and storm sewer analysis utilizing geographic information systems (GIS), Natural Resources Conservation Service (NRCS) rainfall data, National Oceanic and Atmospheric Administration (NOAA) tide data, and available storm sewer information obtained from Ocean City, field visits, and Google Earth.

Michael Baker completed the watershed analysis utilizing NRCS Technical Release 55 (TR-55) and the Environmental Protection Agency (EPA) Storm Water Management Model (SWMM) suite of modeling tools. Overall, the model contained 32,000 feet of pipe, 314 drainage structures, 110 routing points, and 73,000 feet of overflow paths. The model considered rainfall estimates for the 1-, 2-, 5-, and 10-year events. These storm events represent a higher frequency event than the FEMA flood insurance study models and depict the rainfall nuisance events.

Model results indicated that the system surcharges or floods to some extent for all recurrence intervals. This is due to the low elevations of the study area and the backwater condition provided at the outfall. This report discusses mitigation of this flooding by three different strategies: 1) pump system installation to aid the gravity controlled system, 2) improvements to the infrastructure, including new pipes and raising the roadway profile, and 3) green solutions involving small scale detention and infiltration.

Finally, the report discusses the cost of these options and a schedule of the options to best meet the community's needs. Phase 1 of the project includes the pump stations and the necessary sewer upgrades to accommodate only the pumps. The approximate cost of phase 1 is $750,000 per station or $2.25 million for the three stations targeting the biggest problem areas. Phase 1 also includes a maintenance plan that has an annual cost of $5,000 annually for servicing the pump stations throughout the city from the manufacturer plus routine maintenance performed by city staff. Phase 2 includes infrastructure improvements to the lowest roadways in the study area and has an approximate cost of $9.75 million. Phase 3 includes green infrastructure installations and comes with a cost of approximately $520,000 per infiltration system.

Introduction

Ocean City requested that Michael Baker complete a flood mitigation study for the drainage networks
between 26th and 34th Streets and West and Bay Avenues (see the study area map on the following page).
This study area suffers repetitive flooding and lies nearly entirely below FEMA's base flood elevation. While the study area is subject to 1% annual chance flooding from the ocean, the city hopes to mitigate the more common rainfall events that have caused nuisance or routine flooding throughout the study area.

Nuisance flooding causes damage to property, mosquito breeding, foul odors, increased degradation of the infrastructure, and falling real estate values among other costs to this community. The Mayor and City Council have made it a priority to gain understanding of this area's flooding and the magnitude of
solutions required to improve the condition.

The study area is roughly 250 acres of residential, commercial, and open uses. Residential space makes up the majority of the study area, the lots consisting of an average of 60% impervious area. Drainage from the lots is conveyed over land to the roadway collection system and enters the storm sewers. Haven Avenue, Simpson Avenue, and West Avenue run north to south down the center of the island. These three streets have the lowest elevations in the study area. Elevations increase from this low point toward the beach and also toward the bay. The storm sewer network collects from the beach to the bay and drains to the bay.

Michael Baker developed an understanding of the problem, strategized solutions, and developed costs and schedules for the options.


N
WATERWAY RD
SUNNYSIDE CT
BAYLAND AV
SUMMER CT
W 28TH ST
BAY AV
SIMPSON AV
30TH ST
SIMPSON AV
HAVEN AV
34TH ST
33RD ST
WESLEY AV
WEST AVE
29TH ST
28TH ST
ASBURY AVE
32ND ST
27TH ST
26TH ST
25TH ST
CENTRAL AVE
28TH ST
WESLEY AVE
26th to 34th Streets,
West Avenue to Bay Avenue
0 250 500 1,000 Feet

Study Approach

The approach to this study was modeling the existing condition hydrology, storm sewers and tide impacts to understand the nature of the flooding. Understanding the flooding allows a qualitative and quantitative evaluation of various techniques for mitigating those flooding impacts. From these techniques, a phased solution to improve the situation is proposed for the study area. Lastly, the phased solutions include cost estimates to fully chart their potential.

Limited survey data was available for the study, so the modeling effort assumed ideal conditions for the network. Modeling of the network was completed for the 1-, 2-, 5-, and 10-year storm events. Outfalls for the system were given backwater conditions for two tide scenarios: elevation 0' NAVD88 and elevation 3' NAVD88. These tide conditions represent an approximate average tide and approximate high tide, respectively. Coastal storms can produce tides significantly greater than 3 feet, however those conditions are not being targeted for this mitigation effort. For reference the FEMA 1% annual chance (100-year) flood elevation is 9 feet in most of the study area.

Rainfall estimates for the study were gathered from the New Jersey NRCS website. The website lists 24- hour rainfall amounts for Cape May County that are summarized in Table 1. This rainfall data has been developed from the NOAA Atlas 14 dataset.

Cape May County 24-Hour Rainfall Frequency Data				
	1-Year	2-Year	5-Year	10-Year
Inches	2.68	3.27	4.24	5.08
Gallons (millions)	14.67	18.04	23.53	33.79

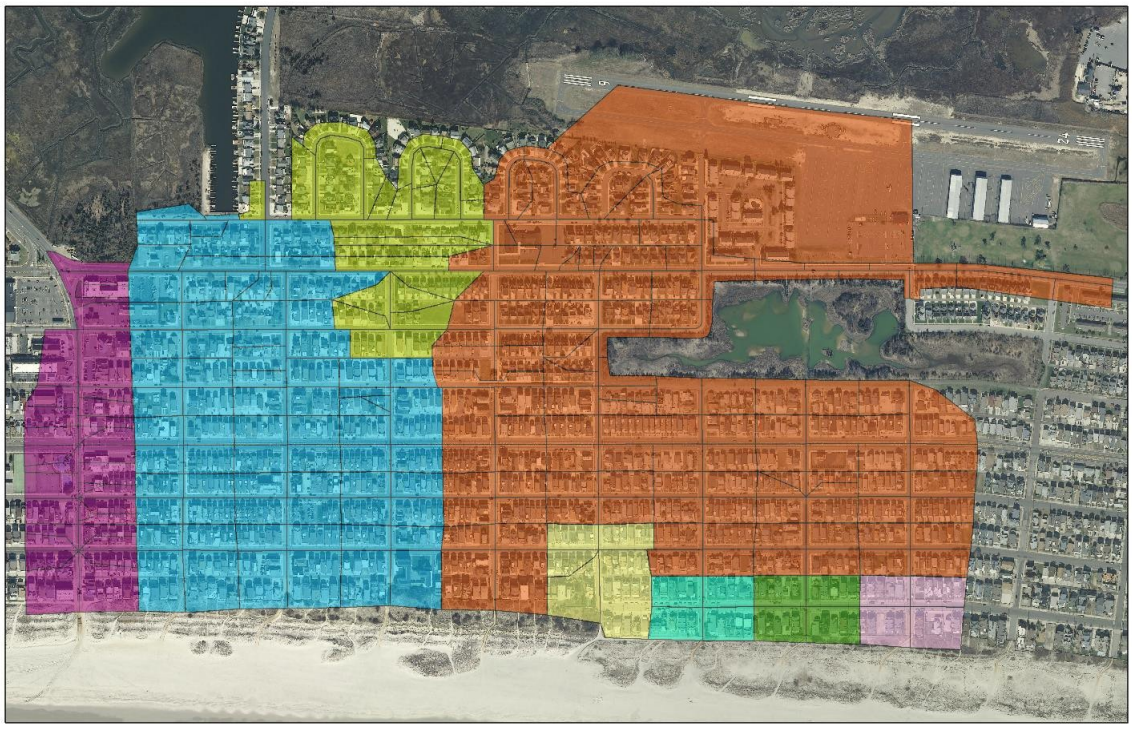
Once the hydrology was established, GIS enabled mapping of drainage areas and land use. The large majority of the study area is residential, and that area was given a 60% impervious attribution. Commercial and open space make up the remainder of the study area as well as the roadway network. The roadway network consists of east-west numbered streets, north-south named streets, and north- south alleys separating residences. The roadway network is laid out in a grid pattern. Each grid typically consists of two north-south streets, two east-west streets, and one north-south alley that bisects the grid. Storm sewers are typically placed at the four corners of each grid.

Drainage areas were determined based on the location of the inlets with the understanding that water drains from the lots to the roadway collection system. The routing of the rainfall was modeled in EPA SWMM. This hydrologic and hydraulic modeling software was used not only for its principal task of storm sewer modeling, but also for its dynamic modeling of storm sewer overflows. This type of model displays water's movement from one drainage network to another and was critical for this study, since the center of the study area is the lowest and overland flow collects in that area.

The GIS data was imported to EPA SWMM. From the land uses and drainage areas developed in GIS, subcatchments were created in EPA SWMM. Rainfall collects in the subcatchments and can leave the subcatchments in three ways: infiltration, evaporation, or surface runoff. Each subcatchment also has a predefined depression storage factor and can store a certain amount of water on the surface. Surface

runoff is determined by Manning's equation. Total runoff drains to the collection system. Horton's equation was used to determine the amount of infiltration that would enter the subsurface. For this study, no field testing was done to verify any modeling assumptions. See Figure 1 for the subcatchment map.

Figure 1 Subcatchments



Once the water drains from the subcatchment, it enters the storm sewer network. Flow routing within the conduits is governed by the Saint Venant flow equations. EPA SWMM has three routing methods: steady flow routing, kinematic wave routing, and dynamic wave routing. Dynamic wave routing was chosen for this modeling effort because it solves the complete one-dimensional Saint Venant flow equations. This method accounts for channel storage, backwater, entrance/exit losses, flow reversal, and pressurized flow. It is the most applicable method for systems with significant backwater influences, which is a significant contributing factor for the study area. Dynamic wave routing also enables the model to account for overland flow. Figure 2 shows the overland flow potential within the model. Over 73,000 feet of overland flow potential was studied. For this study, as water ponded at the inlets, the water could flow into the shoulders of the roadway and cross the center of the road.

Figure 2 Overland Flow

The storm sewer network was established from the available city data, field visits, and Google Street View.

See Figure 3 for the storm sewer network. 32,000 feet of storm sewers were modeled and 314 drainage structures. Inverts were established from the available data sources and assumptions based on minimum slope and cover requirements. Field visits confirmed a large amount of sedimentation build-up in a majority of the inlets. The system's age of over 40 years also raises questions about the continuity of the network and its structural condition. The city has replaced some of the networks, removed the old pipes, and discovered that the bottoms of the pipes were completely deteriorated.

Figure 3 Storm Sewer Network

The city has upgraded the system in a number of ways over the years. One of those upgrades is the
installment of a series of check valves. As they prevent rising tides from entering into the system, these check valves were considered in the model and applied where applicable.

The city recently installed infiltration at the beach blocks from 26th through 29th Streets. The infiltration was modeled, but infiltration parameters for the model were unknown since permeability tests were not completed as part of this study. Parameter guidelines for a subgrade of sand were used to estimate the amount of water that could enter the ground through these systems. Overflow from these systems would flow toward the center of the study area overland due to the elevation differences.

Environmental Investigation

Michael Baker performed a wetland investigation and delineation on March 23, 2015 for the project area. Prior to field reconnaissance, the project was located on 7.5 minute United States Geological Survey (USGS) Quadrangle mapping (Ocean City). This mapping was evaluated for topographic relief, drainage patterns, and subwatershed characteristics, which would suggest potential wetlands. The New Jersey Department of Environmental Protection (NJDEP) Freshwater Wetlands (FWW) and Upper Coastal Wetland Boundary mapping and the United States Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) mapping were examined for wetlands within the study area. Additionally, the United States Environmental Protection Agency (USEPA) Priority Wetlands List for New Jersey was reviewed.

Wetland areas were delineated following the Federal Manual for Identifying and Delineating Jurisdictional Wetlands (January, 1989) and the United States Army Corps of Engineer (USACE) Wetland Delineation Manual (1987) and the Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region Version 2.0 (November, 2010). Use of these methodologies is required by the NJDEP Division of Land Use Regulation and the USACE. In accordance with these methodologies, the following parameters are characteristic of wetlands:

1.The land is dominated by hydrophytes;
2.The substrate is undrained hydric soil; and
3.The substrate is saturated with groundwater or flooded for a significant part of the growing season each year.

Positive indicators of the above listed parameters are the basis for wetland identification. All three parameters must be present in order for an area to be identified as wetland, unless abnormal or atypical conditions are determined to be present. There was no discrepancy in the use of these two methodologies.

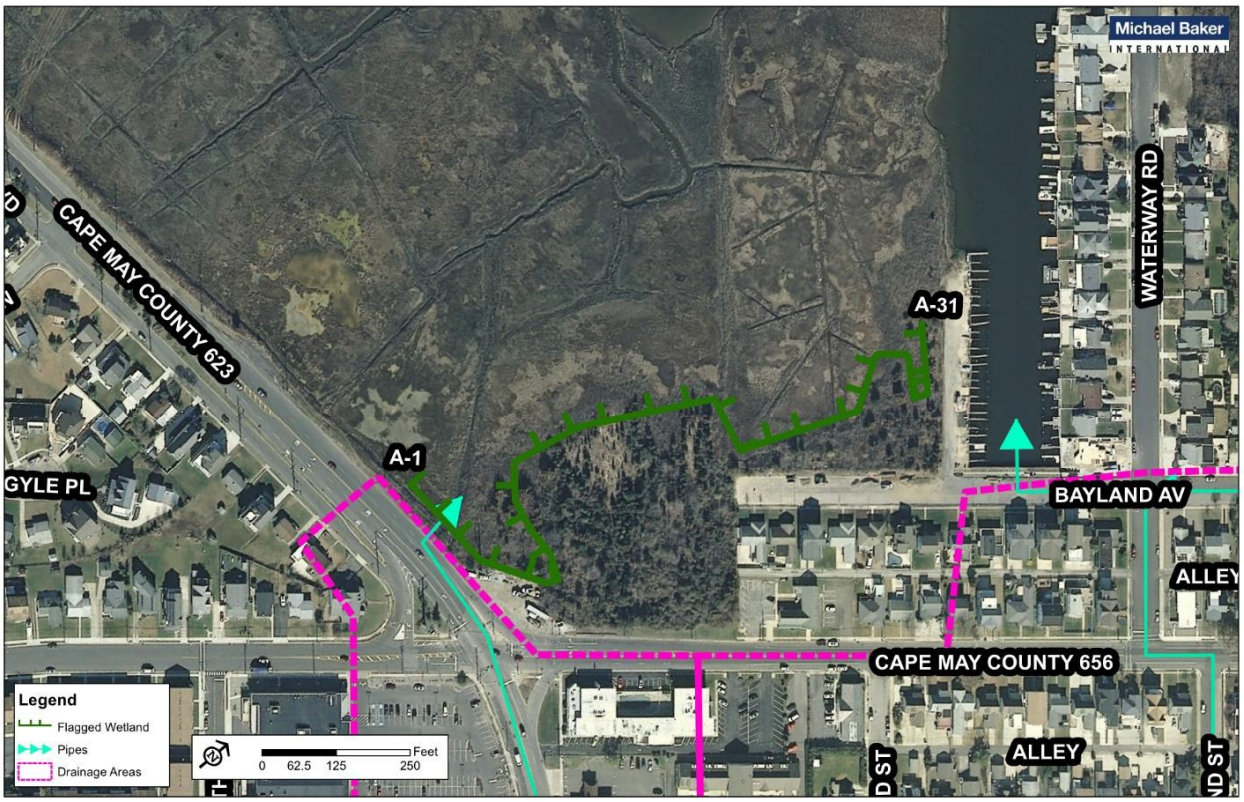
In order to delineate the jurisdictional wetland limits, a series of field observations were made to confirm the presence or absence of positive wetland indicators. First, the dominant vegetation was identified and a determination as to the presence of hydrophytic vegetation was made. If a dominant hydrophytic vegetation community was identified, then a soil auger was used to take samples at the areas along the vegetation community edge that supported a dominance of facultative, facultative wet or obligate plant species to identify the presence of hydric soils. Additionally, the area was also investigated for indicators suggesting clear evidence of wetland hydrology.

The wetland delineation was limited to the vicinity of Roosevelt Boulevard and Bay Avenue, where a pump station is being considered. However, during the wetland investigation, coastal wetlands were identified adjacent to the Ocean City Municipal Airport where outfall improvements and a pump station are also currently being considered. In addition, the Howard S. Stainton Wildlife Refuge (HSSWR), located on Bay Avenue between 23rd and 30th Streets, was also identified within the vicinity of the project area. The HSSWR was converted to natural wetland habitat for local and migrating wildlife.

One wetland, Wetland A, was delineated during the wetland investigation in the vicinity of Roosevelt Boulevard and Bay Avenue. Wetland A is mapped on the NWI as a palustrine emergent persistent seasonally-flooded wetland and as a saline marsh on the NJDEP FWW mapping. Portions of Wetland A

are located within the upper wetland boundary limit of the NJDEP Coastal Wetlands mapping. The site investigation confirmed the presence of a saline marsh wetland. Common reed (Phragmites australis, FACW) was dominate along the wetland/upland boundary. The upland species consisted of eastern red cedar (Juniperus virginiana, FACU), northern bay berry (Morella pensylvanica, FAC), and switchgrass (Panicum virgatum, FAC). Soil samples extracted in the field met the criteria for Sandy Redox (S5) and Dark Surface (S7). Evidence of wetland hydrology observed includes a high water table (A2), drift deposits (B3), drainage patterns (B10), geomorphic position (D2), and a positive FAC-Neutral test (D5).

Figure 4 - Delineation of Wetland A



The wetland identified within the project area is subject to regulation by the NJDEP and the USACE. Depending on where the pump stations are located, and if impacts to wetlands and water resources are encountered, the NJDEP may require a Coastal Area Facility Review Act (CAFRA) Area Permit (N.J.A.C. 7:7-2.1 (a)2), Coastal Wetlands Permit (N.J.A.C. 7:7-2.2 (a)12), Waterfront Development Permit (N.J.A.C. 7:7- 2.3 (d)), and/or a FWW General Permit 11 for Outfalls and Intake Structures. Additionally, if the proposed project results in greater than 5,000 square feet or more of ground disturbance, a Soil Erosion and Sediment Control application will need to be submitted to the appropriate Soil Conservation District.

The project area is located within the CAFRA boundary, as such, a CAFRA Permit may be required if the pump station is installed in the CAFRA area between the mean high water line of any tidal waters, or the landward limit of a beach or dune, whichever is most landward, and a point 150 feet landward of the mean high water line of any tidal waters or the landward limit of a beach or dune, whichever is most landward. Additionally, Wetland A was partially delineated within the upper wetland boundary limit of

the NJDEP Coastal Wetlands mapping. If the proposed project activities result in any filling, excavation or construction of any structure in the portion of the wetland that is mapped as a coastal wetland, then a NJDEP Coastal Wetland Permit will be required. A NJDEP FWW GP 11 may also be warranted if the installation of the pump station impact any portion of Wetland A that is regulated under the Freshwater Wetlands Protection Act Rules (N.J.AC. 7:7A).

As mentioned above, Wetland A is also regulated by the USACE and if the proposed project results in impacts to waters of the United States a Nationwide Permit (NWP) 7 (Outfall Structures and Associated Intake Structures) for the installation of the pump station and NWP 12 (Utility Line Activities) for the proposed replacement of existing pipes may be warranted.

Both the aforementioned NJDEP permits and USACE permits will require cultural resources review. Based on the nature of the proposed activities and developed land use of the project area, it is not anticipated that the project will result in adverse impacts to historic structures or archaeological sites. However, formal coordination with the NJ State Historic Preservation Office is anticipated.

The permit requirements for the project will be re-evaluated during final design of the project.

Model Findings

Through the four various rainfall events and two different tide options, a total of eight scenarios were run for the purposes of this study. All of the modeling scenarios produced some level of roadway flooding. The 1-year storm with the low tide boundary condition produced flooding in the lowest areas of the study area on Haven and Simpson Avenues. The less frequent 5- and 10-year events produced significantly more roadway flooding with longer durations. The high tide event of 3' NAVD88 causes significant flooding at all levels. The model assumes empty and intact pipes at the start of each run.

Holistically, the model revealed a number of issues. Pipe capacity, travel length, structure condition, and overland flow are among those issues. Areas along Haven Avenue, Simpson Avenue, and West Avenue contain the highest number of areas below 3' NAVD88. Areas below this high tide elevation will flood whenever it rains during high tide under existing conditions. Check valves in the system prevent the bay from entering the system, but in order for water to exit the system by gravity the water elevation on these streets would need to be above 3' NAVD88. In many instances this would be a flood condition.

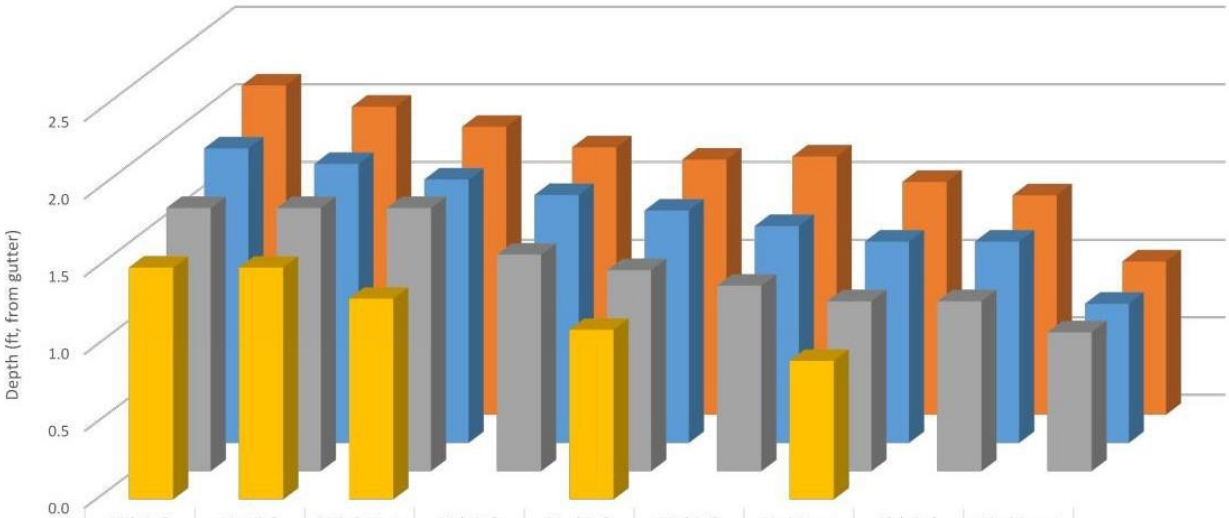
The city has historically experienced flooding at high tides even without a rainfall event. This situation indicates an issue with storm sewer continuity. High tides can impact groundwater elevation and force water through the deficient storm sewer and drainage structures. See Figure 5 for a location map of the outfalls. The highest percentage of drainage travels to outfalls 3, 4, 5, and 6. The water needs to travel a long distance at a very low slope, causing capacity problems during low tides. Figure 6 shows the areas of the study that show the greatest flooding potential.

