

Technical Memorandum

Roadway and Stormwater Structures Data Collection

*Monroe County Roadway Vulnerability Analysis and
Capital Plan*

Monroe County, Florida

June 1, 2020

Prepared for Monroe County



HR wood.

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Purpose of Memo

This memo provides a summary of the existing available roadway and stormwater infrastructure information provided by the County, and lists specific geotechnical, roadway, utility, and stormwater data as well as data coverage and specific infrastructure locations. All received and collected data has been included in the project GIS database.

Project Intent and Description

As part of the Monroe County (County) Roadway Vulnerability Analysis and Capital project, the roadways maintained by the County will be evaluated in order to develop a long-term roads adaptation plan based on design criteria, Sea Level Rise (SLR) projections, adaptation methodology, policy/financing evaluation, and public/stakeholder outreach. The primary objective of the project is to analyze the impacts of current and projected levels of SLR on all County maintained roads and develop an implementation plan and timeline to adapt roads for SLR. The results will be used to determine new policy considerations and design criteria for what acceptable levels of service should be.

Available County Data

The first step in data collection consists of requesting all existing data from the County, including but not limited to as-built plans, GIS layers, and any reports and studies. The purpose of collecting and analyzing this data is to document the existing County infrastructure and facilities, its current conditions, in order to properly assess impacts as the roadways and access to facilities become affected. **Table 1** summarizes the information and format in which the data was received. All Geodatabase files has been included in the comprehensive GIS database being used to for this study.

Roadway and Stormwater Structures Data Collection

County Data	Type
Roadway, Right of Way and Facilities	
Right of Way	Geodatabase File
Parcels	Geodatabase File
Easements	Geodatabase File
Shoreline	Geodatabase File
Subdivisions	Geodatabase File
Roadway Centerlines	Geodatabase File
Critical and Essential Facilities	Geodatabase File
Land Use	Geodatabase File
Future Land Use	Geodatabase File
Parks	Geodatabase File
Public Lands	Geodatabase File
Drainage	
Catch Basins	Geodatabase File
Injection Wells	Geodatabase File
Manholes	Geodatabase File
Outfalls	Geodatabase File
Trench Drains	Geodatabase File
Key West Drainage Lines	Geodatabase File
Key West Drainage Structures	Geodatabase File
Species and Habitats	
Land Cover Habitat	Geodatabase File
Cape Sable Thoroughwort	Geodatabase File
Caretta Caretta (Loggerhead Sea Turtle) Habitat	Geodatabase File
Sea Turtle Nests	Geodatabase File
Cotton Mouse	Geodatabase File
Eastern Indigo Snake	Geodatabase File
Key Deer	Geodatabase File
Marsh Rabbit	Geodatabase File
Schaus' swallowtail	Geodatabase File
Silver Rice Rat	Geodatabase File
Silver Rice Rat Critical Habitat	Geodatabase File
Cactus	Geodatabase File
Snails	Geodatabase File
Woodrat	Geodatabase File

Table 1. Data Provided by Monroe County

Furthermore, this existing data, as well as new data to be collected will be used in the Vulnerability Assessment and Prioritization part of the study. This data will be translated into a complete list of criteria and be given criticality values. This assessment will help identify the most critical vulnerable areas that will benefit from being prioritized when implementing improvements and mitigation strategies. A complete description of this process will be presented in the Technical Memorandum *Prioritization of Roadway Segments based on Vulnerability Assessment*.

The County commissioned Michael Baker International (MBI) to conduct mobile Light Detection and Ranging (LiDAR) elevation, surveying and mapping services of the County roadway network for the area within the right of way, and County facilities. This high definition data was provided by the County for use in this study, and was assessed by our team for accuracy as outlined in the Technical Memorandum *Monroe County Mobile LiDAR Vertical Accuracy Assessment – Road Elevation Data and Finished Floor Elevations (FFE)s*. **Figures 1** and **2** show LiDAR data superimposed on Monroe County aerial imagery. Additionally, lower resolution LiDAR data was obtained from an available public source to supplement the MBI LiDAR data for areas outside of the right of way, **Figure 3** shows this additional data.