Figure 5 Outfall Locations

Figure 6 Highest Flood Potential

The following table and graph show the predicted flood depths at the most susceptible areas of the study area:

Figure 7 - Flood Depths



	26th St & West Ave	31st St & West Ave	28th & West Ave	34th St & West Ave	32nd St & West Ave	33rd St & Asbury Ave	33rd Street & Haven Ave	29th St & Haven Ave	32nd Street & Simpson Ave
1-year	1.5	1.5	1.3		1.1		0.9		
2-year	1.7	1.7	1.7	1.4	1.3	1.2	1.1	1.1	0.9
5-year	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.3	0.9
10-year	2.1	2.0	1.9	1.7	1.6	1.7	1.5	1.4	1.0

The results indicate significant depths in the roadway gutters of the study area for the four modeled storm events. As the flood waters crest above the inlets water is quickly dispersed in the roadway gutters. Flood waters recede in the modeled storms in approximately 5-6 hours. Flood depths remain similar across the modeled storm events. This is significant because it indicates a substantial role that the tide boundary condition has on the system performance.

Mitigation Recommendations

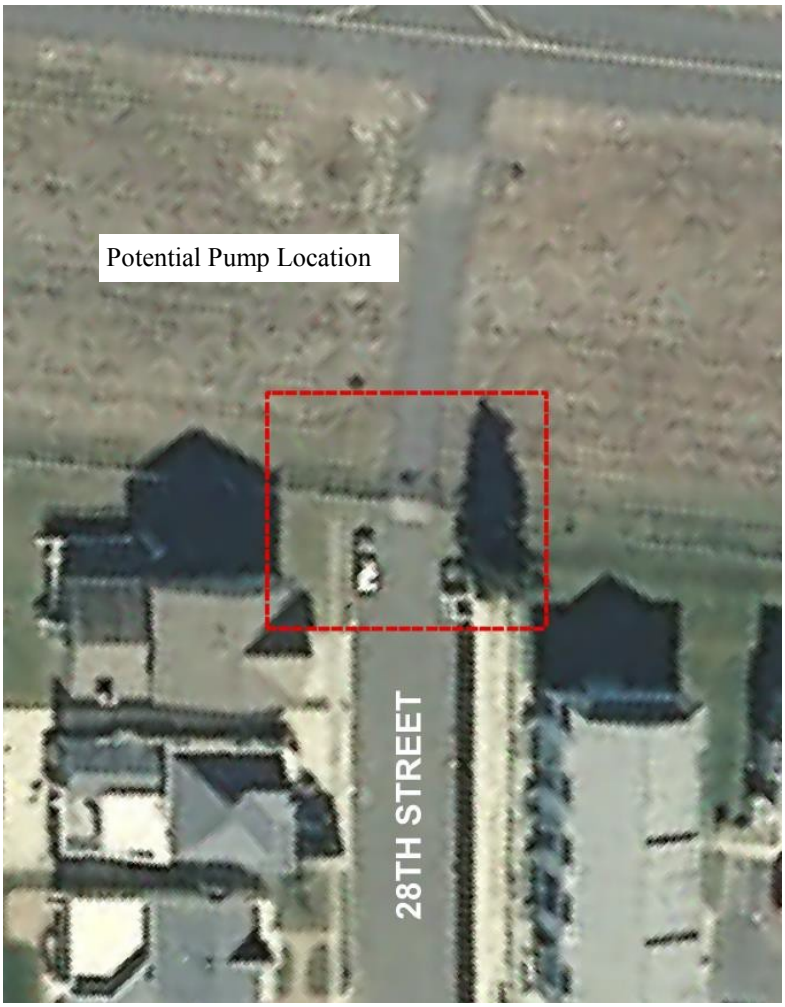
Mechanical Solutions

Installing pump stations at outfalls 3, 4, 5, and 6 would create a mechanism to assist the conveyance of water from the low points along Haven Avenue, Simpson Avenue, and West Avenue. The drainage network could be entirely replaced to create a pump dependent system, or the pumps could be added to the existing systems to assist the gravity flow mechanisms currently in place. Based on the modeling results, a pump solution would enable the system to combat the tidal impacts controlling the system performance.

For the purposes of this study and the cost estimate, the pumps are assumed to be an offline solution that would require limited upgrade of the upstream drainage network. This solution would call for a diversion structure to be added near outfalls 3, 4, 5, and 6. Outfalls 3 and 4 could likely be conveyed to one system. Outfalls 5 and 6 would most likely need their own systems due to the demand. As an estimate, it is assumed that the stations should be able to handle 20,000 gallons per minute based on the existing size of the upstream system. It is also suggested that the stations themselves be larger than required in order to allow for additional pumps being added for an increase in demand. Two proposed locations are presented in Figures 8 and 9. A third station would be ideal somewhere on the airport property.

Figure 8 - Outfall 3&4 Approximate Pump Station Location

Figure 9 - Outfall 5 Pump Station



Infrastructure Improvements

Improving the drainage system for the entire study area and raising Haven Avenue, Simpson Avenue, West Avenue, and the related numbered streets would provide significant improvements to the flooding issue. Currently this area lies lower than the beach and bay sides of the study area. The model revealed that flooded water on the streets would flow to the center of the study area and create a “bathtub” effect.

Field visits and existing survey have highlighted the potential for some elevation increases to these roadways while still collecting drainage from the resident’s properties. The network itself should also be laid out with the intention of keeping the inlets offline from the main storm sewers. This layout will allow maximum slope from inlets to the main and eliminate extra pipe length on the main sewers. Smaller dual or triplex pipe mains should also be considered to maximize slope in the network.

Existing pipes should be replaced with ductile iron pipe or a properly anchored plastic pipe. Ductile iron has the advantage of requiring less cover from the road traffic due to its durability, but it comes at a higher cost and will need to be wrapped in a plastic cover to prevent saltwater deterioration.

Green Infrastructure Strategies

Green infrastructure strategies include infiltration and storage. Due to the soil conditions on the barrier island, infiltration is anticipated to only be successful close to the beach where sandy soils would allow for water to drain. Rain barrels and rain gardens should be considered on properties to retain water and lower peak surges in the drainage system.

For infiltration, the city has had success in separating the storm sewers at the beach blocks from 26th Street to 29th Street into infiltration under the roadway. It is proposed that concrete chambers be installed under the beach block from 30th–34th Street to remove drainage areas from the overburdened systems. Soil borings or test pits will need to be collected to determine the infiltration capacity of the soil in this area. The system will still need to have overflow capacity back into the existing system, but this solution should remove significant flow from the system surcharging the roadways.

Phased Approach

These mitigation solutions are separated into the three previously mentioned categories and can be installed independent of one another. By creating offline pump stations, the drainage systems would operate by gravity as they do now, but as the system begins to flood the pump stations would be engaged to keep up with the demand. Though the systems would require limited improvements upstream from the pipe networks, they would need upgrades by way of new pipes to the outfalls to handle the pumped flow. These stations would significantly alleviate flooding in the area but could require permitting, depending on the locations selected. The pumps' electrical infrastructure would also need upgrades to provide a three-phase supply.

The roadway and drainage improvements can happen independent of the pump stations and green infrastructure improvements but require longer design time. This modification would improve the roadway conditions and raise the drainage network. The pump station design would allow for these improvements with limited replacement of that system.

The green infrastructure solutions can also be constructed parallel to the other mitigation solutions. This category of improvements would require city contracts for the large under-the-road infiltration facilities, but the rain barrels and rain gardens would be put in place by the property owners. Programs and grants are available to obtain materials and give training for the construction of these devices to residents. This initiative has the smallest flooding reduction impact but also comes with the smallest costs.

Cost Estimates

Phase 1 – Pump Stations

Cost Per Station	
Mobilization	$ 40,000.00
Three (3) 80 HP Pumps and Cables	$ 135,000.00
Pump Controls	$ 40,000.00
Internal Piping	$ 25,000.00
Outfall Pipe	$ 100,000.00
Diversion Manhole	$ 50,000.00
Piling Support	$ 50,000.00
Concrete Station	$ 150,000.00
Electric Upgrades	$ 100,000.00
Soil Erosion Sediment Control	$ 10,000.00
Stairs and Other Access Requirements	$ 50,000.00
TOTAL:	$ 750,000.00
TOTAL FOR 3 STATIONS:	$ 2,250,000.00

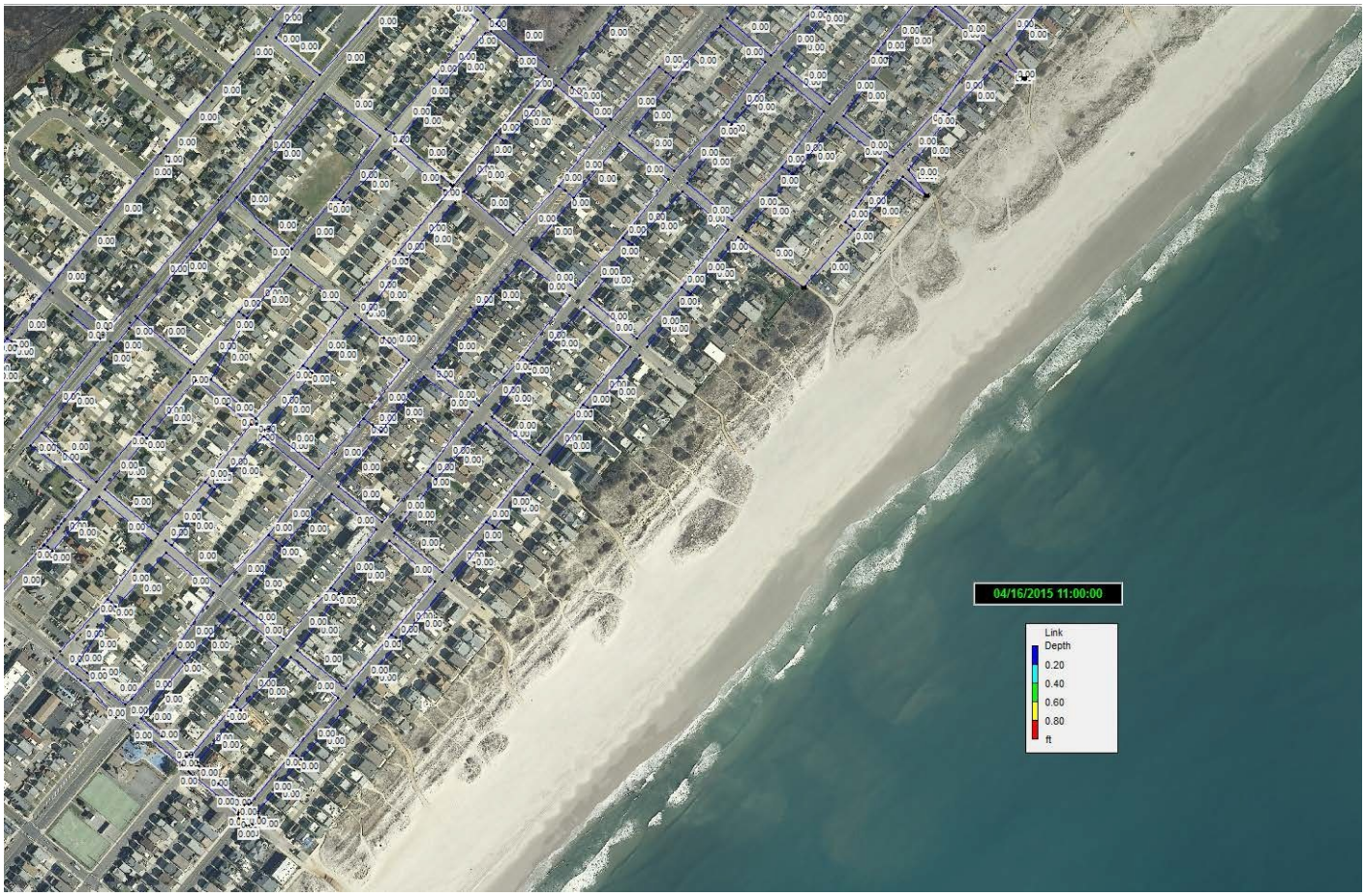
Phase 2 – Roadway and Drainage Network Improvements

Upgrades to Simpson, Haven, West and Numbered Streets	
Necessary Drainage System Upgrades	
Mobilization	$ 75,000.00
Soil Erosion Sediment Control	$ 30,000.00
Pavement Upgrades	$ 4,500,000.00
Drainage Upgrades	$ 3,600,000.00
Sidewalk Improvements	$ 1,400,000.00
Utility Conflicts	$ 100,000.00
Traffic Control	$ 50,000.00
TOTAL:	$ 9,755,000.00

Phase 3 – Green Infrastructure Strategies

Cost Per Unit	
Mobilization	$ 40,000.00
Soil Erosion Sediment Control	$ 5,000.00
Drainage Upgrades	$ 75,000.00
Infiltration System	$ 400,000.00
TOTAL:	$ 520,000.00

Appendix – 10 Year Event Gutter Flooding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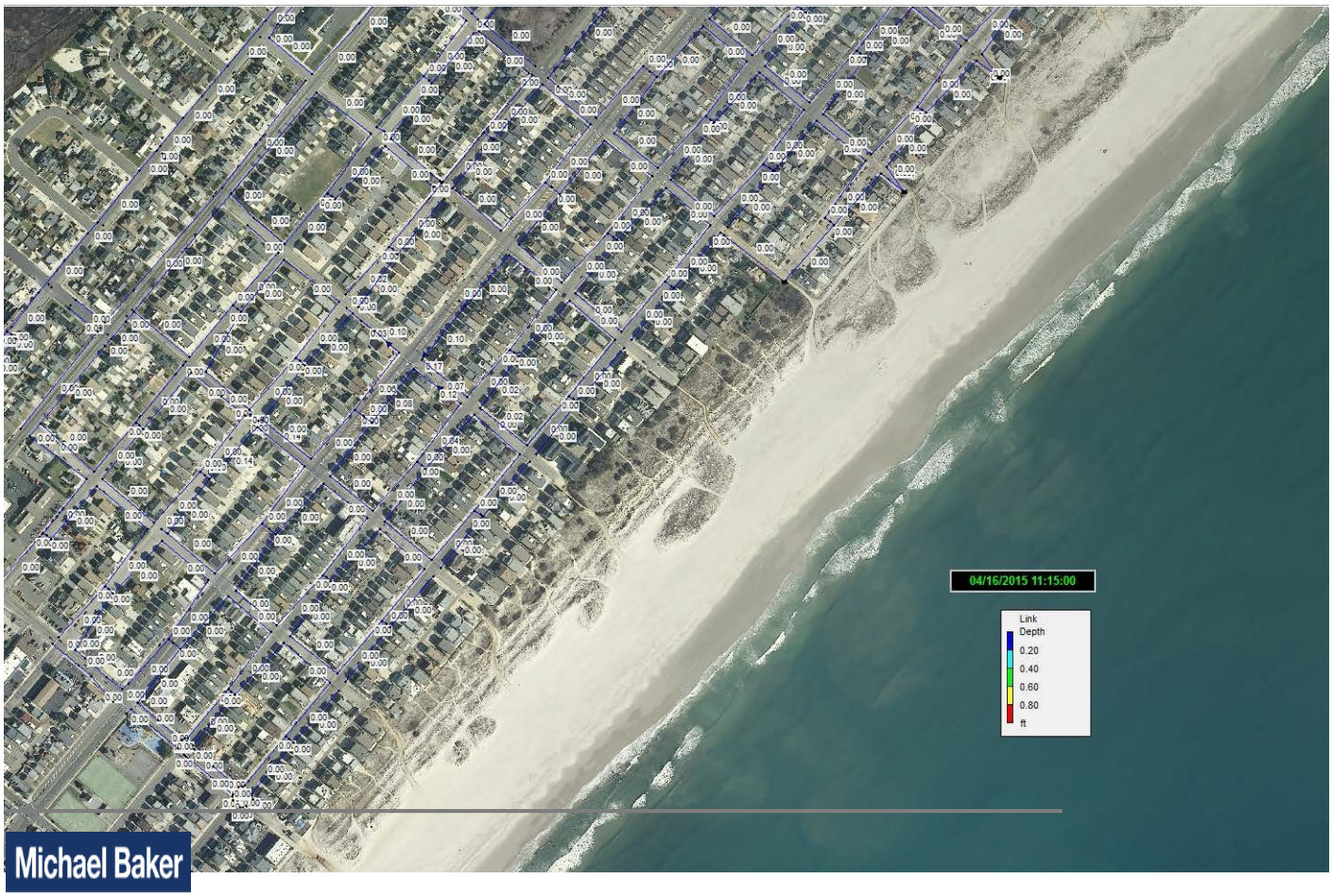
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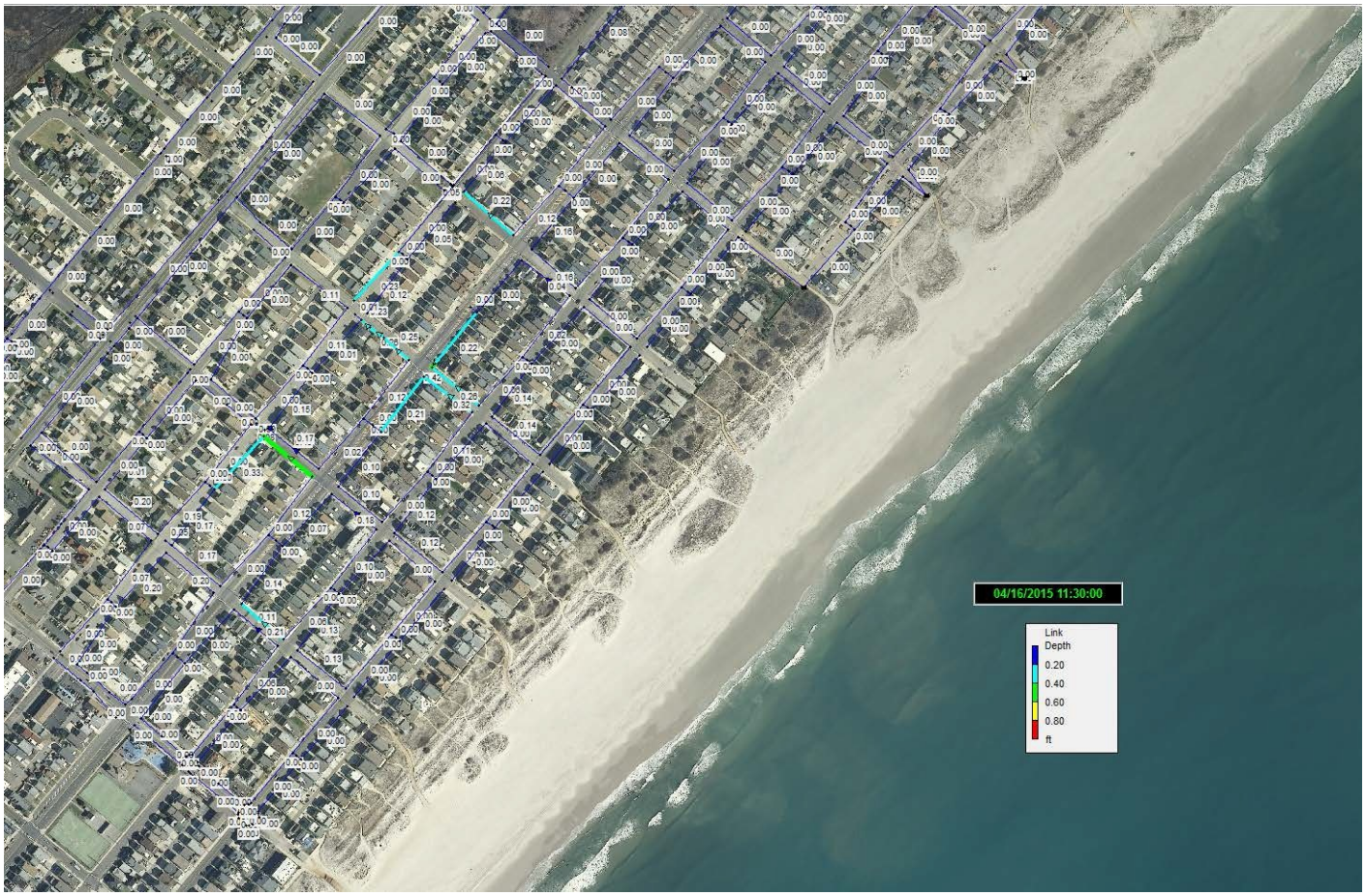