Roadway and Stormwater Structures Data Collection



Figure 1 – Key West and Stock Island Study Limits LiDAR Elevation Data

Plotted study limits and the color corresponds to existing roadway elevation ranges with purple being the highest to red being the lowest

Roadway and Stormwater Structures Data Collection

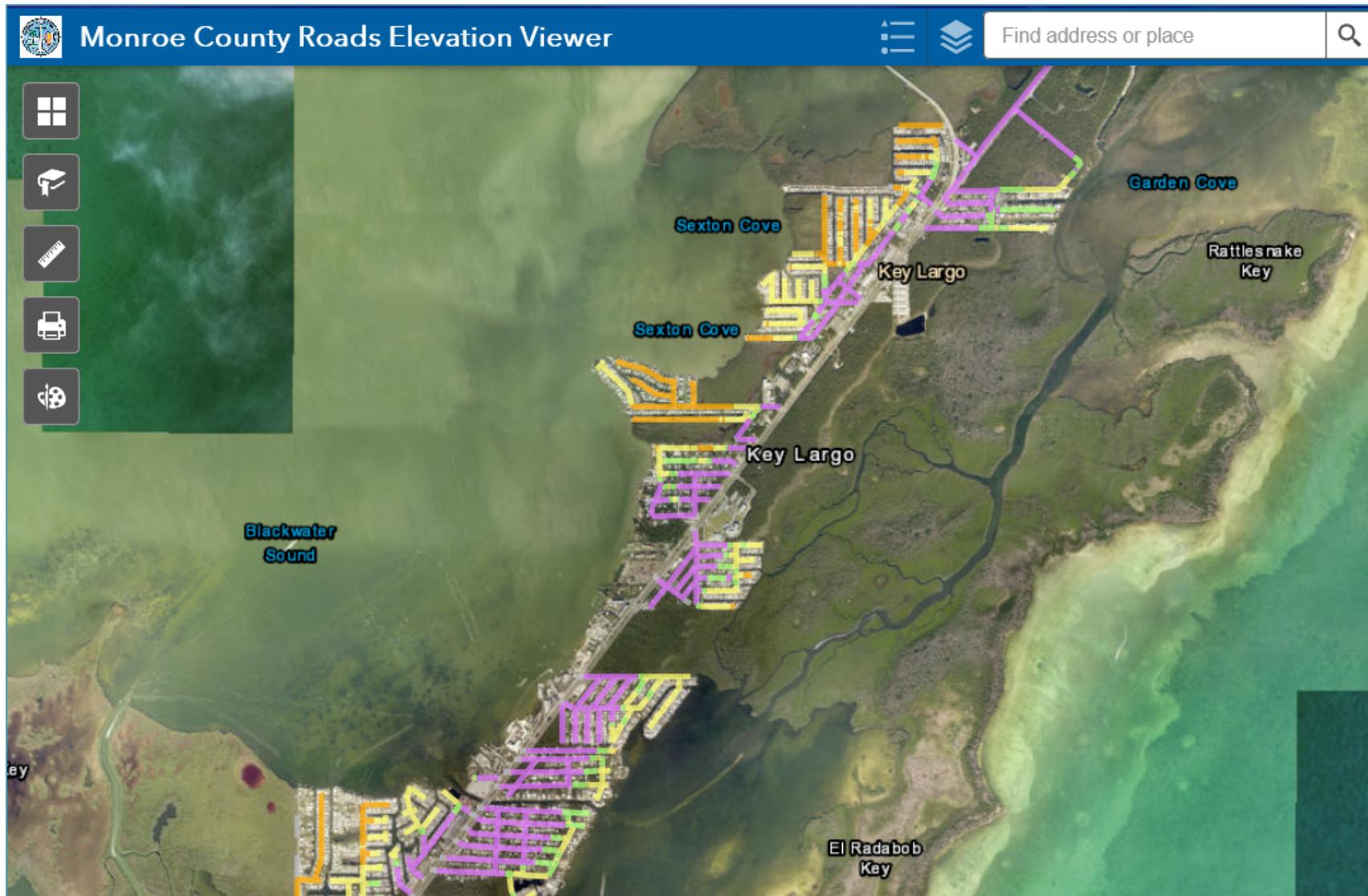


Figure 2 – Key Largo Study Limits LiDAR Elevation Data

Plotted study limits and the color corresponds to existing roadway elevation ranges with purple being the highest to red being the lowest

Roadway Data Collection and Related information

Most of the roadway data has been collected via a desktop review and supplemented by field data collection for areas where roadway characteristics could not be identified in any of the online sources used. Google maps and its street view capabilities, as well as GIS layers were used as resources in order to collect roadway characteristics and verify provided information, both of which were then stored in dedicated GIS maps developed for this study. Roadway characteristics, adjacent utilities, critical facilities, and important species and habitat related information has been categorized and included in the GIS maps to be used throughout the study, and delivered to the County for their records.