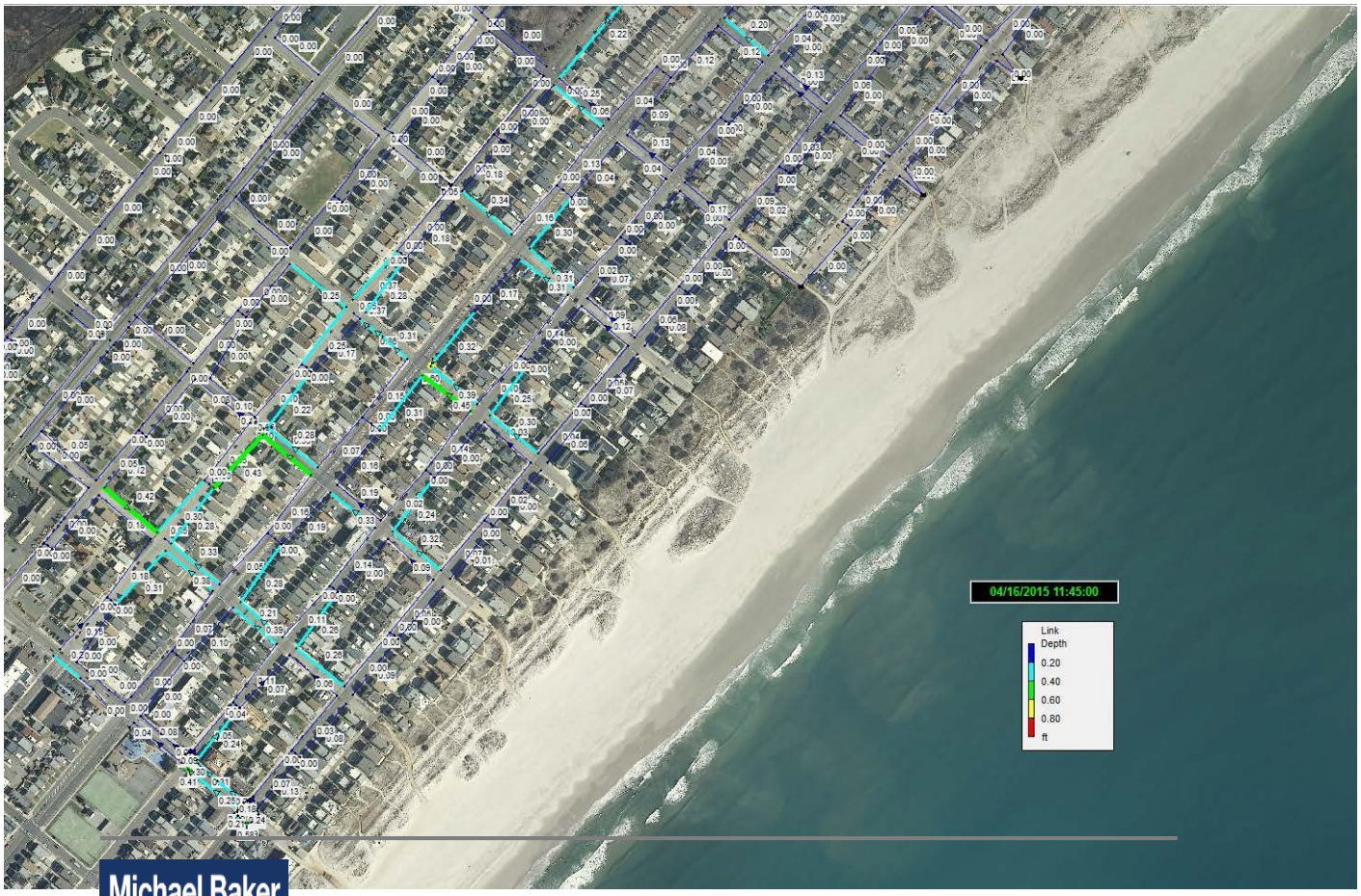

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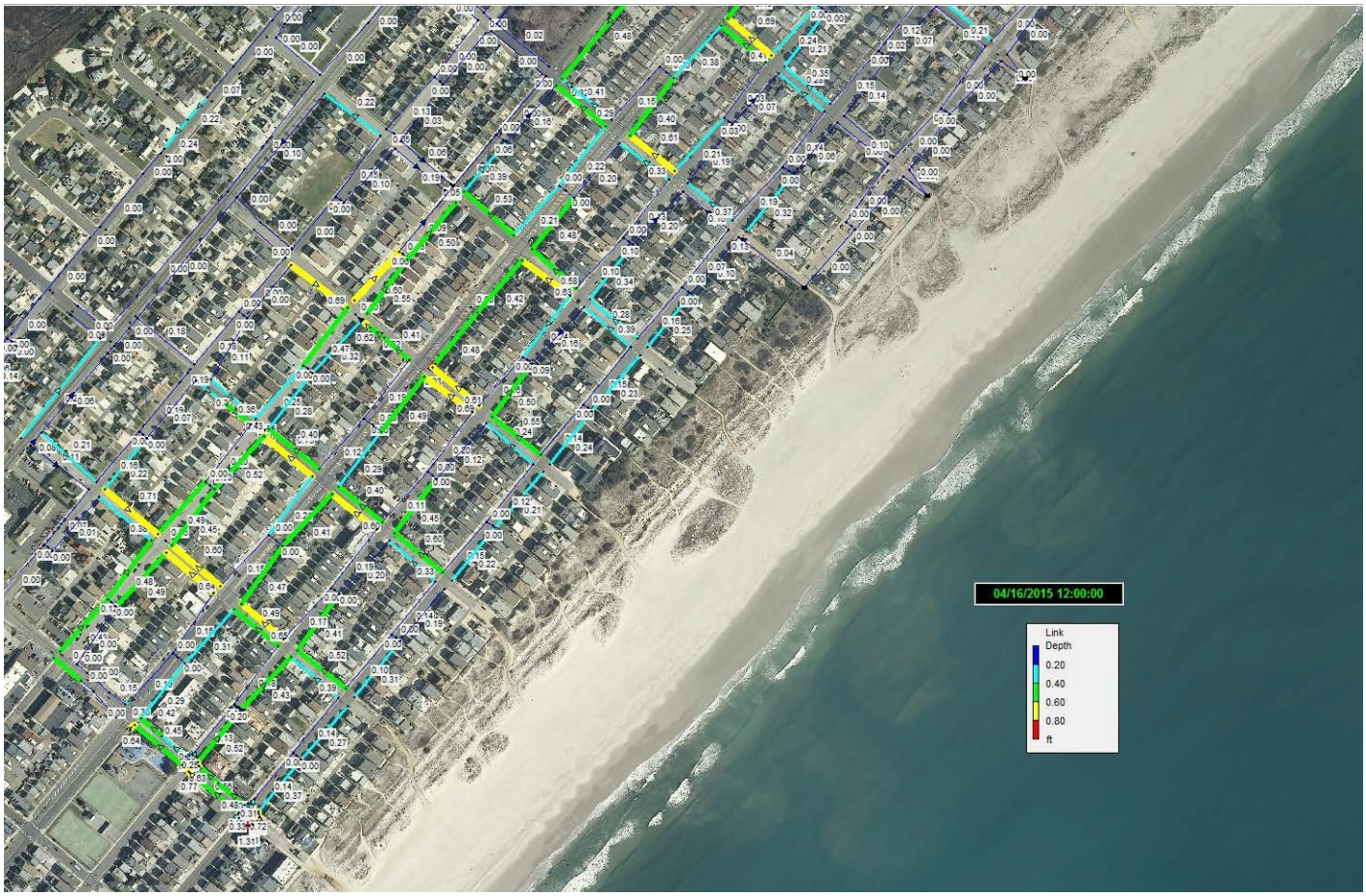

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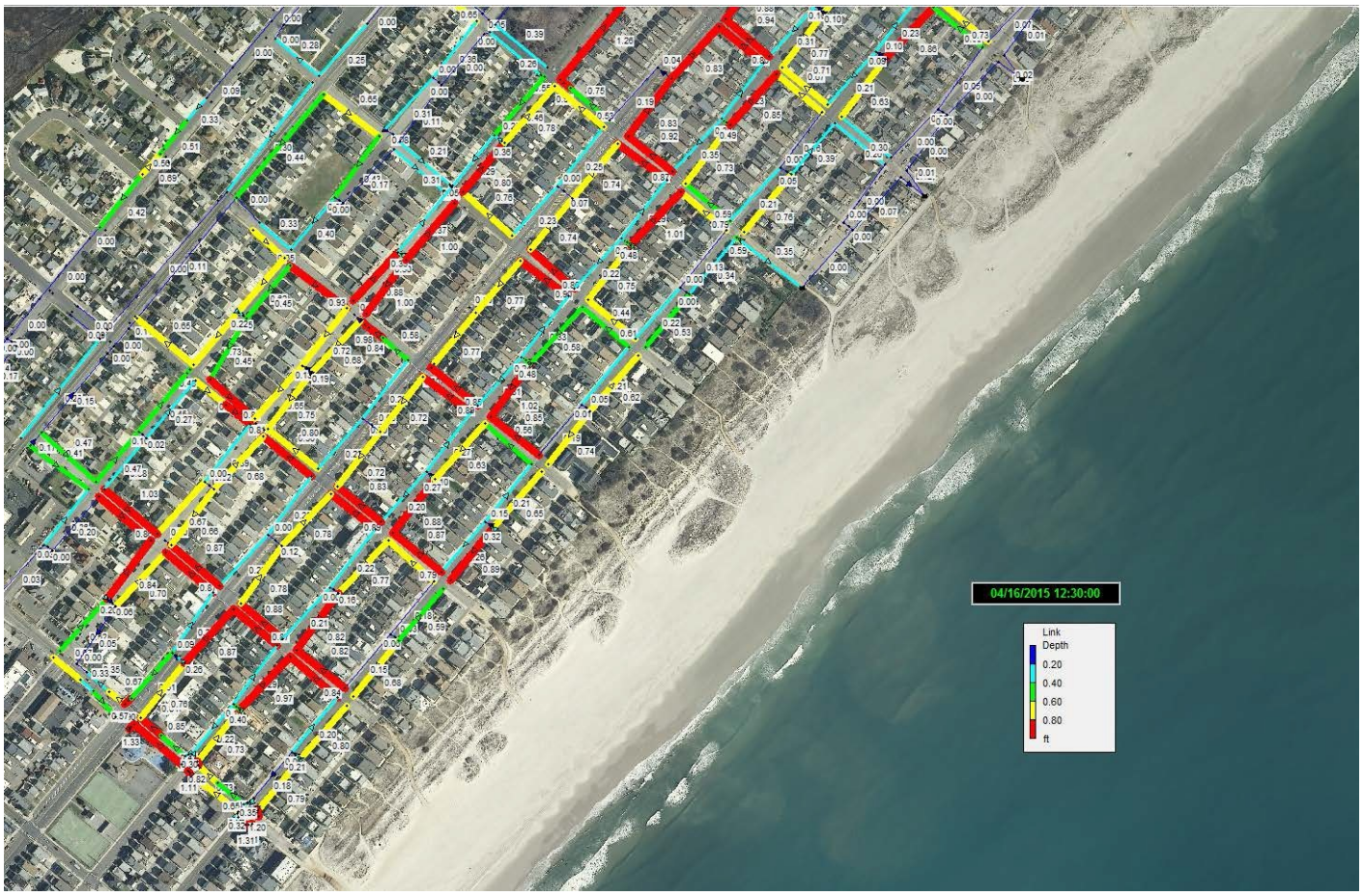

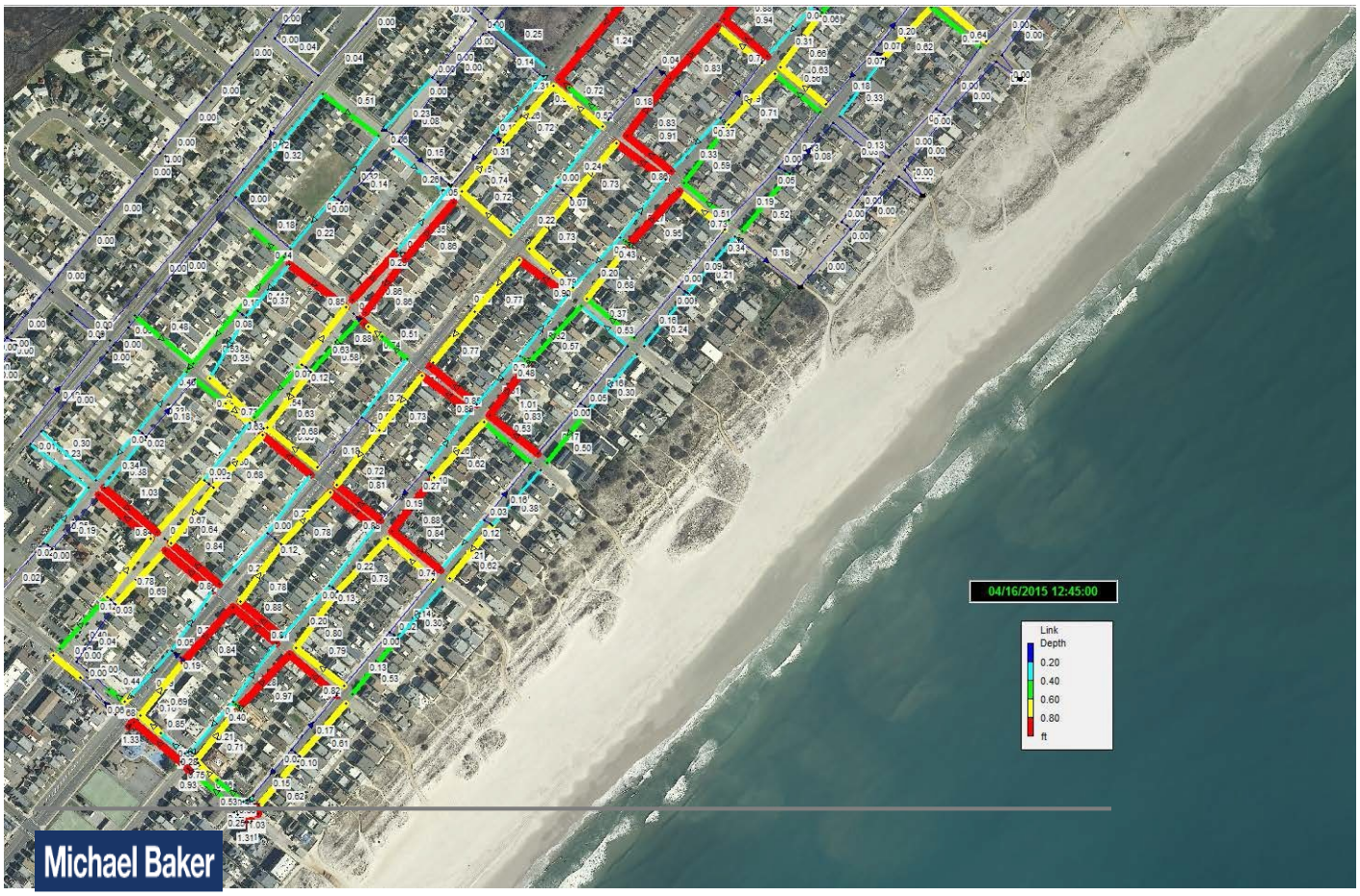

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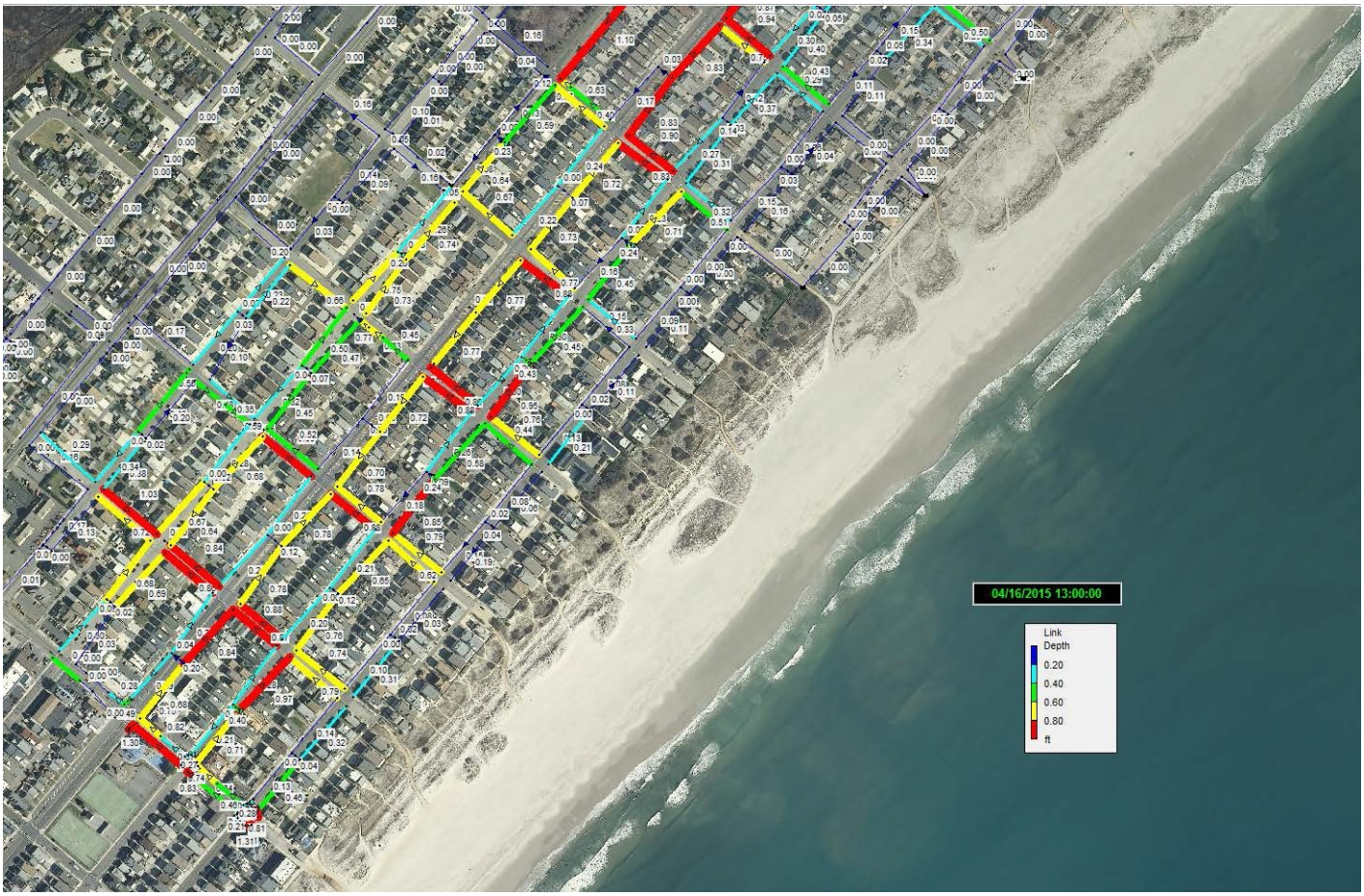

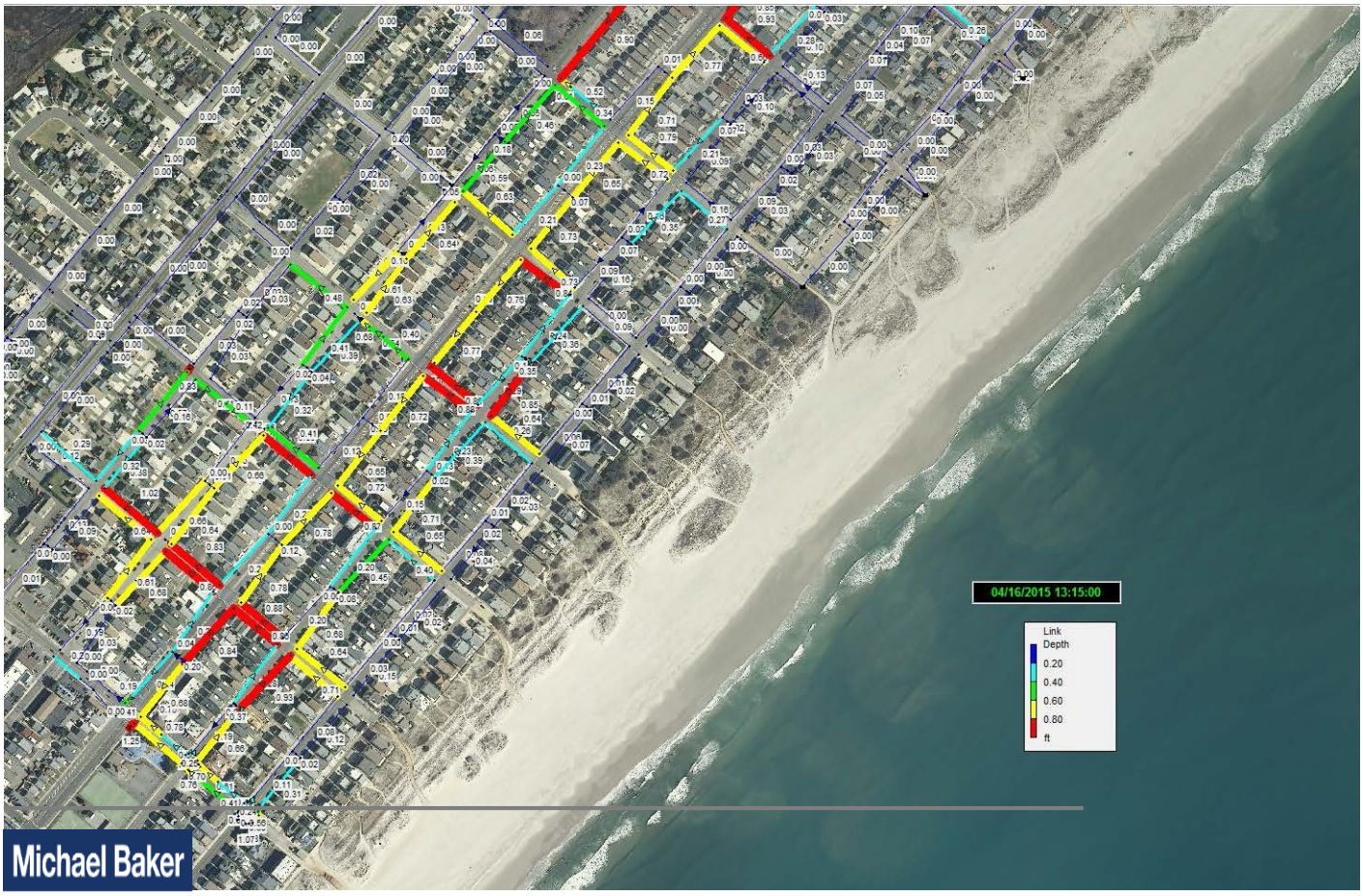

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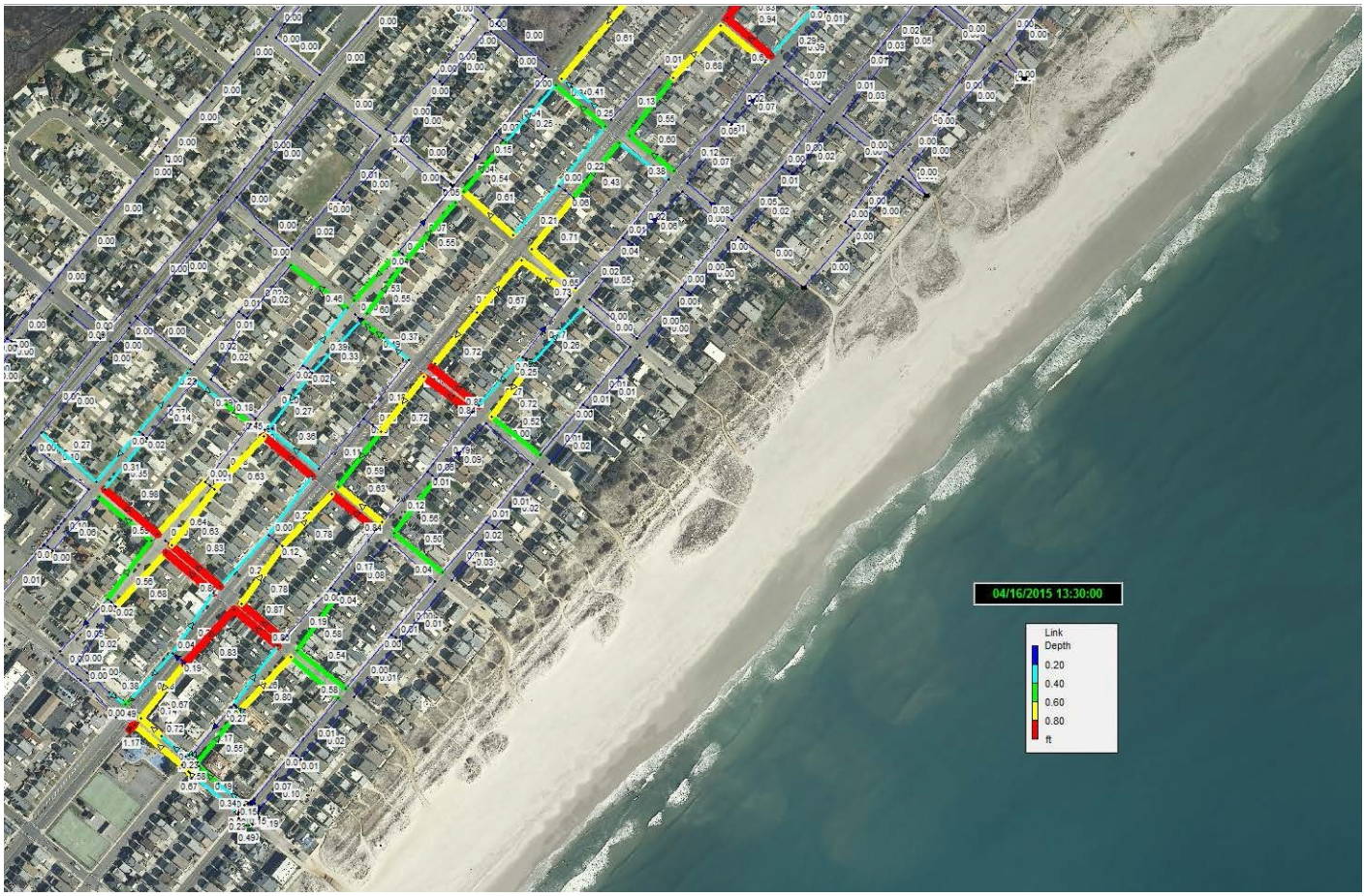
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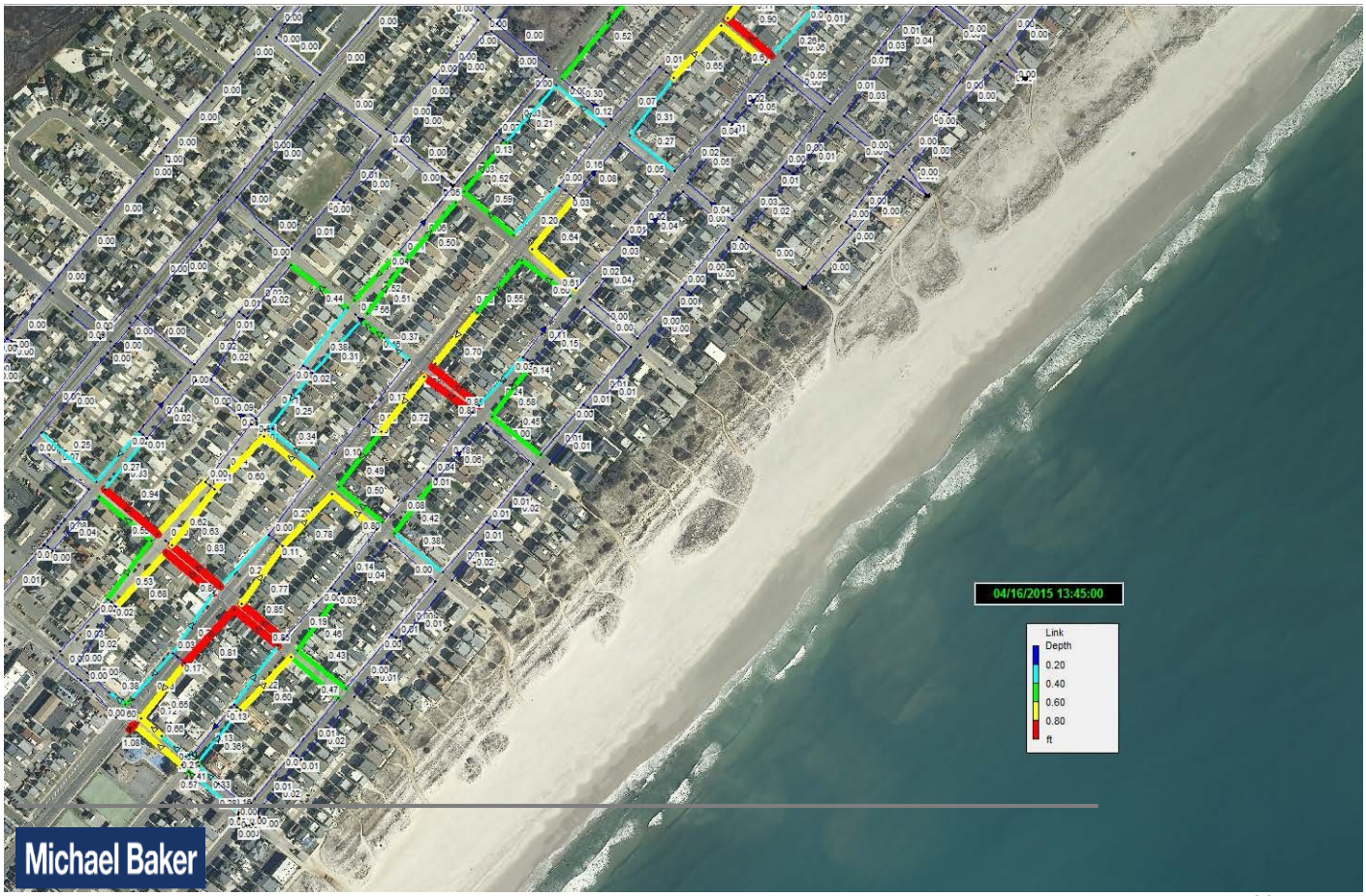
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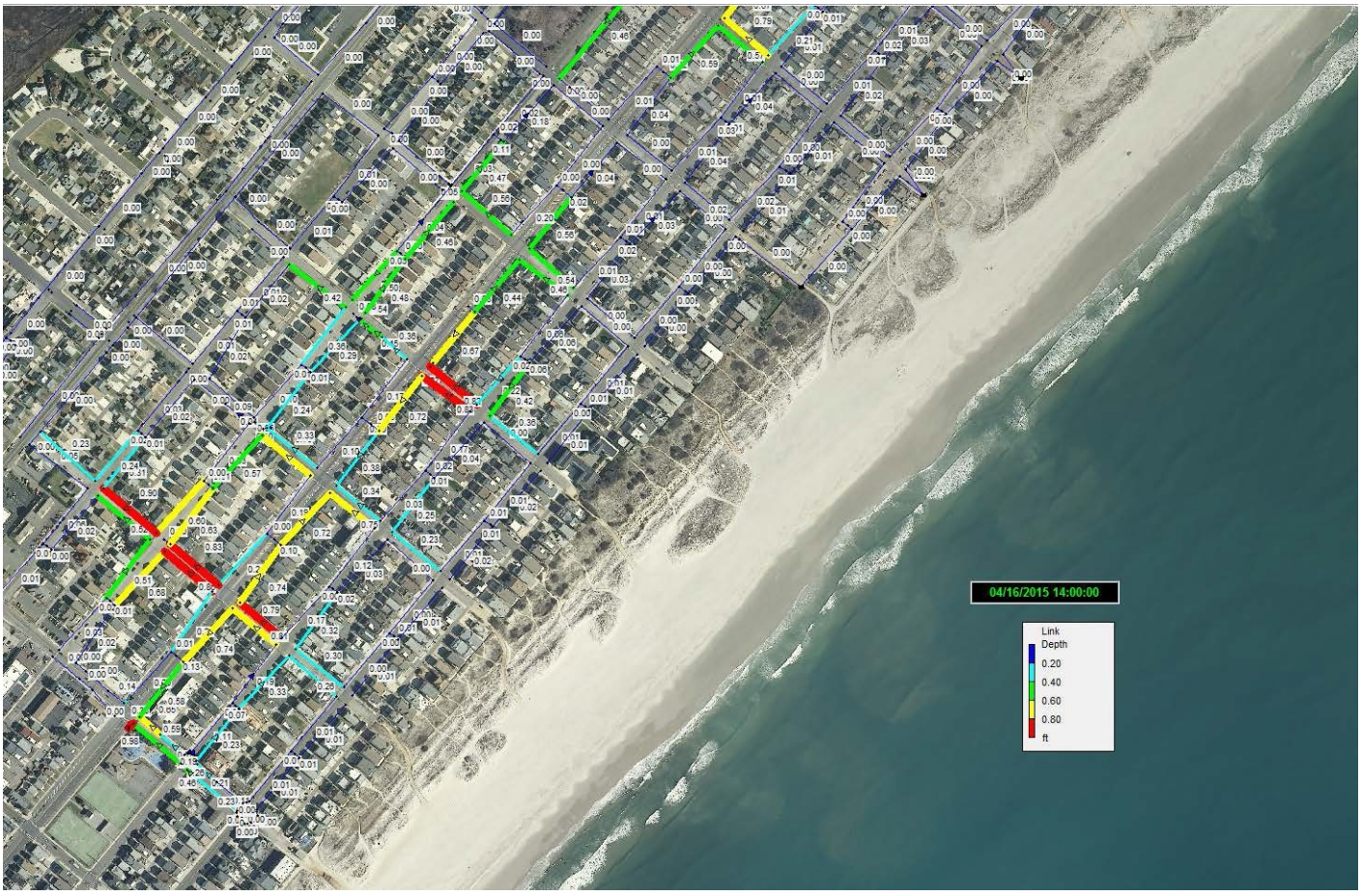
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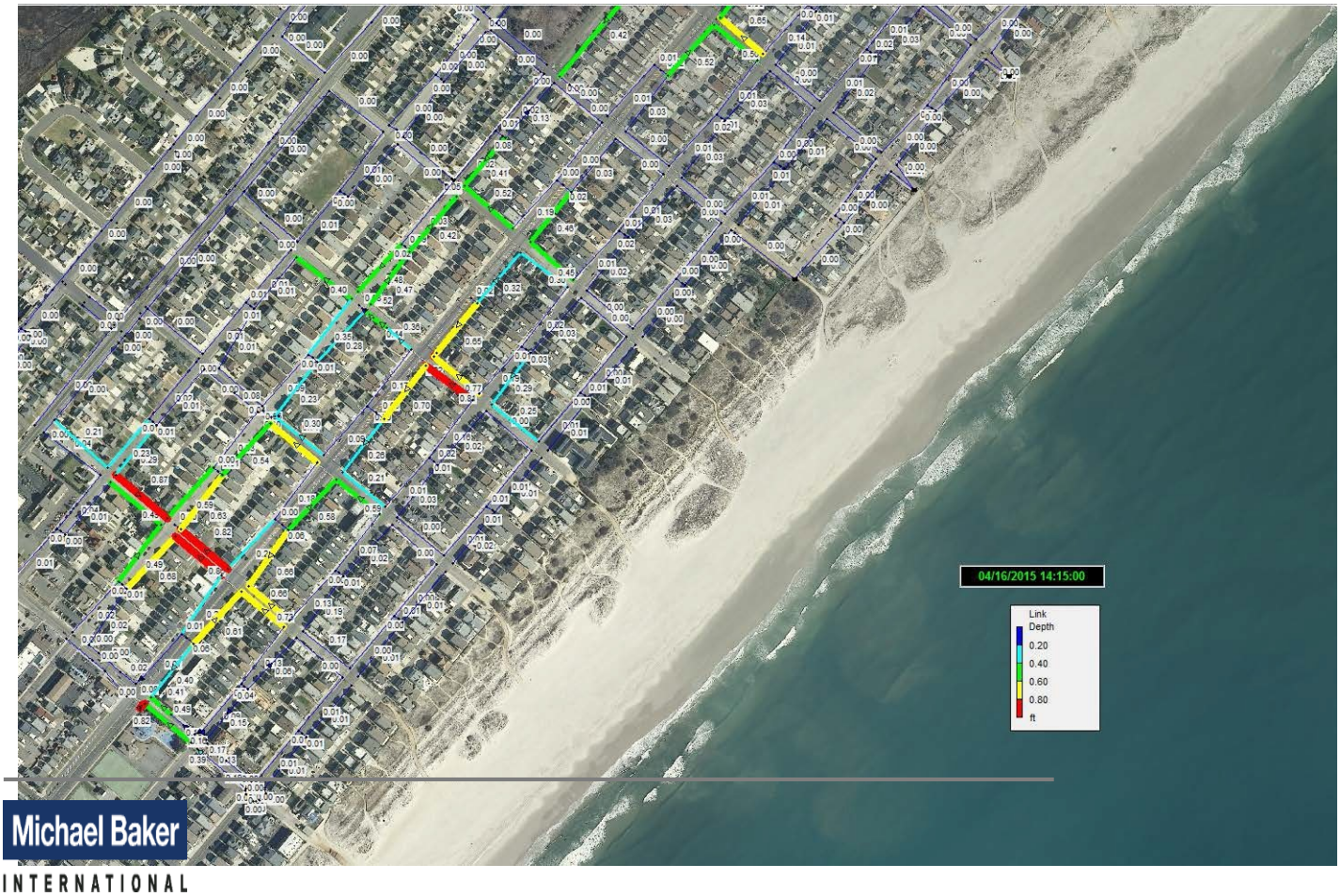
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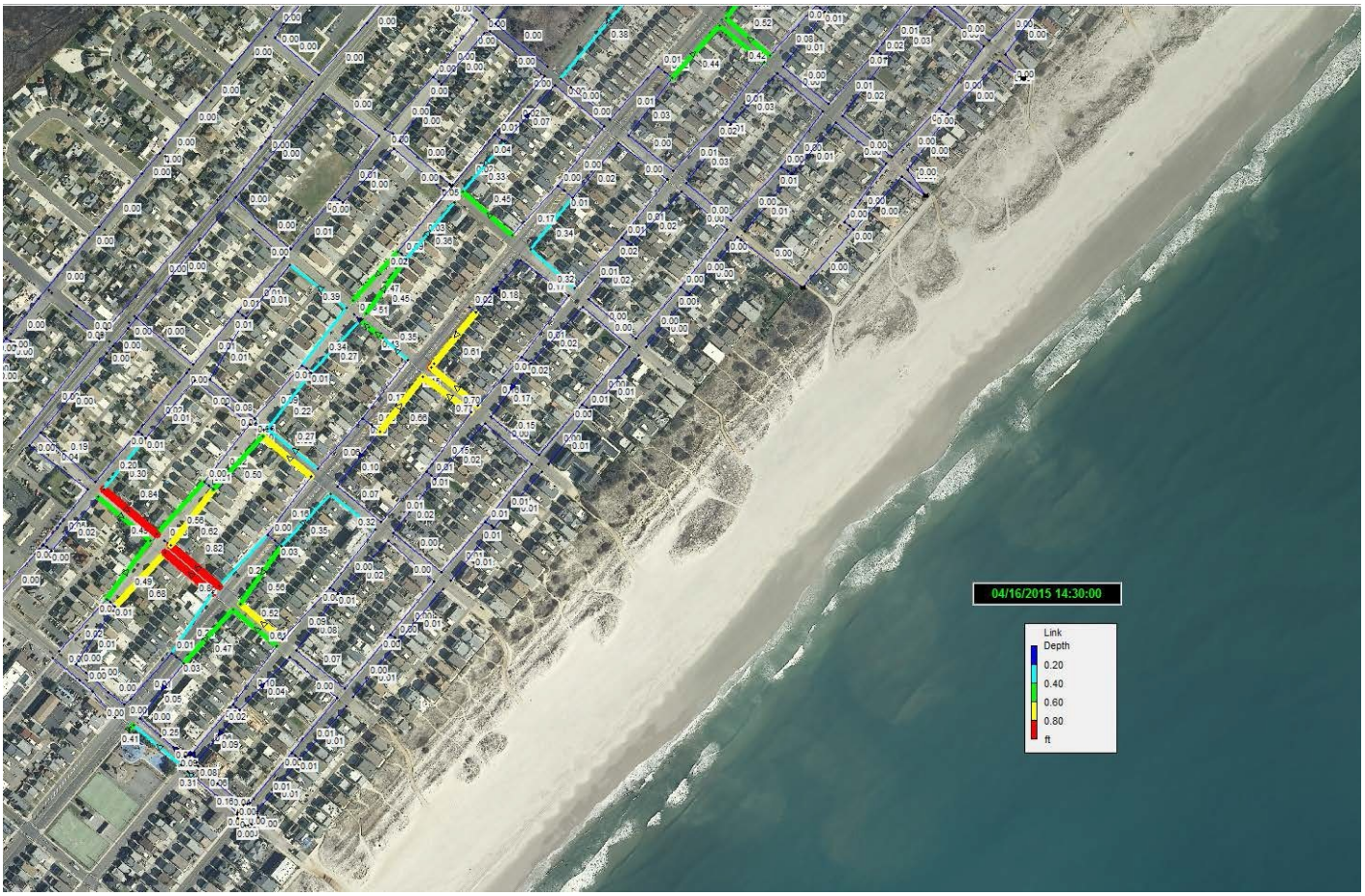
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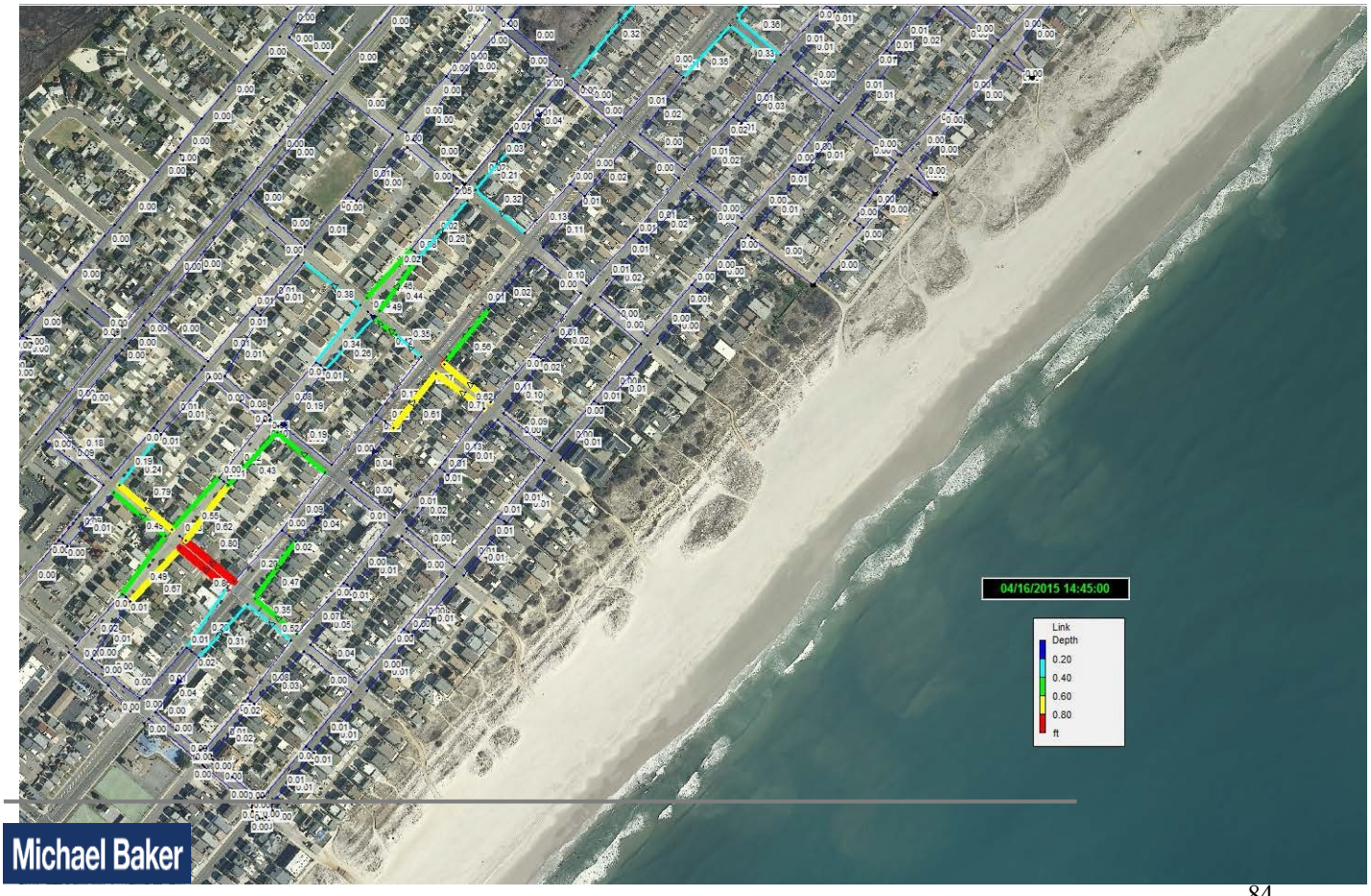