GIS Data Maps Developed

The critical facilities map was developed based on the information provided by the County in the Monroe County Comprehensive Emergency Preparedness Plan. All critical facilities were included in a GIS layer and displayed on the MCRVS Critical Facilities Location Map (**Figure 3**), each location was then cross checked and confirmed using both the Monroe County website, and Google Maps in street view mode. The map identified airports, hospitals, fire departments, schools, shelters and etc. **Figure 3** shows a snippet of this map and the critical facilities included in Key West and Stock Island. The facilities may be either emergency incident sites for disaster impacts, or could be used as emergency management support facilities. From the overall view of the entire county, it is observed that approximately half of the critical facilities are on or near a road on the County roadway network to be evaluated by this study.

Existing driveways that could potentially be impacted by roadway improvements were recorded in the MCRVS Driveway Location Map (**Figure 4**). A driveway is defined as a paved or graveled pathway that is clearly defined by one exit and/or entrance, and provides direct access to a property or facility. The driveways were collected for properties such as residential, commercial, and industrial properties, schools/colleges, government facilities, churches, community centers, parks, recreation and sports facilities, and emergency services such as police and fire stations, and hospitals. It can be noted that majority of the driveways identified were for residential properties. Stock Island however, stands out from the rest of the County as having more driveways leading to commercial and industrial properties. Another notable observation was that SR 905 in Key Largo and SR 939 in Sugarloaf Key have minimal number of driveways despite being among the longest road segments within the study limits.

Identifying and recording existing utility locations was one of the most important datasets, as utility impacts can add high costs to any improvements or mitigation strategies considered. The existing utilities were recorded in the MCRVS Utilities Location Map (**Figure 5**) and categorized as one out of three types: manhole/pull boxes which include utility access cover, pull boxes, and valve access covers, overhead for any electric, telephone, or cable lines running along posts, and roadside cabinets/meters which also include any other above ground facilities. In general in the residential areas it was observed that posts with overhead utilities were located approximately every two properties and were the most occurring type of facility throughout the County. The least frequent utility were the roadside cabinets/ above ground facilities, with the exception of Key Largo, where most residential properties have sewer vacuum system vents.