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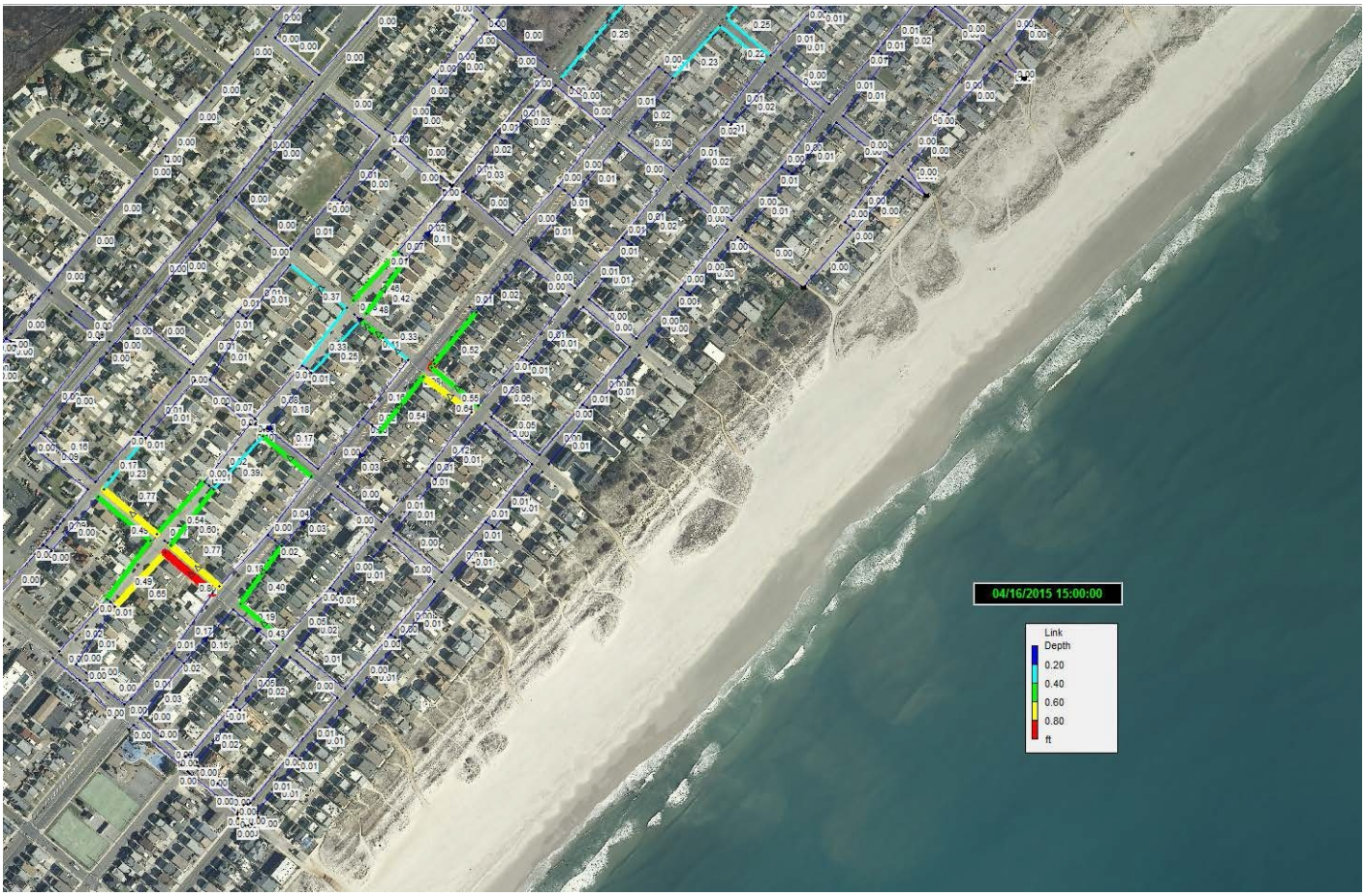
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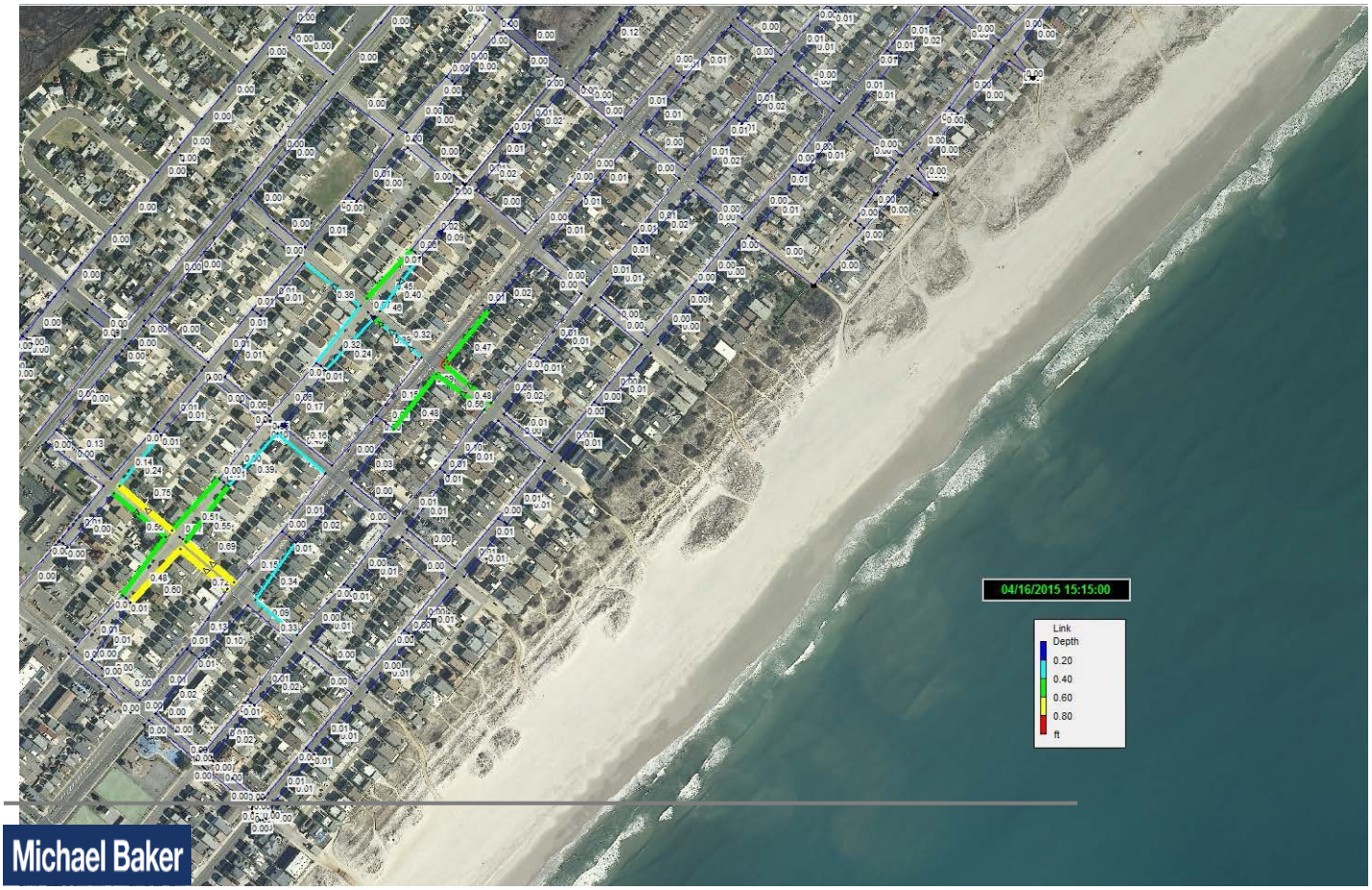
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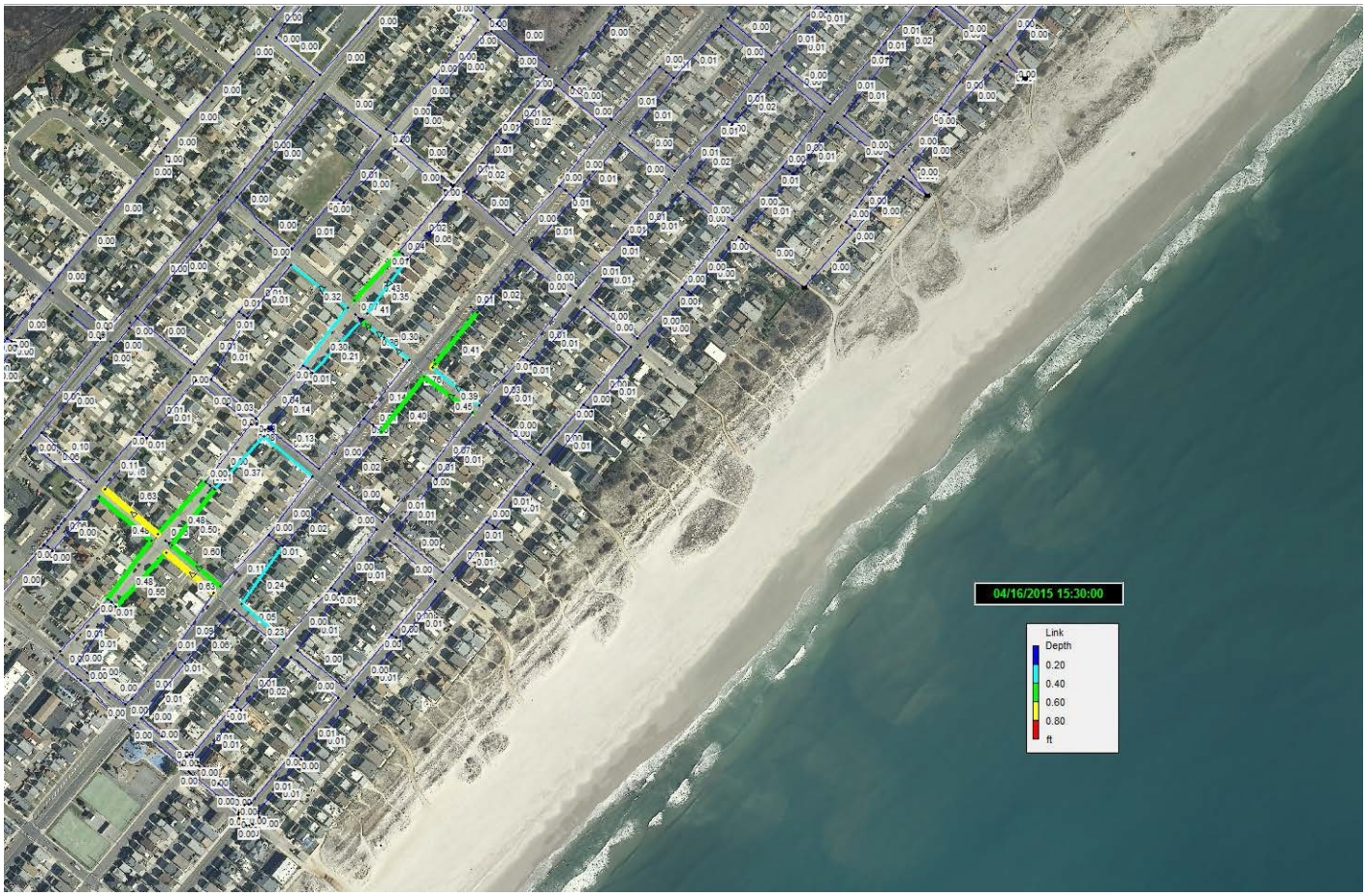
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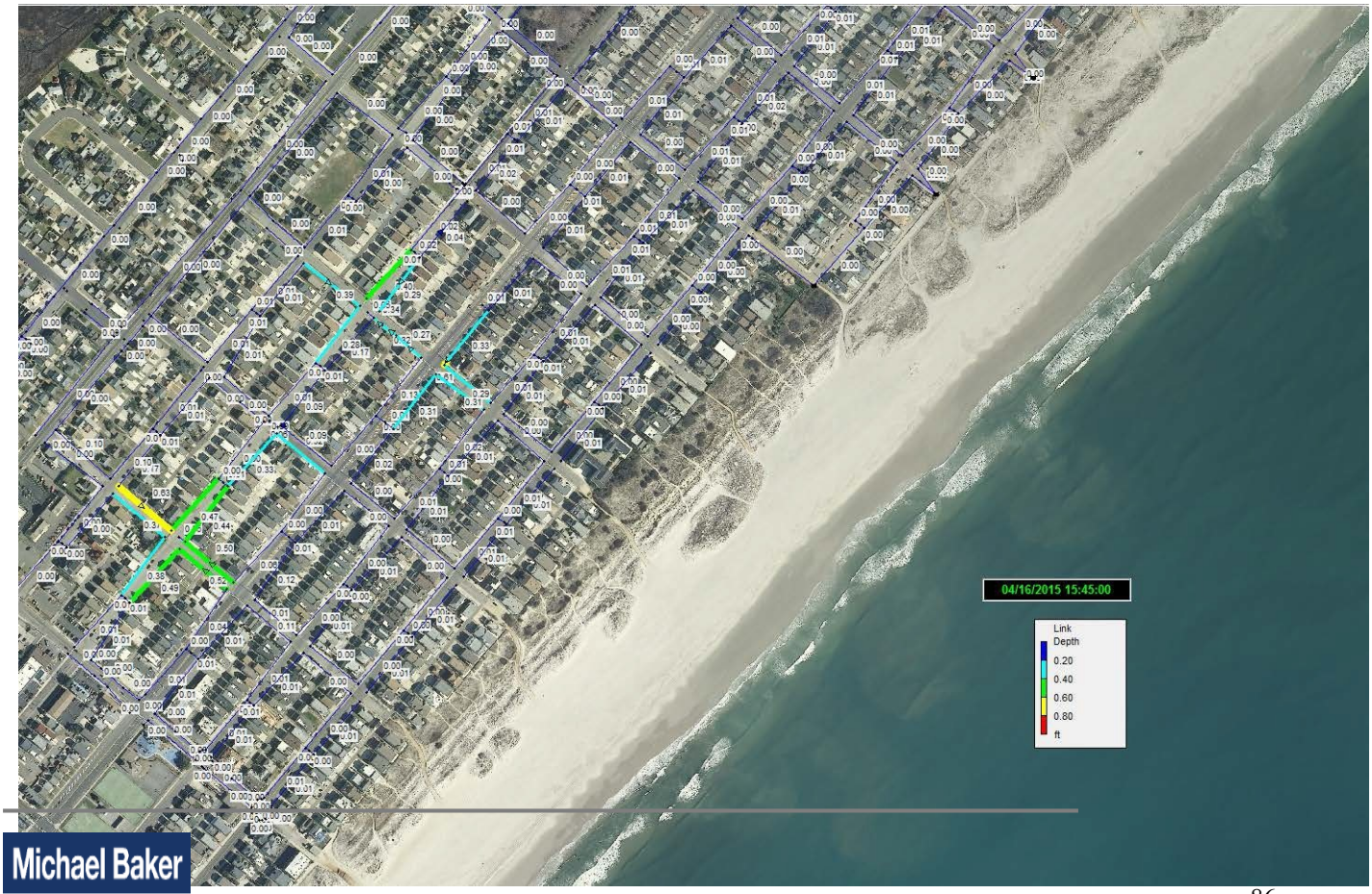
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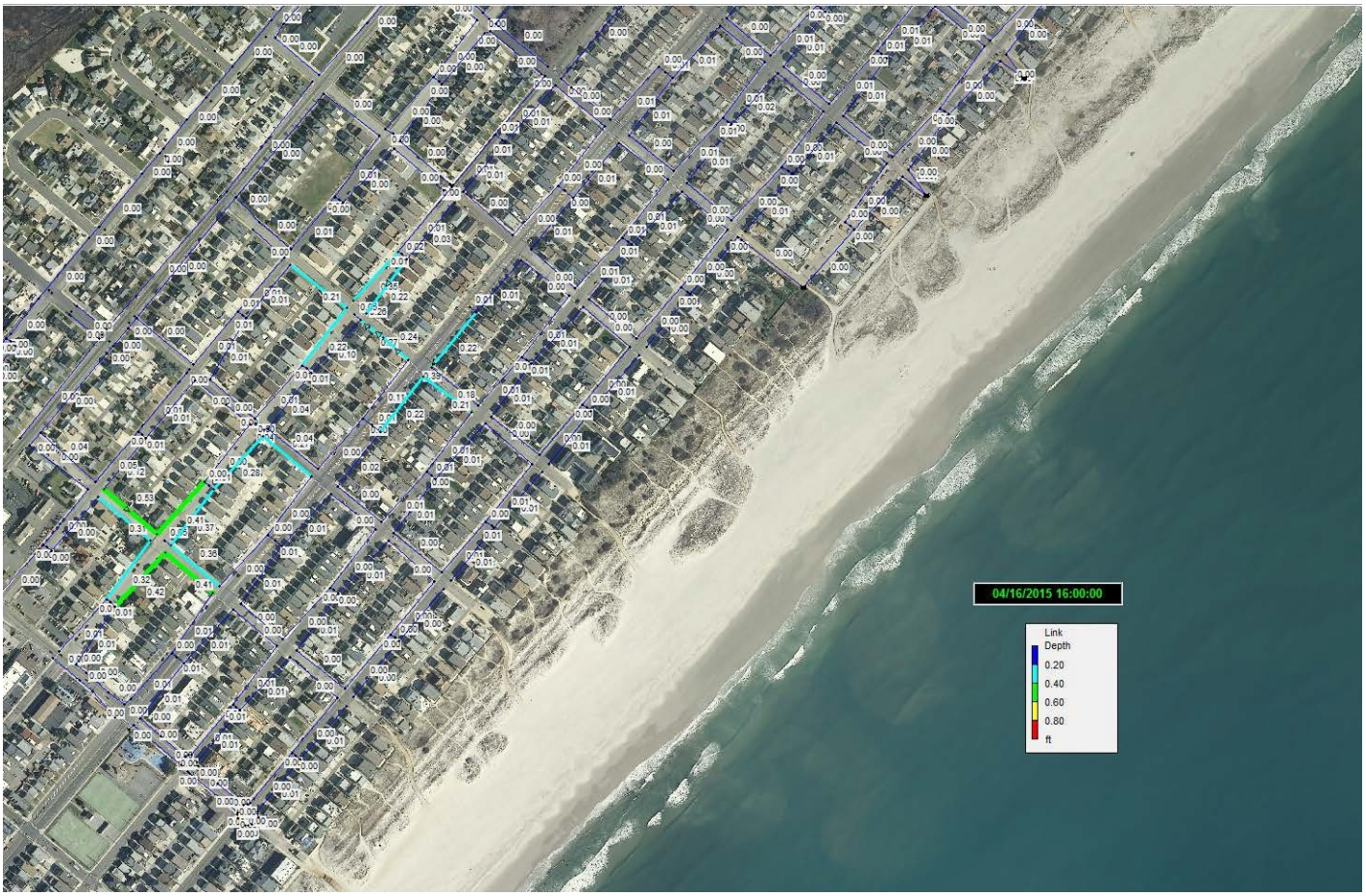
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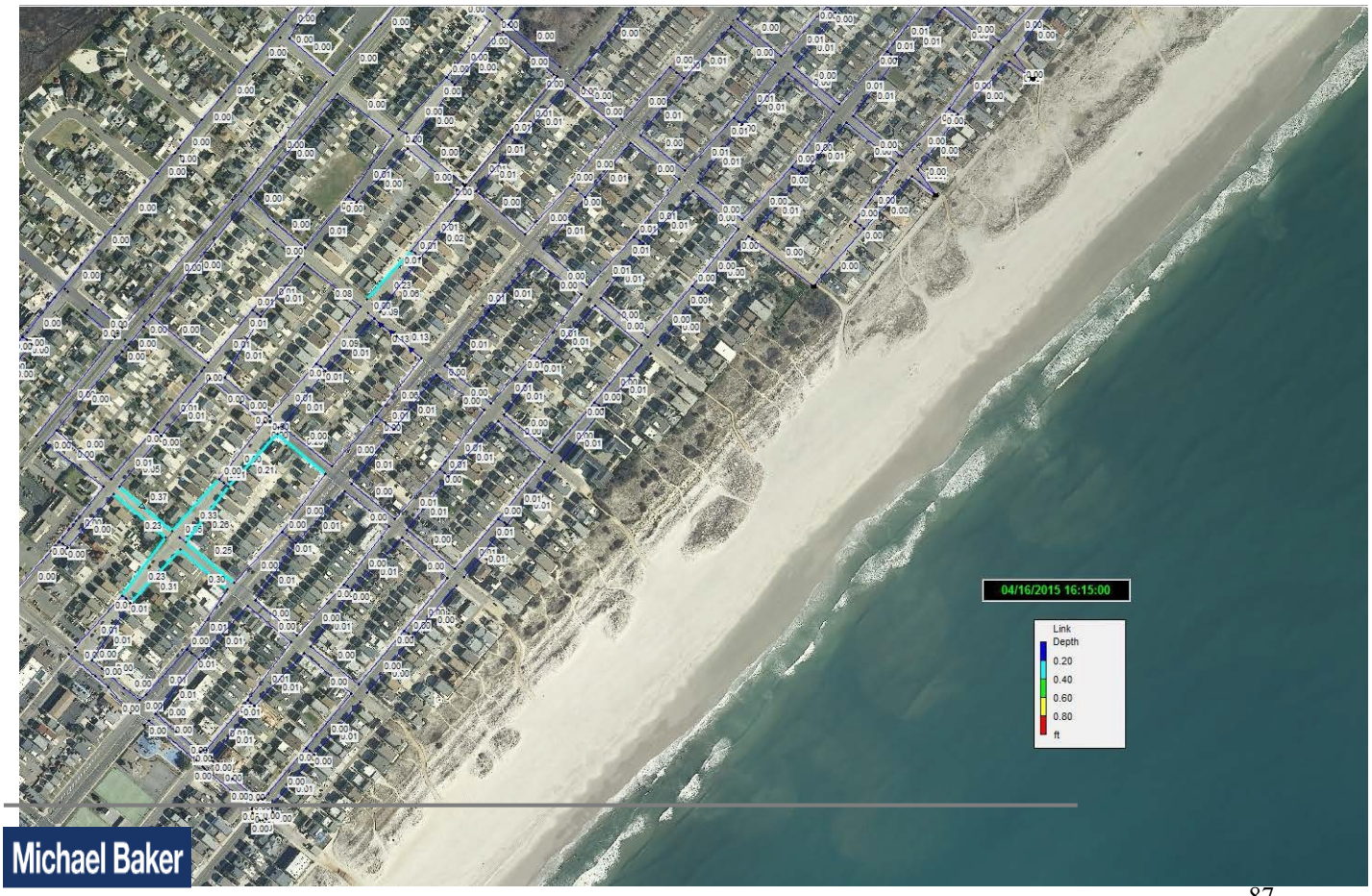
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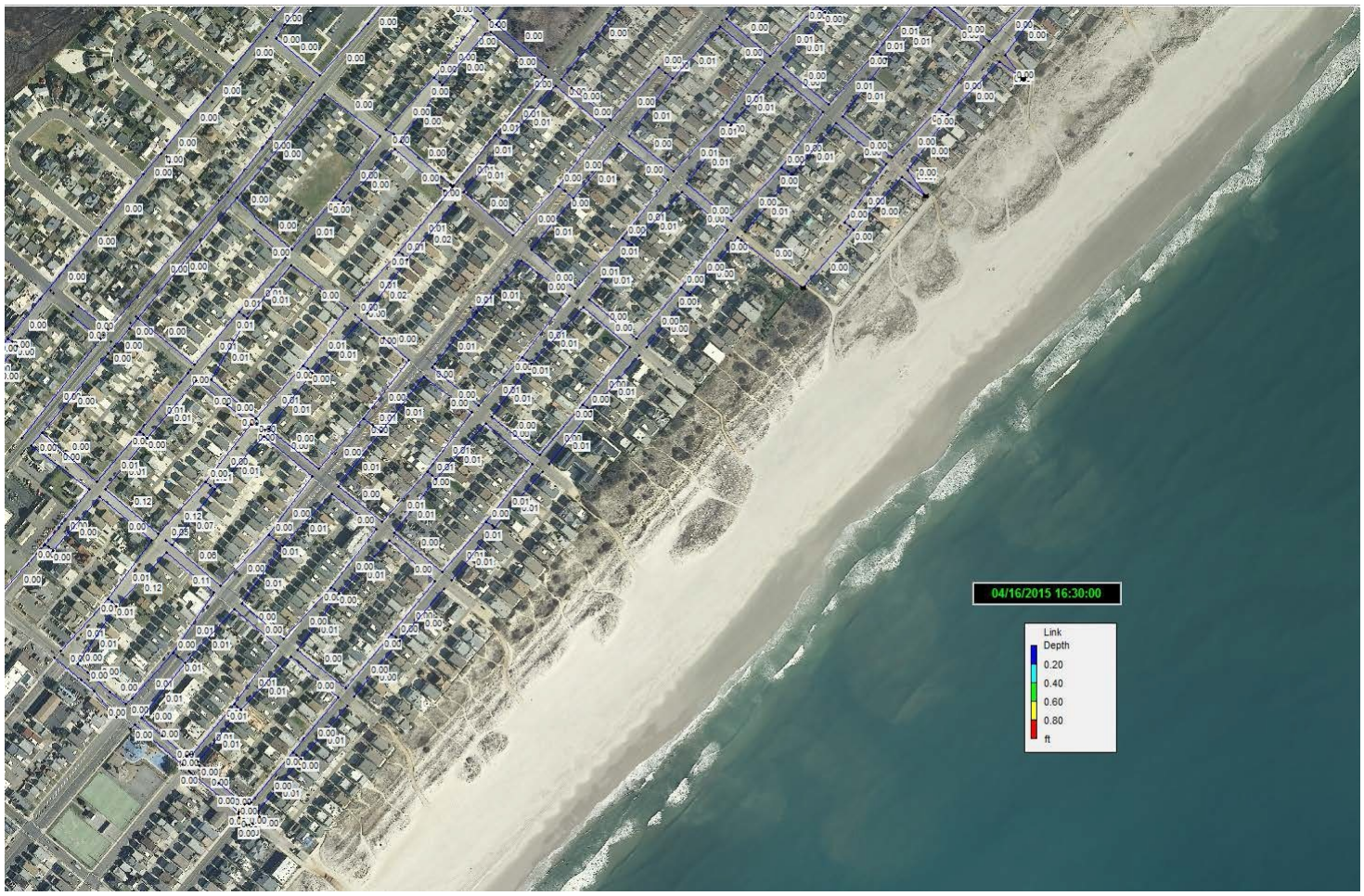