Roadway and Stormwater Structures Data Collection



Figure 3 - MCRVS Critical Facilities Location Map
Key Largo and Stock Island

Roadway and Stormwater Structures Data Collection

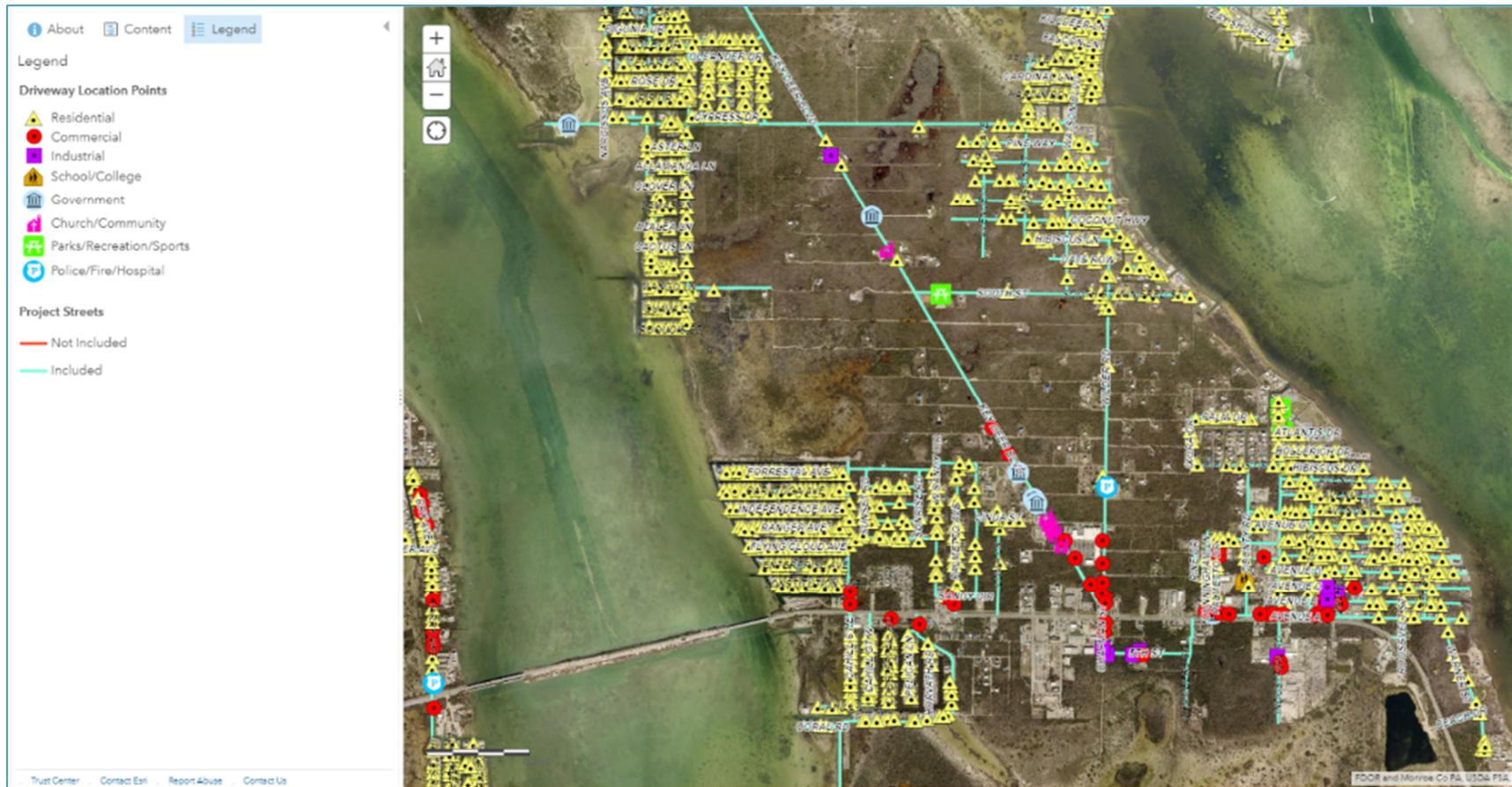


Figure 4 - MCRVS Driveway Location Map
Big Pine Key

Roadway and Stormwater Structures Data Collection



Figure 5 - MCRVS Utilities Location Map
Key Largo

Roadway and Stormwater Structures Data Collection

The most critical data collected were all the roadway characteristics recorded in the MCRVS Desktop Screening Map. The desktop screening consisted of identifying all roadway characteristics and components, while corroborating and correcting – if needed – the information provided by the County in their existing GIS layers. From the County provided GIS layers, the road name, functional class, division and subdivision were able to be populated onto the Desktop Screening map before the additional data was collected. All data collected to complete this map is summarized in **Table 2**. A sample Information dialog box that can be accessed within the map is shown in **Figure 6**. Using GIS map tools like the measure tool, enable the team to collect the lane, shoulder, and median widths where applicable. All other non-quantifiable characteristics like type of shoulder or roadside protection, number of lanes, median type and roadway surface type were identified using Google Maps street view.

MCRVS ArcGIS Collector Application Design - Roadway		
Field Name Alias	Field Name	Comments
Road Name	ROAD_NAME	Complete street name from MC GIS database
Key Name	KEY_NAME	Name of Key on which road is located
Join Key	JOIN_KEY	Street Name-Key Name database join key
District	DISTRICT	District from MC GIS Database
Subdivision	SUBDIVISION	Subdivision name from MC GIS database
Road Ownership	ROAD_OWNERSHIP	Road ownership from MC GIS database
Road Lanes	ROAD_LANES	Number of through lanes on road, both directions
Road Surface	ROAD_SURFACE	Roadway surface type (Asphalt, Concrete, Gravel)
Road Curb	ROAD_CURB	Roadway curb type
Road Median	ROAD_MEDIAN	Roadway median type
Road Protection	ROAD_PROTECTION	Roadway guardrail or barrier type
Road Rank	ROAD_RANK	Road rank from MC GIS database
ROW Width	WIDTH_ROW	Road ROW width from MC parcels or measured
Road Width	WIDTH_ROAD	Road width for through lanes between curbs measured
Lane Width	WIDTH_LANES	Lane width calculated as WIDTH_ROAD\ROAD_LANES
Functional Class	FUNC_CLASS	Functional Class from RCI data or entered manually
Posted Speed	SPEED_POSTED	Regulatory speed limit from RCI or MC GIS data
Evacuation Route	EVAC_ROUTE	Evacuation Route from RCI data or entered manually
Shoulder Type	SHOULDER_TYPE	Shoulder type (Paved, Unpaved)
Shoulder Width	SHOULDER_WIDTH	Shoulder width measured
Parking Type	PARKING_TYPE	Parking type
Parking Width	PARKING_WIDTH	Parking width measured
Sidewalk Type	SIDEWALK_TYPE	Sidewalk type
Sidewalk Surface	SIDEWALK_SURFACE	Sidewalk surface determined from aerials
Sidewalk Width	SIDEWALK_WIDTH	Sidewalk width measured
Bike Lane Type	BIKELANE_TYPE	Bike lane type
Bike Lane Width	BIKELANE_WIDTH	Bike lane width measured
Notes	NOTES	Enter up to 256 characters of notes
Inventory Status	STATUS	Select inventory status from drop-down list

Table 2 – Roadway Data in the MCRVS Desktop Screening Map

Roadway and Stormwater Structures Data Collection

Roadway Data Entry Status Legend:

- Not Invented
- In Progress
- Question
- Complete
- QC Rejected
- QC - Complete

Road Segment: INDIES DR N

Road Name	INDIES DR N
Key Name	DUCK KEY
District	MIDDLE
Subdivision	DUCK KEY RESUBDIVISION SECTION
Road Ownership	Monroe County
Road Lanes	2
Road Surface	Asphalt
Road Curb	None

[Zoom to](#) [Edit](#) [Get Directions](#)

Expanded Road Segment Information:

Road Name	INDIES DR N
Key Name	DUCK KEY
District	MIDDLE
Subdivision	DUCK KEY RESUBDIVISION SECTION
Road Ownership	Monroe County
Road Lanes	2
Road Surface	Asphalt
Road Curb	None
Road Median	None
Road Protection	None
ROW Width	50.0
Road Width	19.0
Lane Width	9.0
Functional Class	19 - Local (Urban)
Posted Speed	25
Evacuation Route	No
Shoulder Type	Unpaved
Shoulder Width	6.0
Parking Type	None
Parking Width	
Sidewalk Type	None
Sidewalk Surface	None
Sidewalk Width	
Bike Lane Type	None
Bike Lane Width	
Notes	Lane width varies 9-10; Shoulder width varies 6-15
Inventory Status	Complete

[Zoom to](#) [Edit](#) [Get Directions](#)

Figure 6 - MCRVS Utilities Location Map and Information Dialog Box

Roadway and Stormwater Structures Data Collection

The MCRVS Transportation Facilities Map was developed using existing information provided by the County and data collected by our team. This map contains County Bridge information from a GIS layer provided the County and prepared by Kisinger Campo and Associates Corp and the results of the Pavement Condition Inventory conducted as part of this study. **Figure 7** shows this data for Sugarloaf Key. Bridge characteristics include, year built, bridge length, deck length, estimated repair and replacement costs among other raking and ranking information which can be seen in the information dialog box in **Figure 7**. There are a total of 27 County maintained bridges with approximately one third of these bridges being in Key Largo. Some observations about the bridges that were made was that the built years range from 1955 to 1995, as well as the lengths of the bridges vary widely in range at 18ft for the shortest and 2775ft for the longest.