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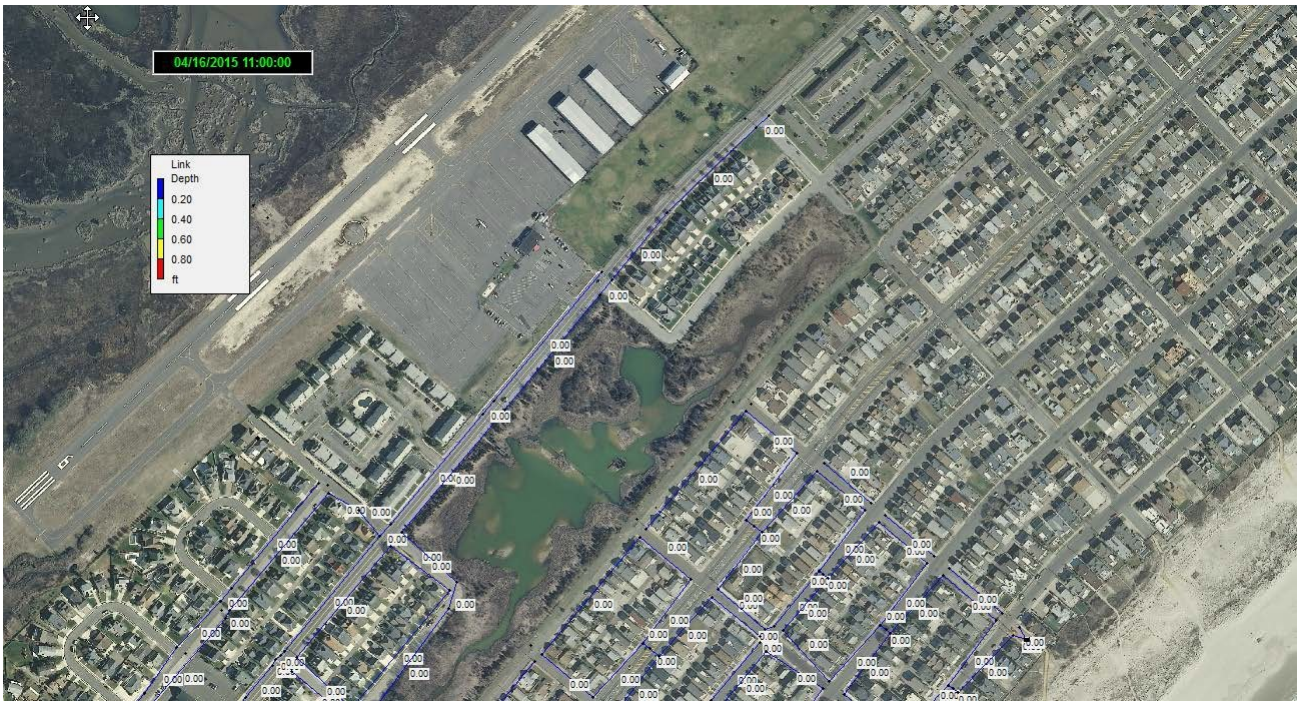
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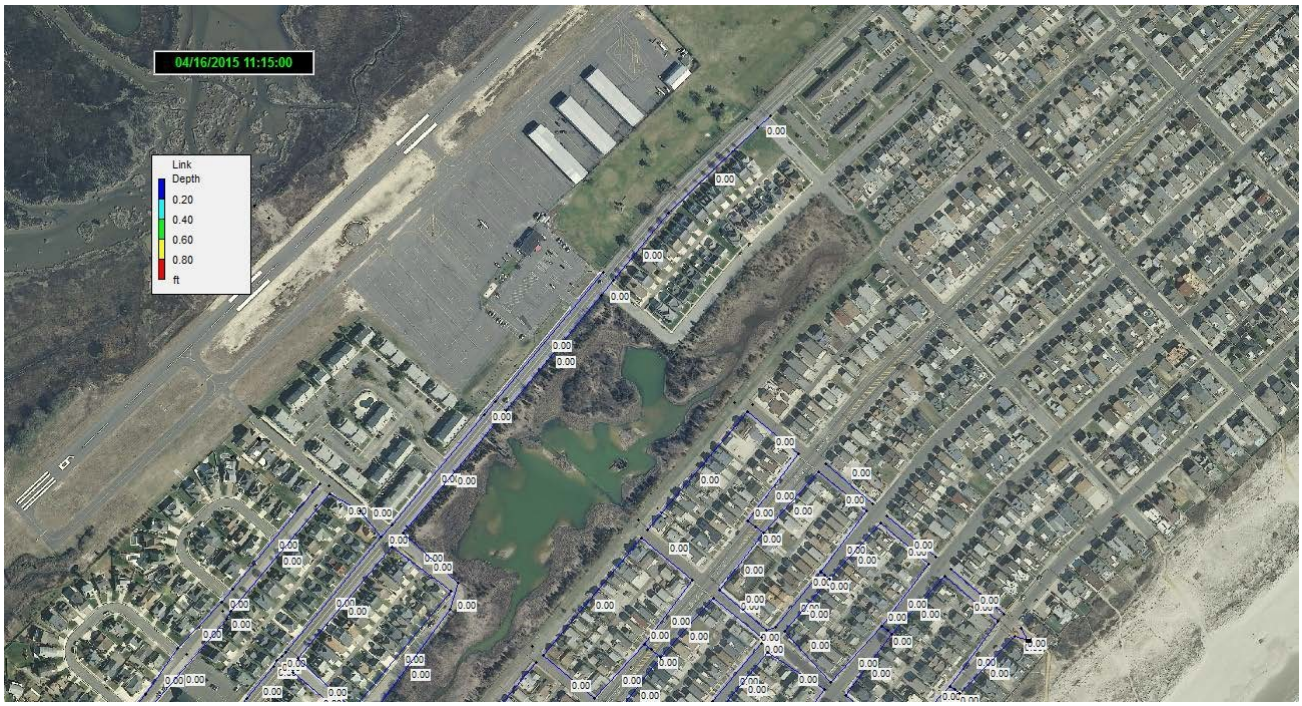
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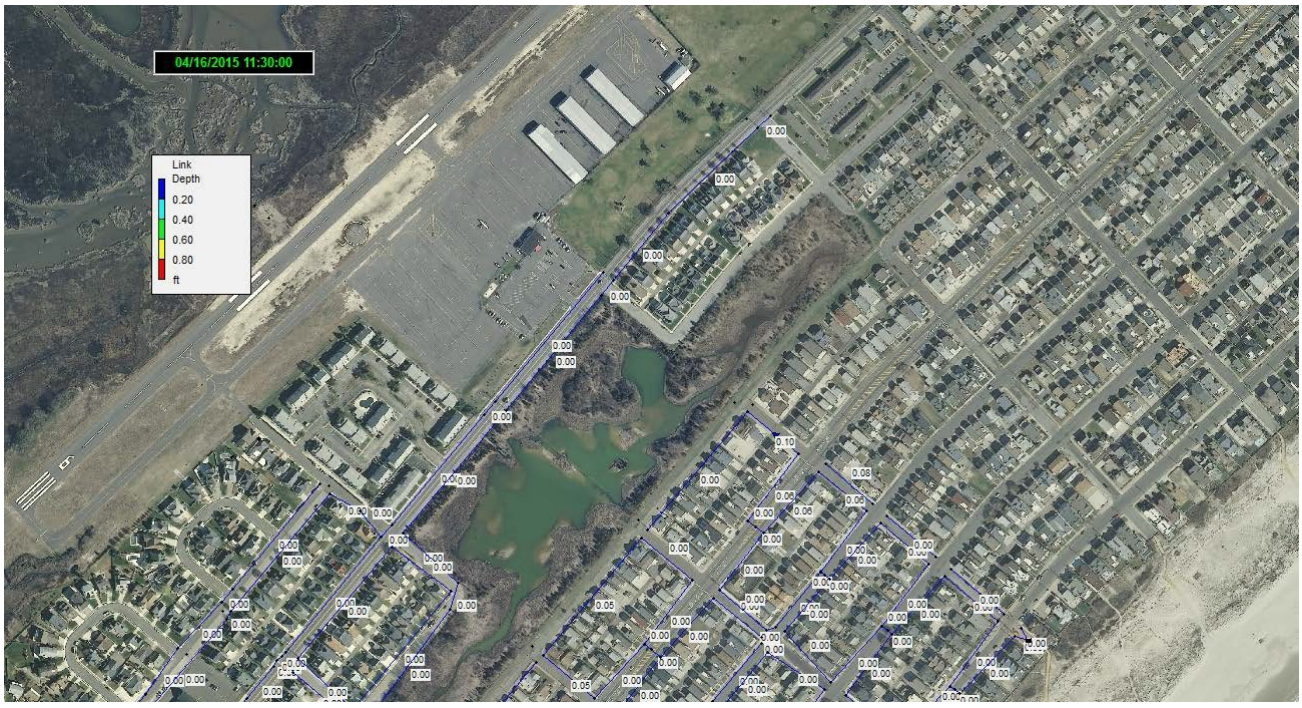
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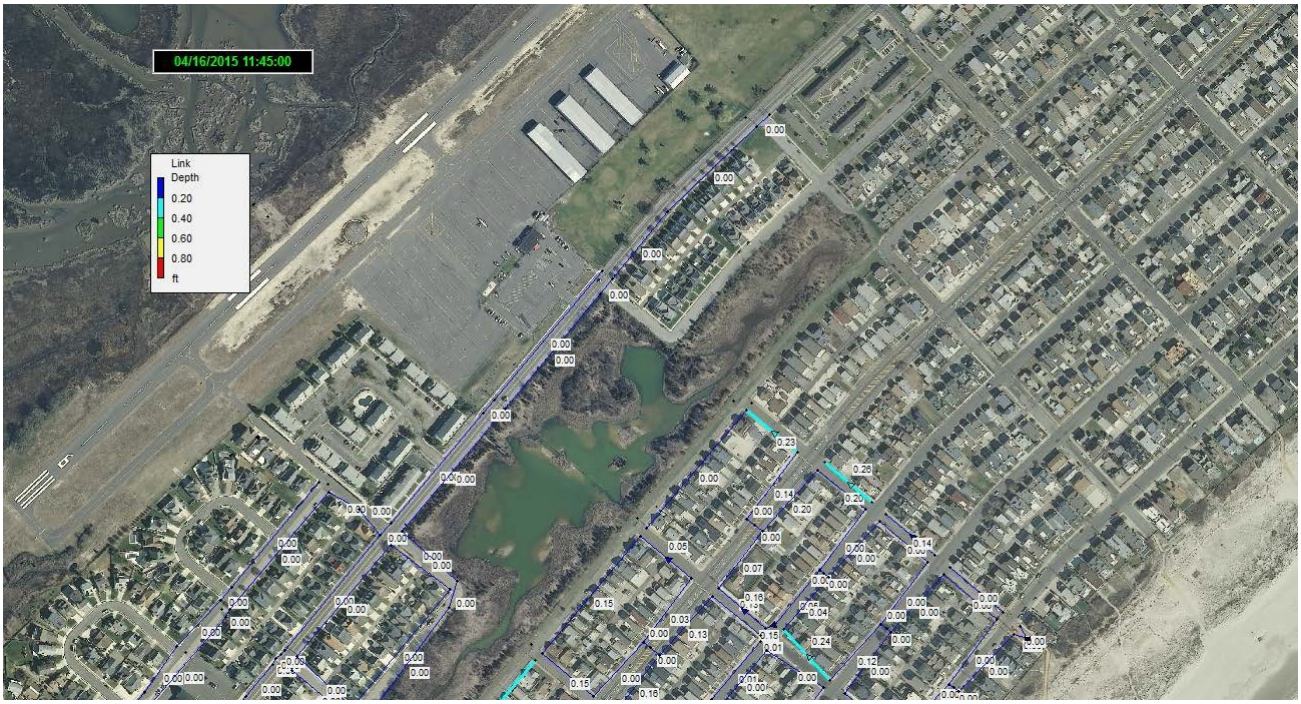
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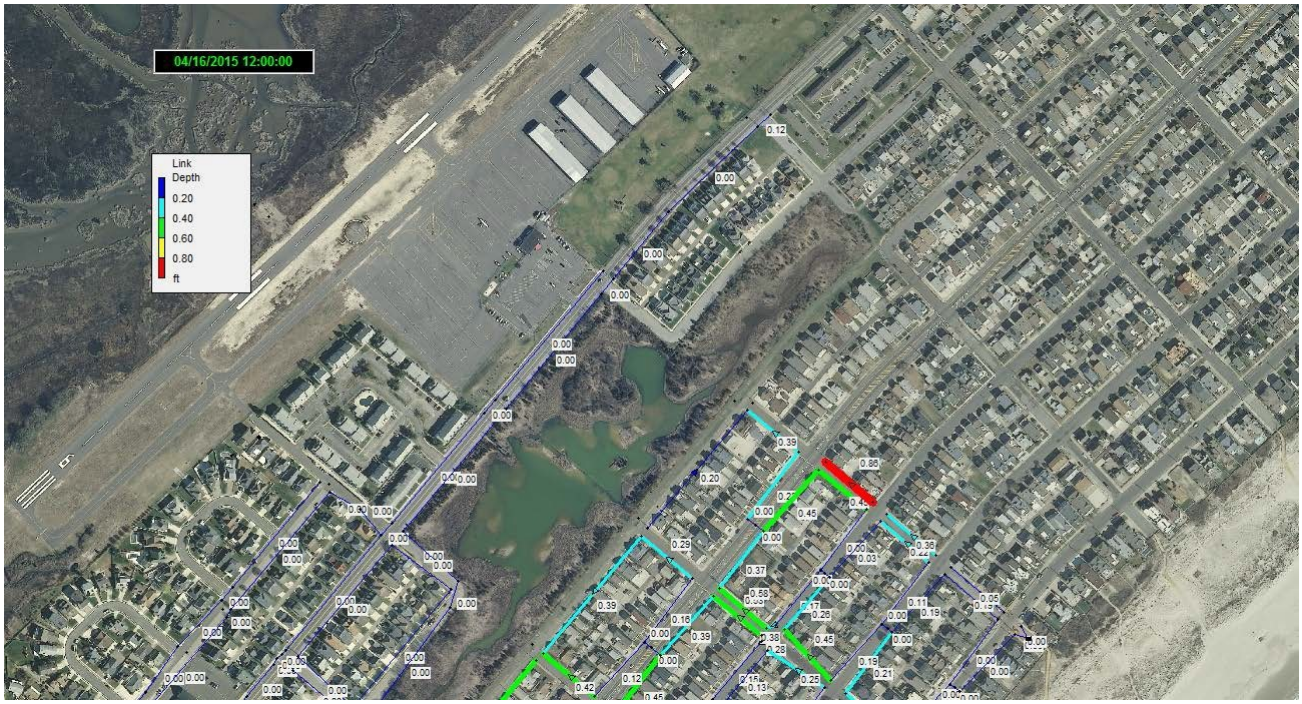
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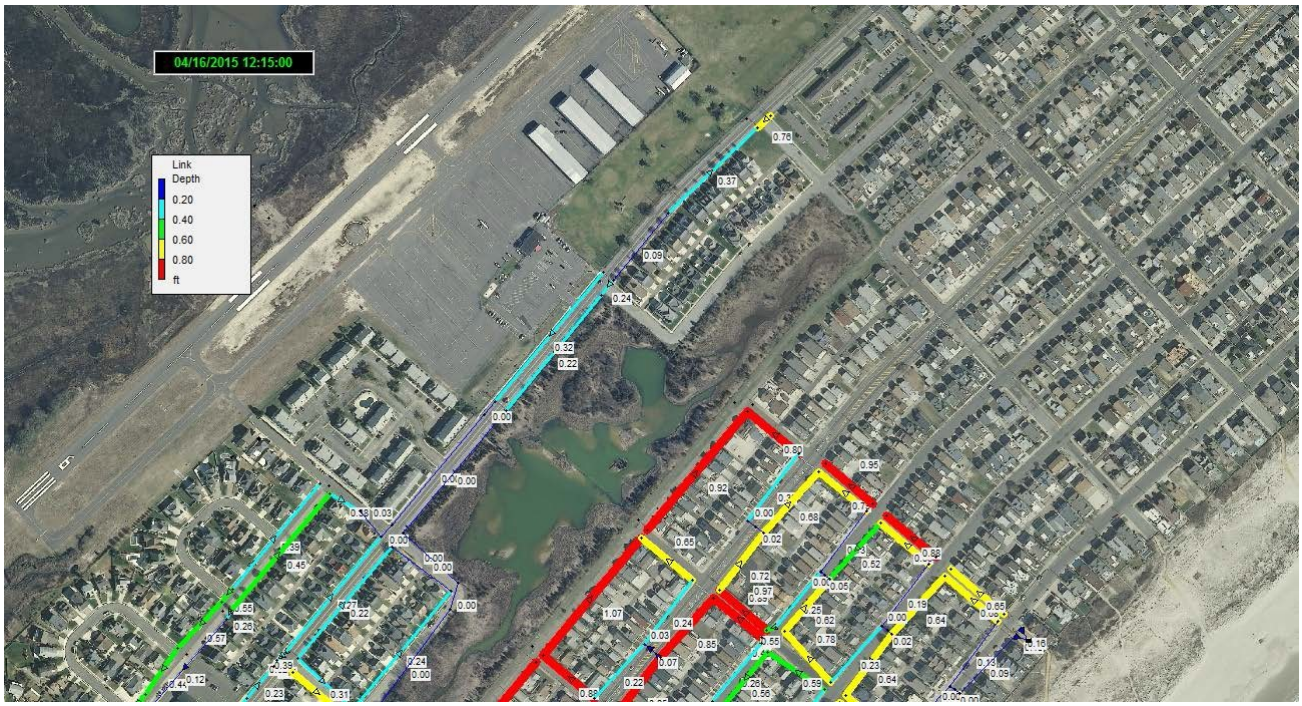
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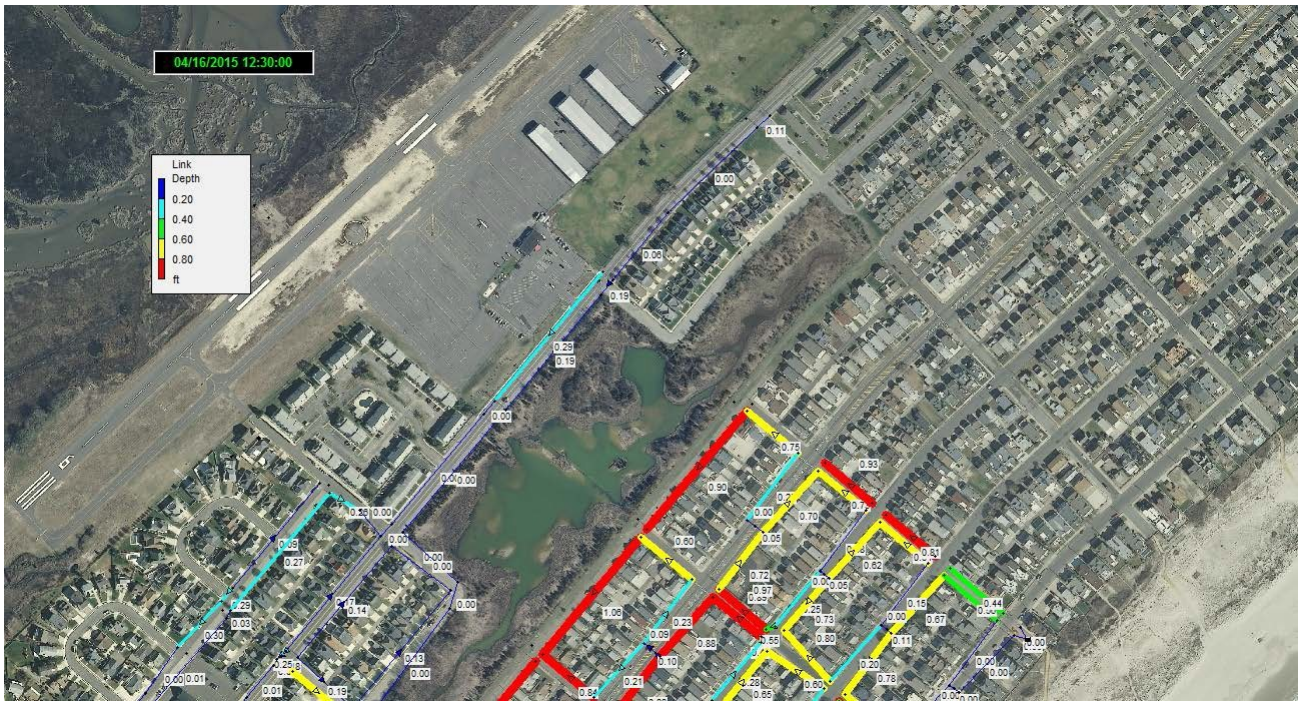