Roadway and Stormwater Structures Data Collection



Figure 7 - MCRVS Transportation Facilities Map and Bridge Information Dialog Box

Stormwater Data Collection

The storm drainage system is a feature that must to be further examined in later phases of the study. Currently, an overview of Monroe County's drainage has been gathered in the MCRVS Drainage Structure Review Map, which shows the location of trench drains, catch basins, injection wells, manholes, and outfalls (**Figure 8**). The drainage structure layer to be used on with GIS was provided by the county and supplements drainage improvements reports. The team conducted a field validation test to confirm that the locations of the drainage structure were accurate. Throughout the County's roadway network, there are 41 injections wells, 145 trench drains, 398 catch basins, 67 manholes and 38 outfalls. Majority of the County's drainage structure consists of catch basin and trench drains. There are no drainage systems on Duval Street and Eaton Street which are two main roadway segments in Key West.

Looking separately at each specific key, it was found that there are no drainage structures in East Rockland Key, Ramrod Key, Big torch Key, Middle Torch Key and Little Torch Key. An unexpected finding, was that Sugarloaf has very few drainage structures within a dense roadway segments network. In addition to the existing storm drainage throughout the different keys, the current pilot projects preceding this study located in the Twin Lakes community of Largo and the Sands community in Big Pine Key, propose new storm drainage structures, including catch basins, curb inlets, injection wells, and stormwater pump stations. The Stillwright Point neighborhood, which has become a focus area in the study, due to the level of flooding experienced in the past years, has no existing storm drainage system.

In addition the inventory of storm drain structures, a GIS map has been created for the watersheds throughout the study limits, to be used in the concept design phase of this study after roadway segments have been prioritized. The watershed map shows the pattern of the water running onto the road segments, and helps determine if the drainage structure in place at the studied location is able to withstand the predicted run on water. The Drainage Pour Points Map (**Figure 9**) uses the Parcel Boundary Elevation points which are dots that show the pattern of where the water would flow. The flow would either go into the road segment or run off between the houses or buildings. This information is presented in the map using the roadway elevations obtained from the LiDAR data, and the aforementioned pour points, which are locations of surface runoff drainage to surface waters, and these are used to generate the watershed boundaries.