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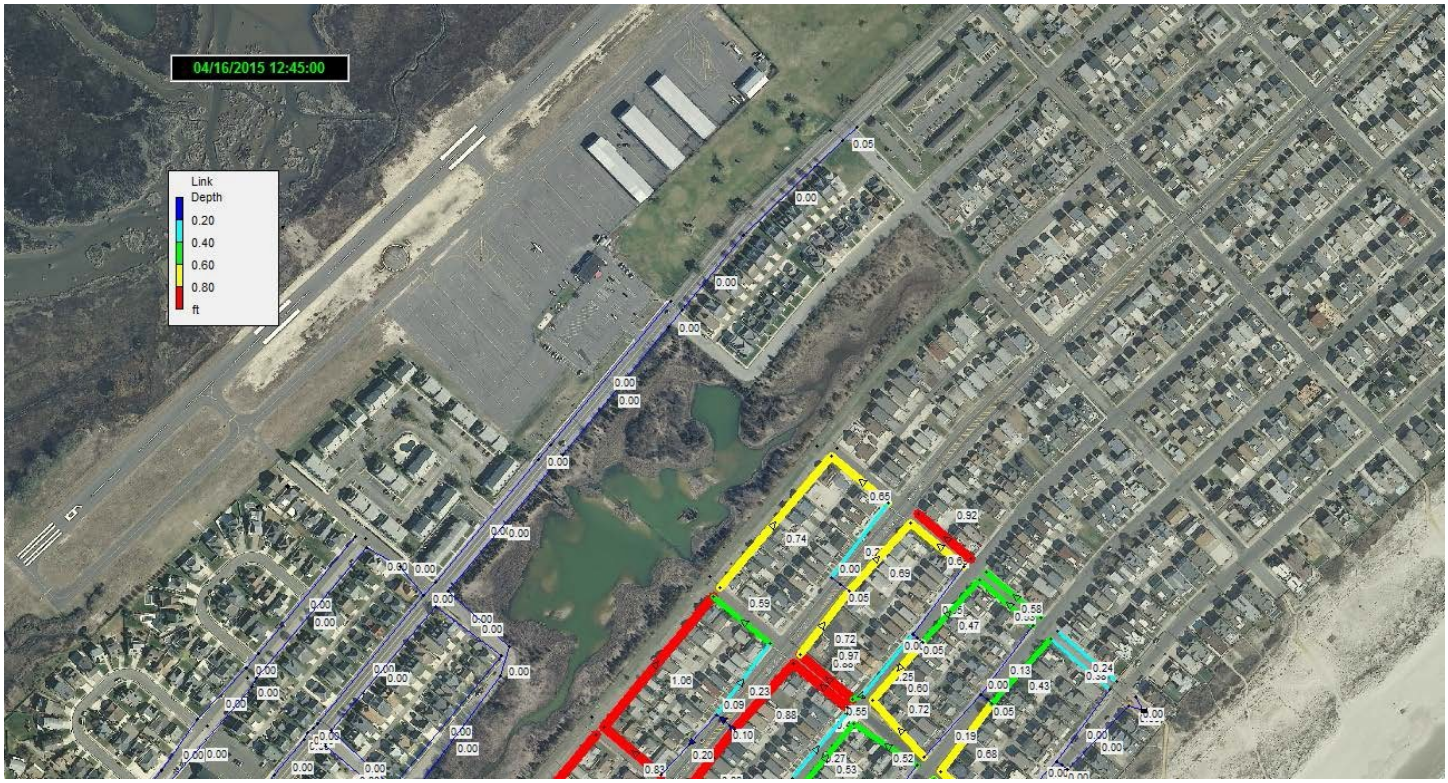
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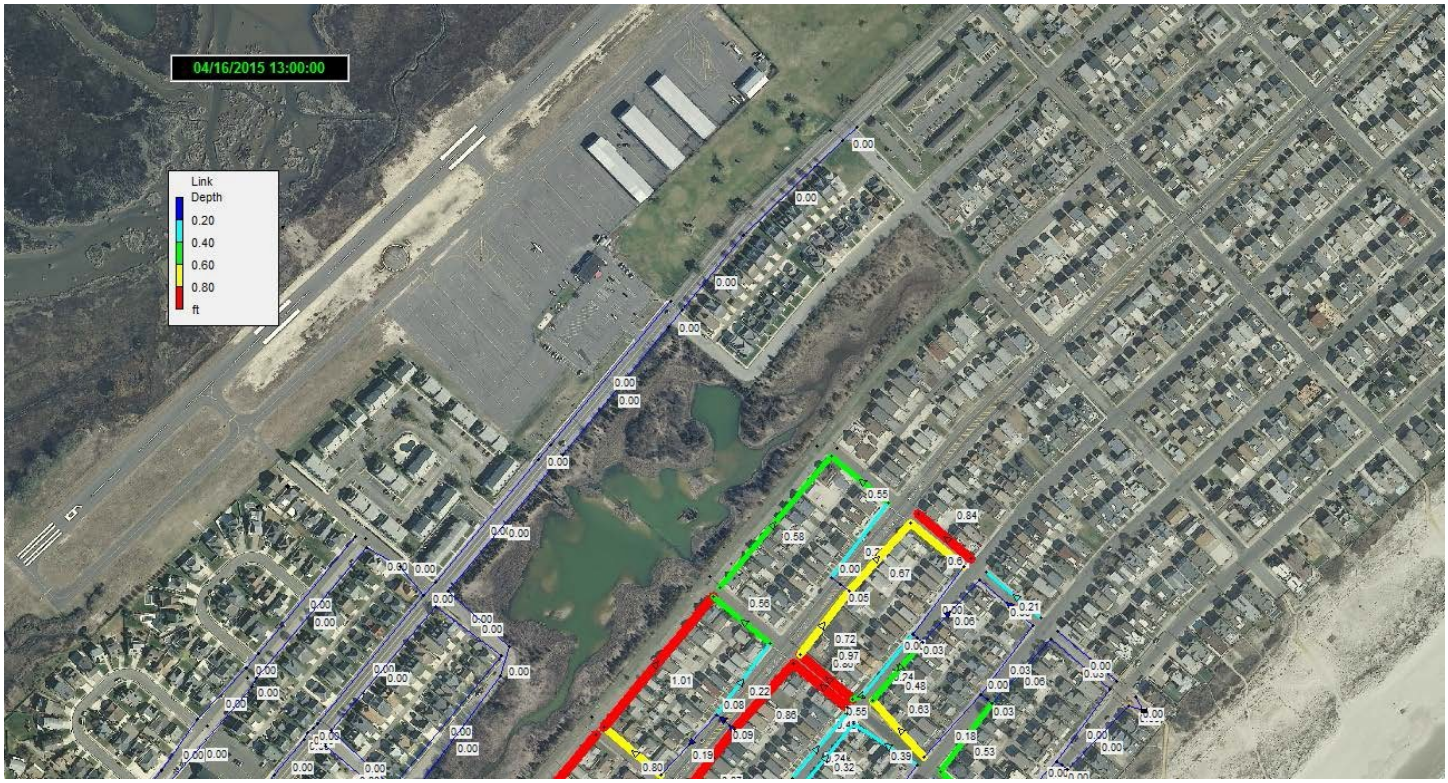
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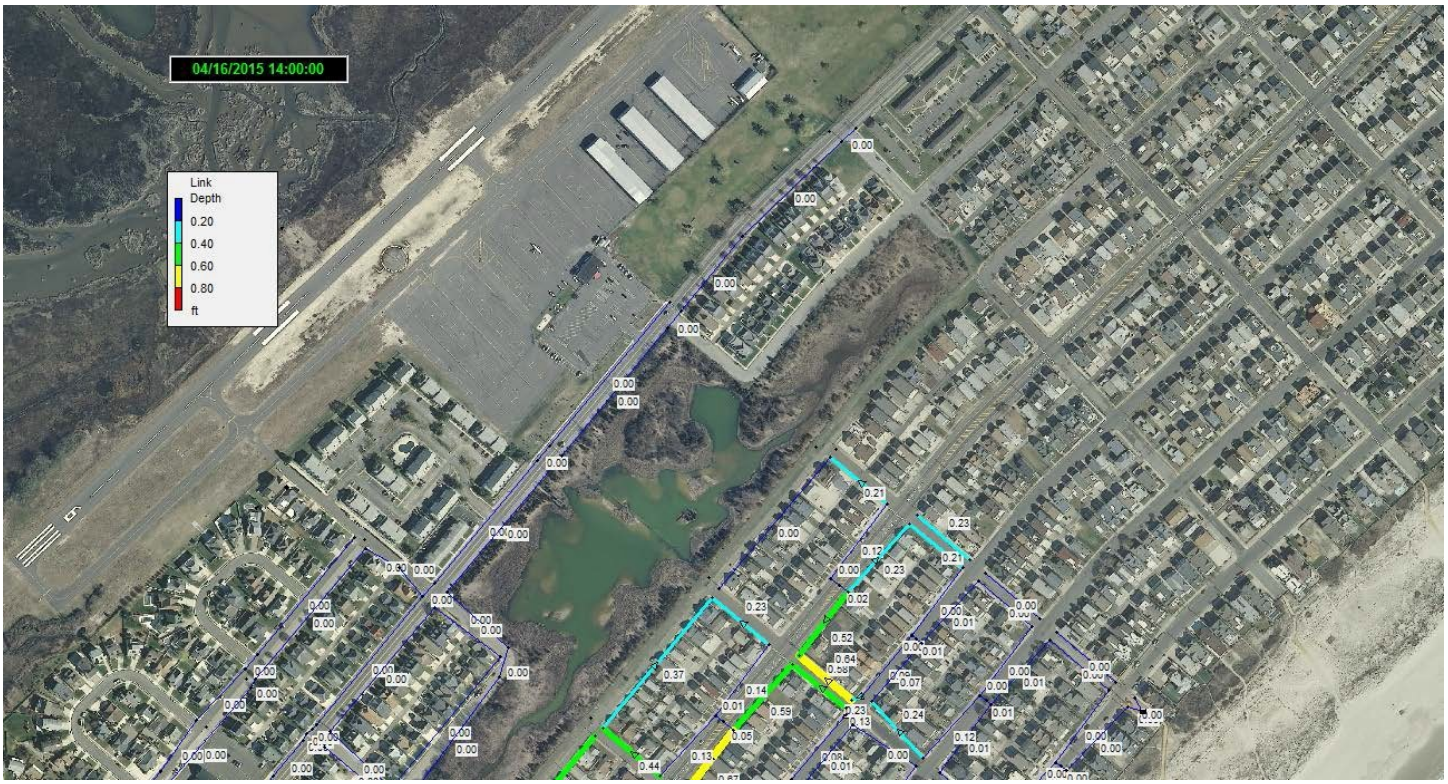
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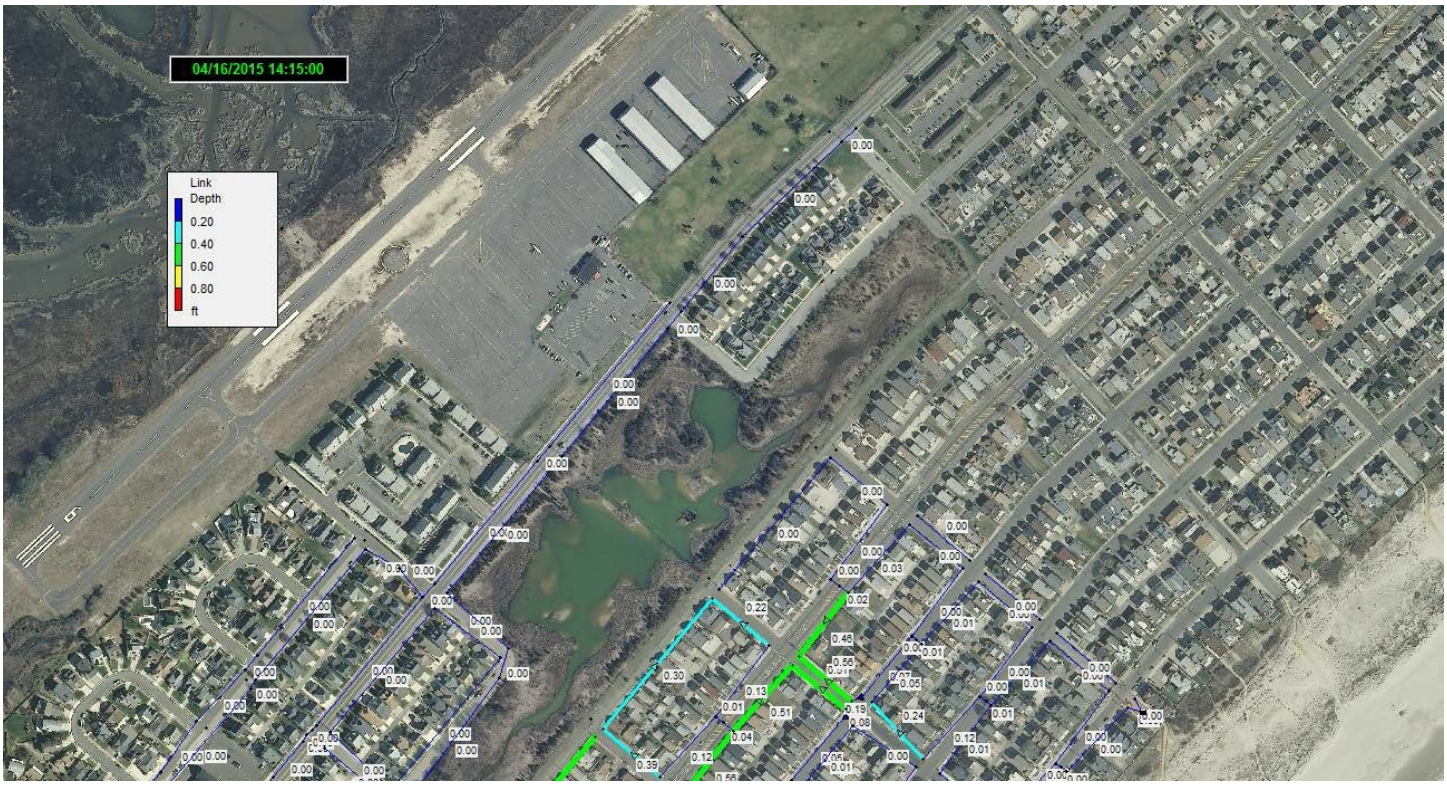
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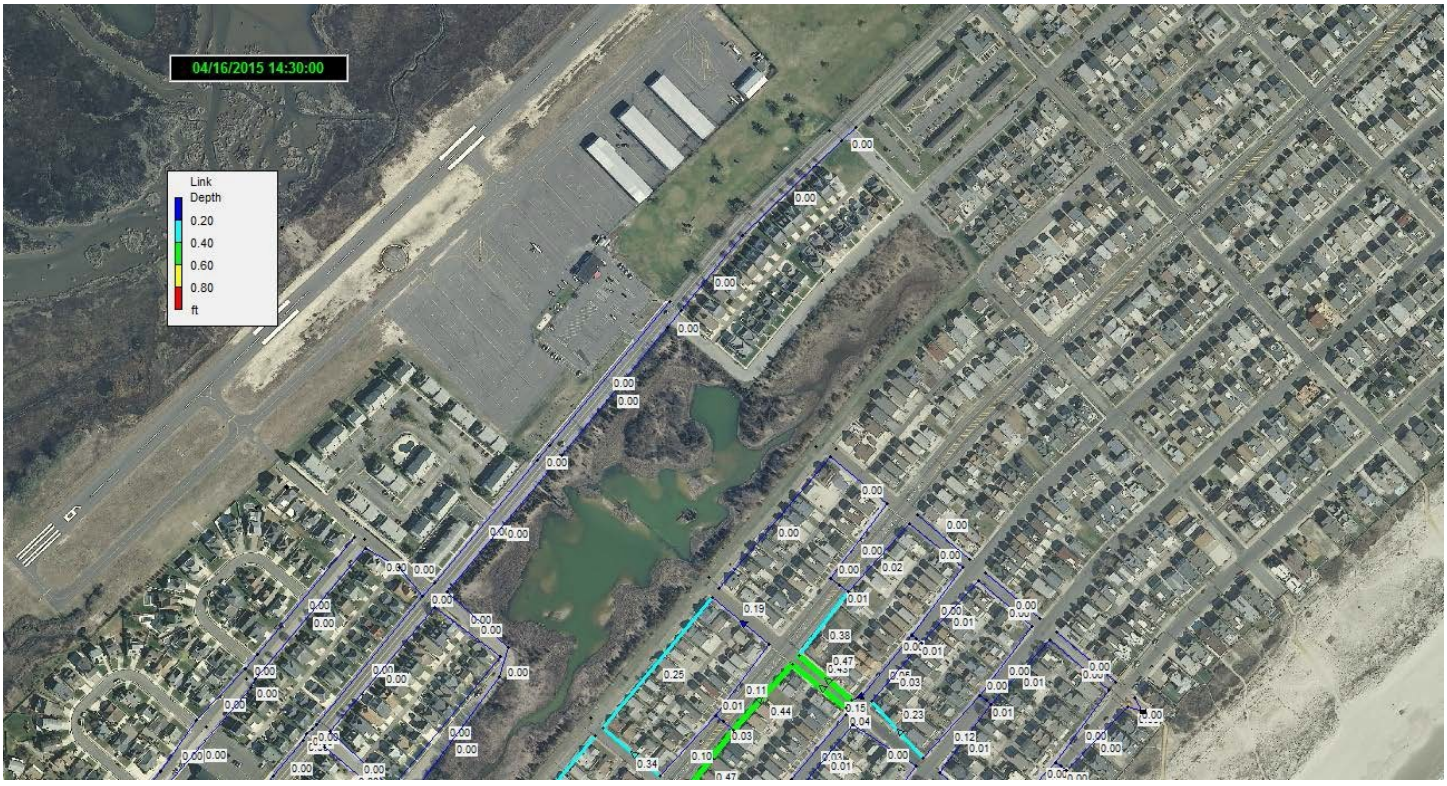
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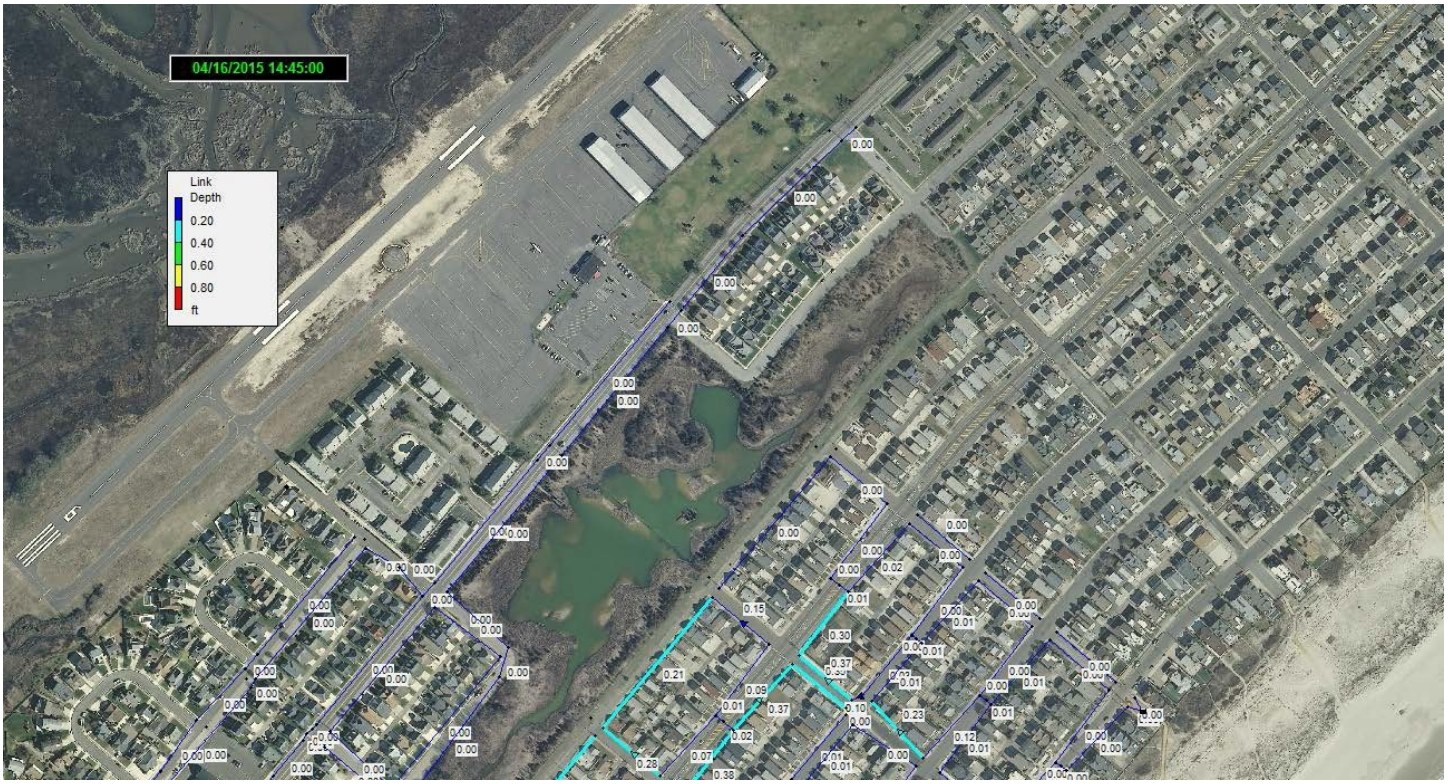
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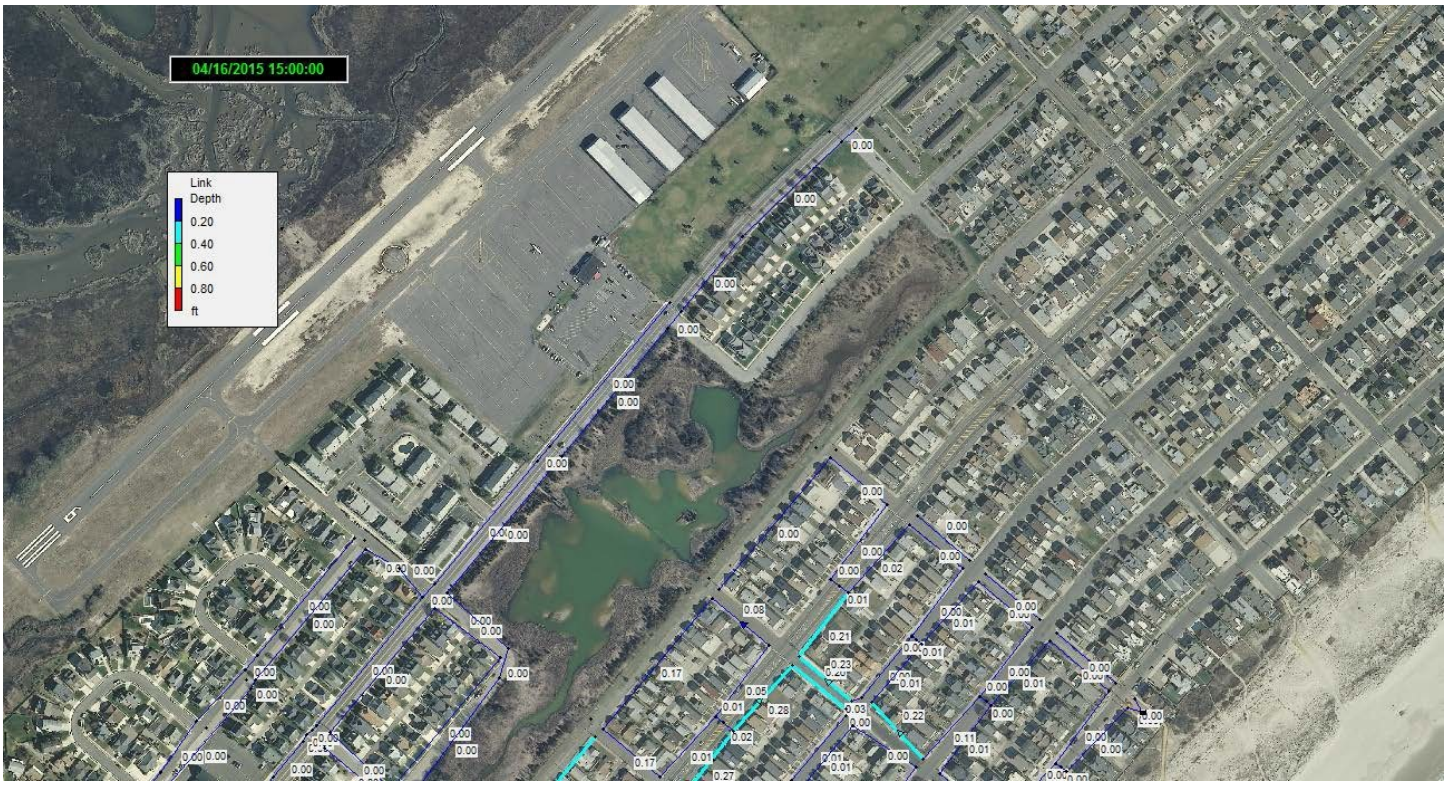
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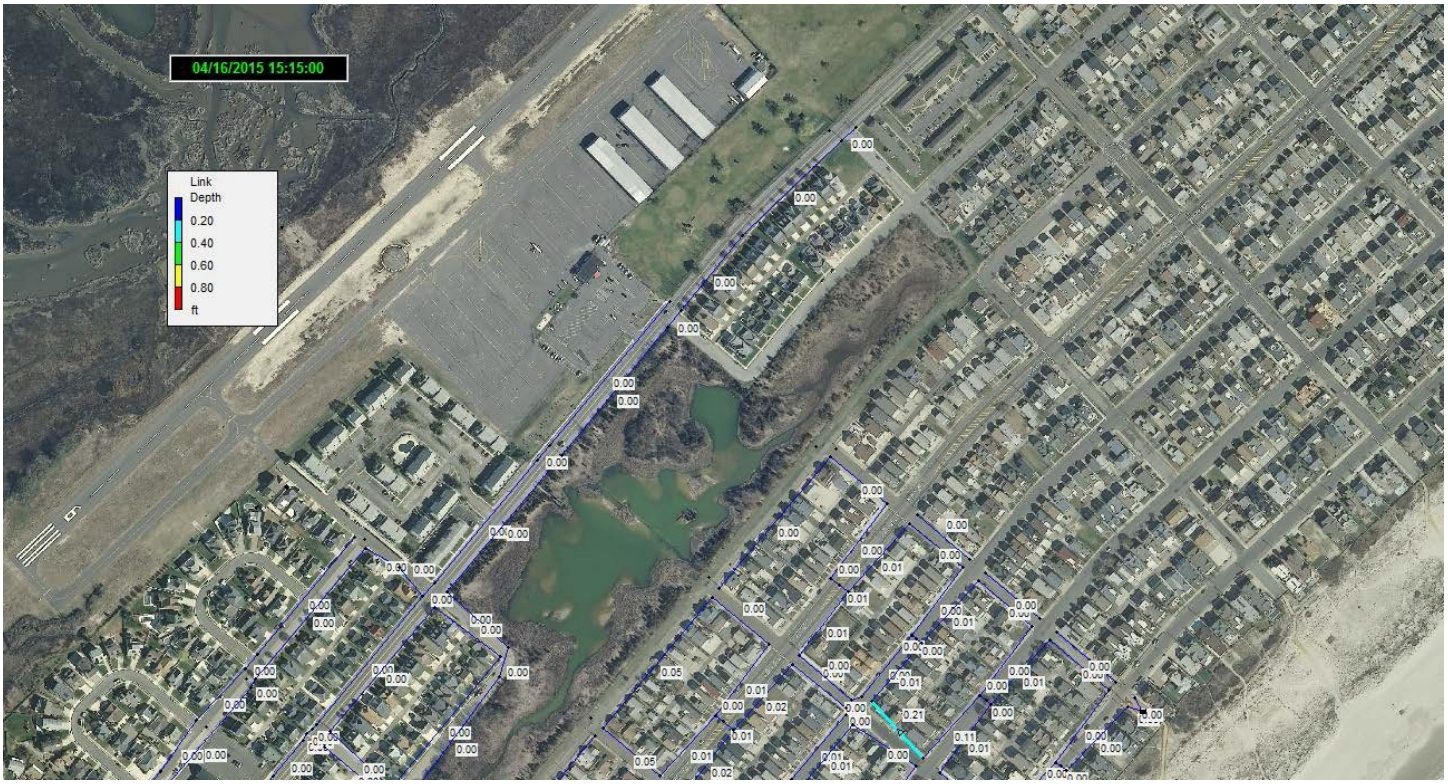
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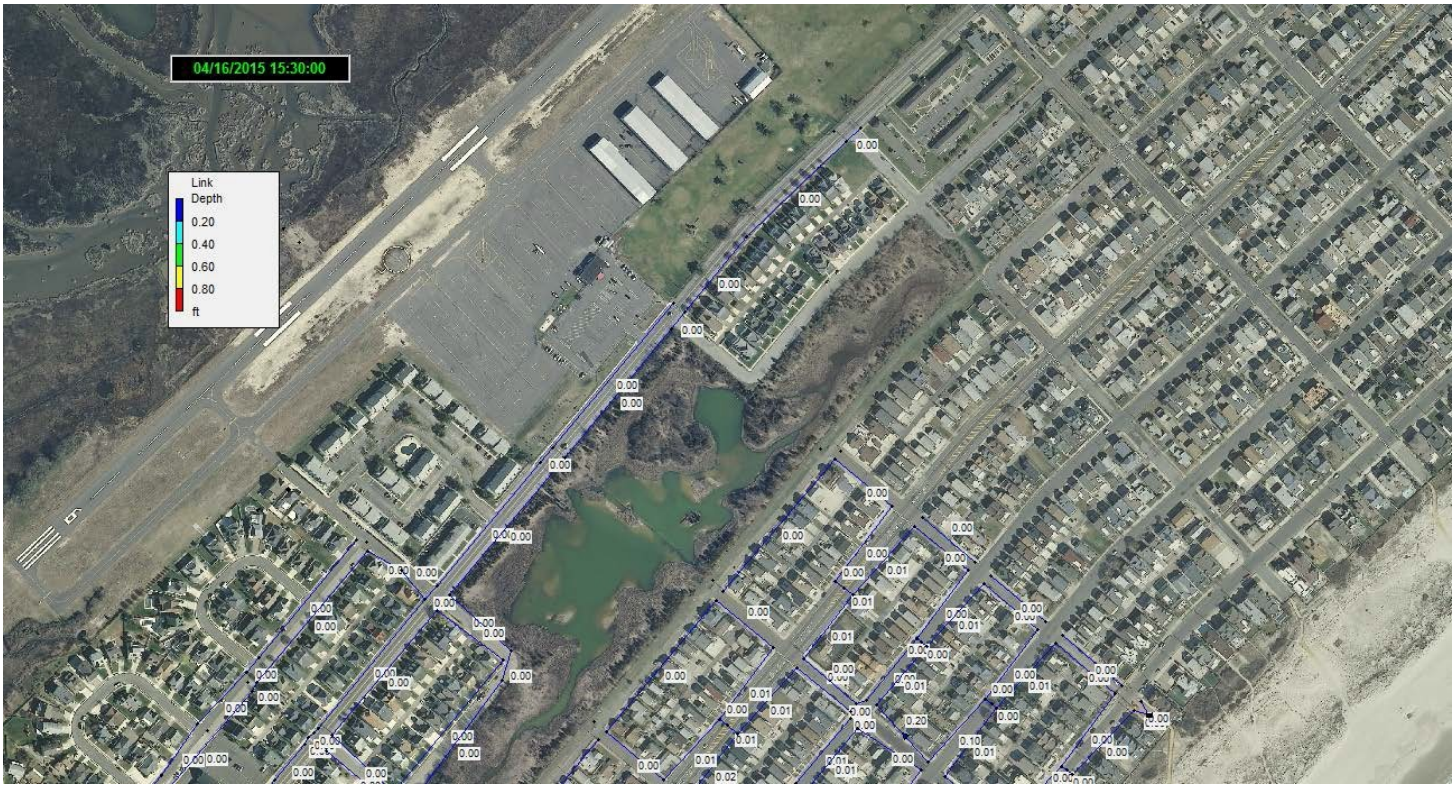
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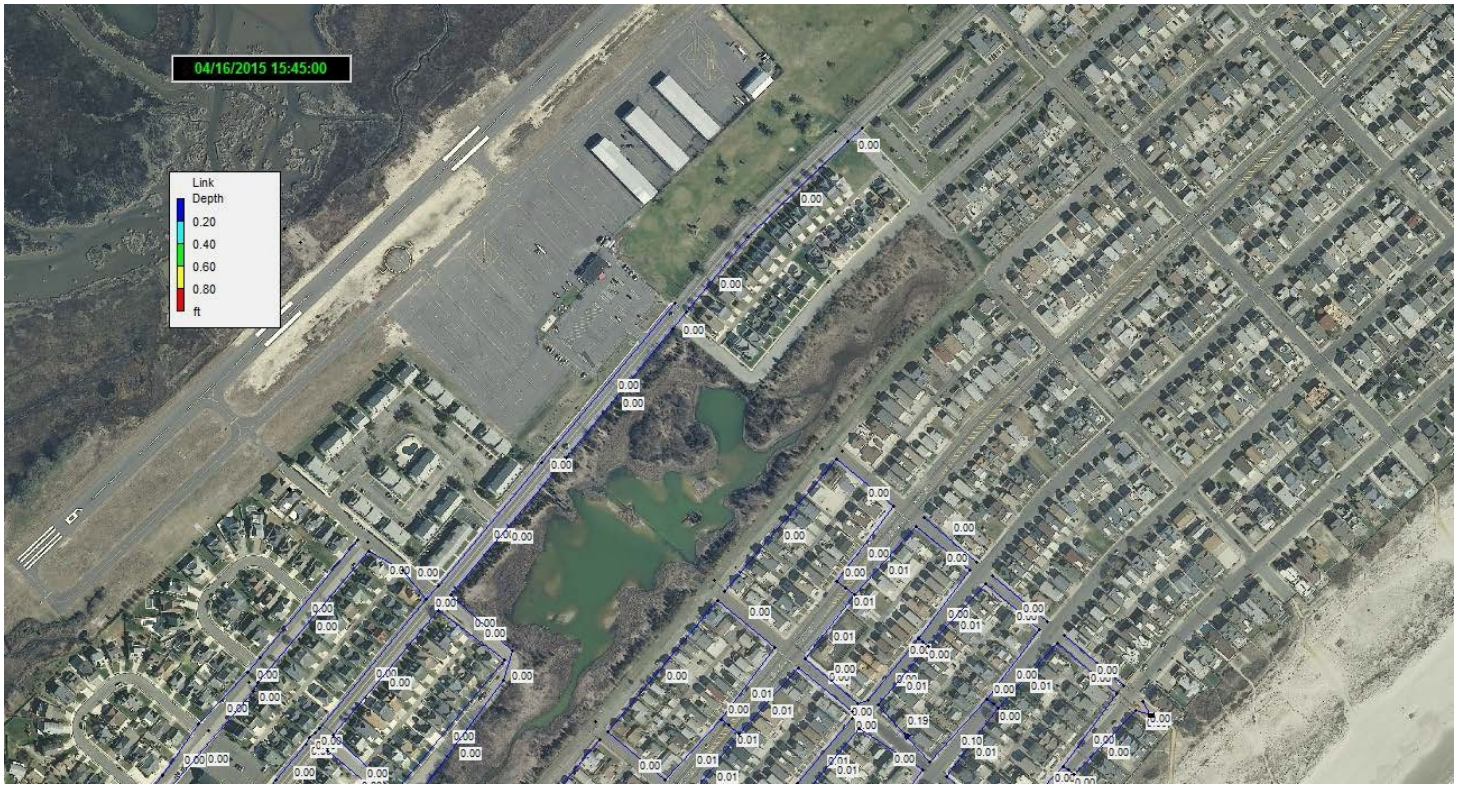
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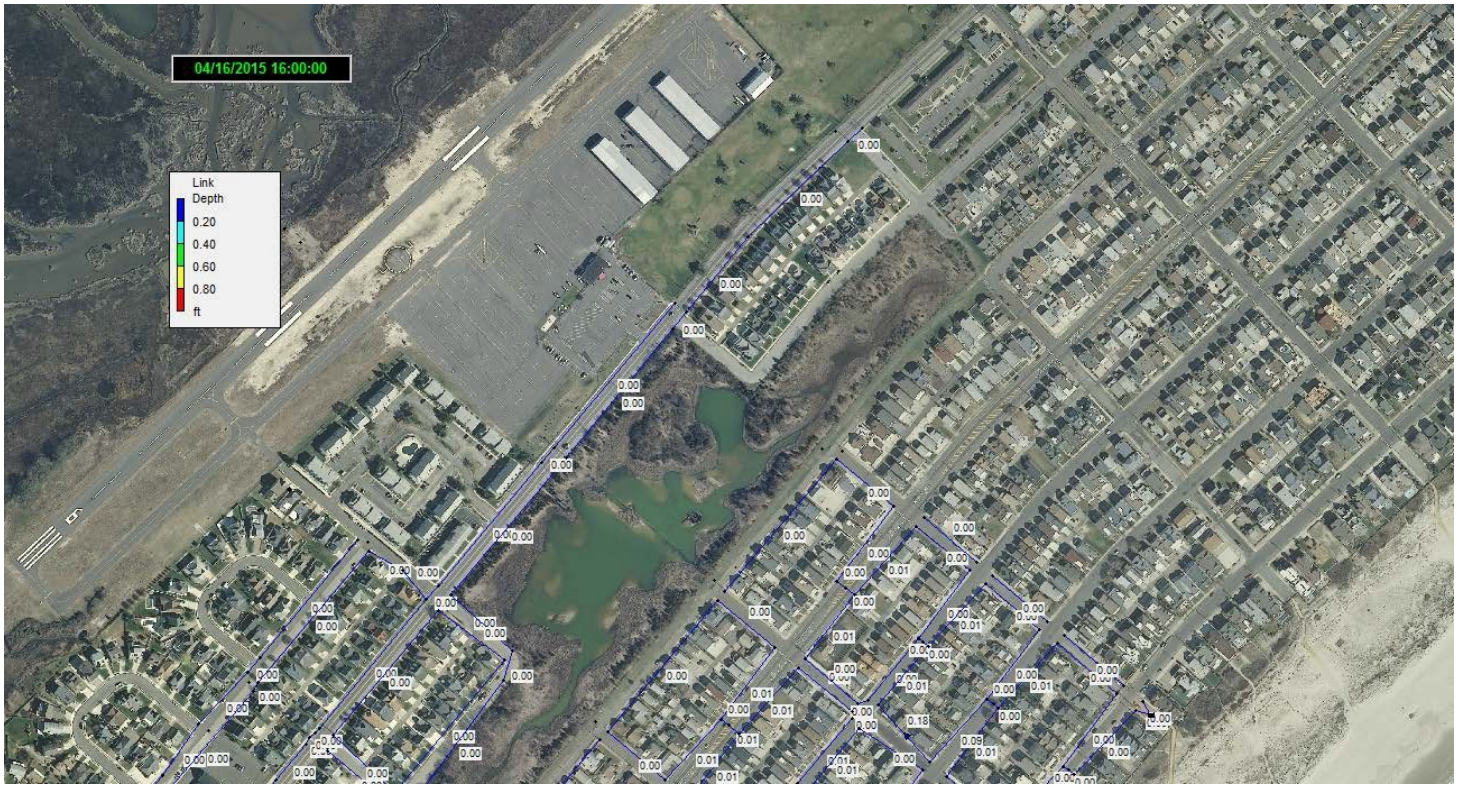
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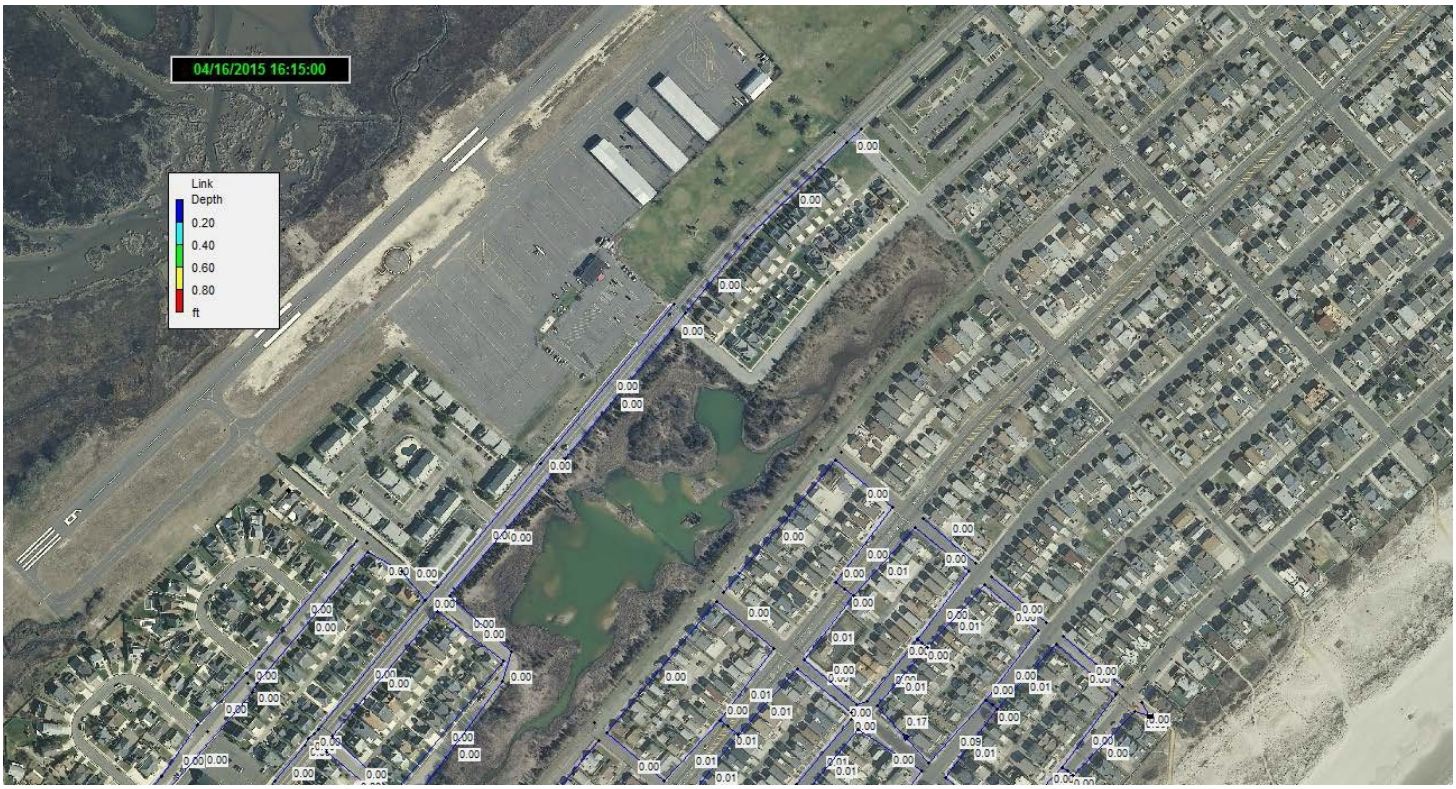
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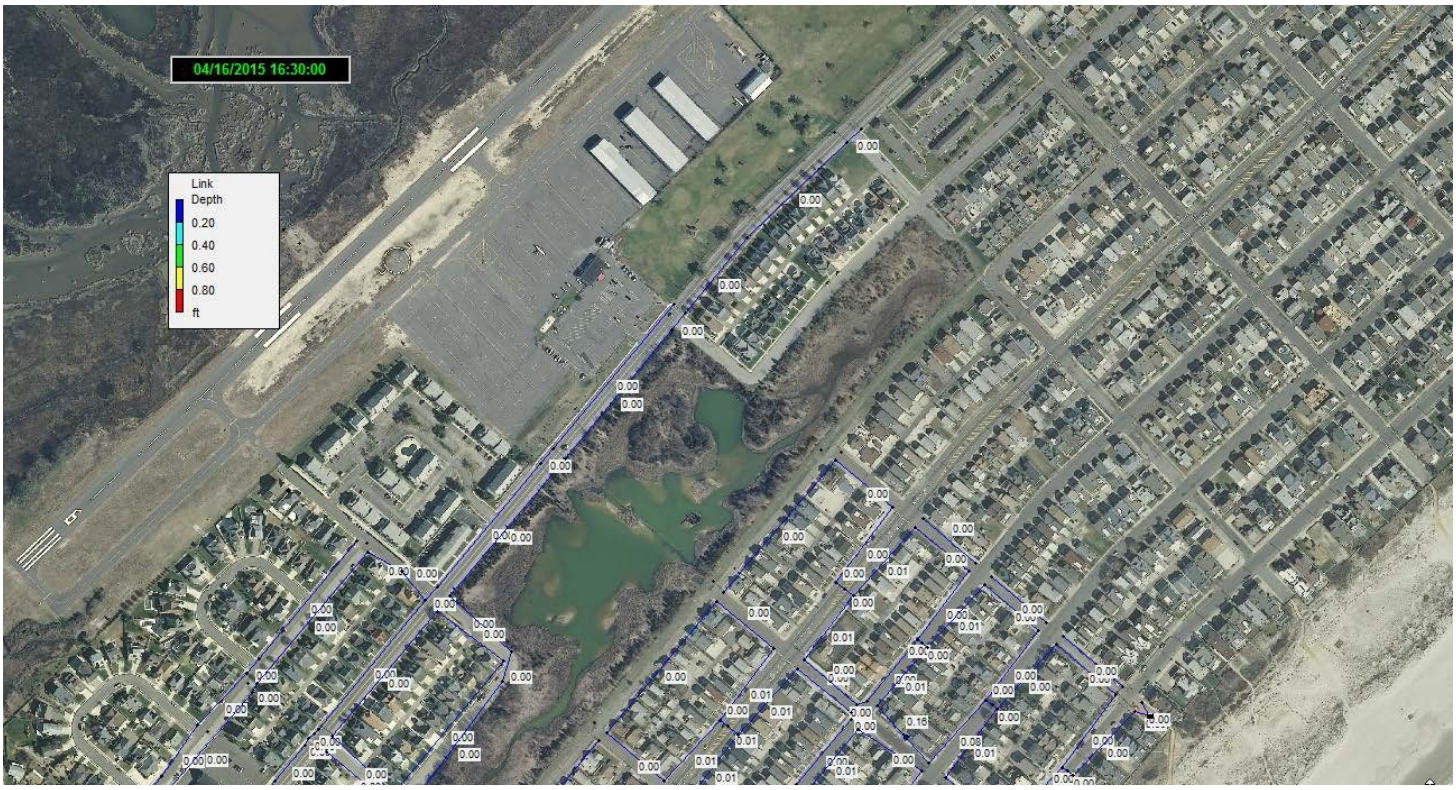
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