Roadway and Stormwater Structures Data Collection

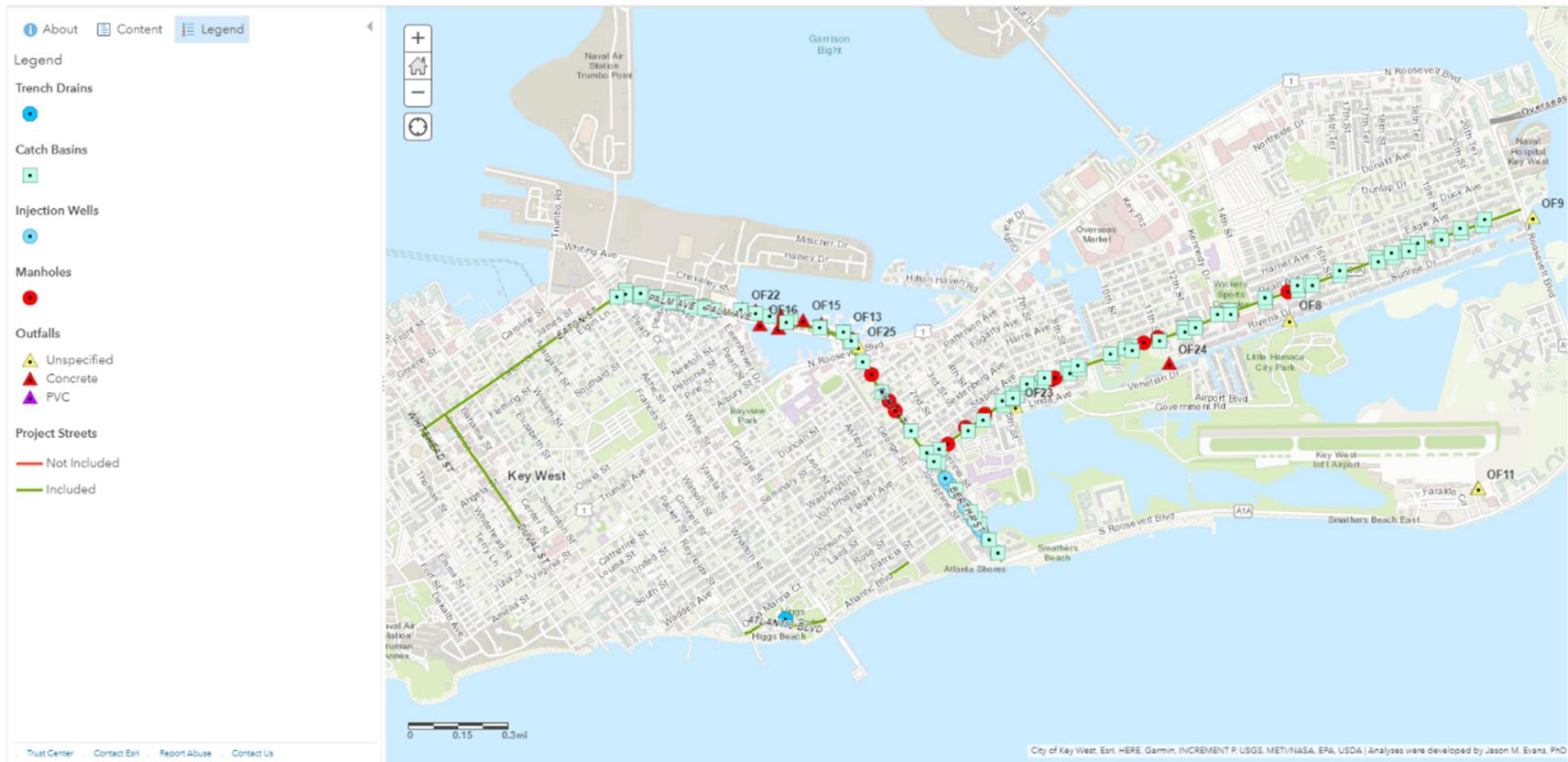


Figure 8 - MCRVS Drainage Structure Review Map

Roadway and Stormwater Structures Data Collection



Figure 9 - Drainage Pour Points map
Stillwright Point

Roadway and Stormwater Structures Data Collection

Also as part of the storm drainage data collection, there is anticipated survey of the downstream pipes and outfalls. The survey should only be conducted until the roadway segments have been prioritized, and locations have been narrowed down to ensure that maximum service of this survey is being obtained. This survey is intended confirm the stormwater drainage structures based on the Stetson University/Clearview Geographic LLC Vulnerability Assessment for the Monroe County Stormwater Drainage Systems. Once the survey is completed, more specific information such as the dimensions of the outfall pipes will be recorded, and integrated into an updated technical memorandum.

Additional Data Collection and Survey

Geotechnical Data

Geotechnical data collection was intended to be limited to a few locations/areas and to serve as supplement for existing data available. After all available data was received from the County, it was determined that the existing geotechnical data is limited. Due to the limited data, in order to maximize the project geotechnical services, it was recommended for the geotechnical testing and analysis to take place after the prioritization exercise has been conducted to ensure the geotechnical analysis efforts are focused on the prioritized areas. Results from the geotechnical data collection task will be recorded, and integrated into an updated technical memorandum.

Right-of-way (ROW) Survey

In similar circumstance as with the geotechnical data, survey containing ROW information is also limited, thus ROW survey efforts will also occur after the prioritization exercise, and used to verify existing ROW. These strategically selected points where the ROW survey is to be conducted will be used to confirm the accuracy of the existing ROW information provided by the County in existing GIS layers. Any adjustments to ROW, if needed, will be made prior to the concept design phase to ensure all improvements accurately depict the ROW and potential impacts to it, if any.

Conclusions

The data collection phase of this study became a two phase process. The first phase of the data collection was focused on cataloging, documenting, and organizing existing data received from the County, this included the creation of several of the GIS maps, and the inclusion of this existing data within those maps to prepare for the second phase of the process. Phase two consisted of using these GIS maps as a base, and collecting and recording all data that will be needed throughout the study, both for the prioritization exercise and the concept design phase for the selected roadway segments.

All data collected, analyzed, confirmed, and presented in maps, GIS layers, and/or reports will be part of a comprehensive database and delivered to the County at the conclusion of this study to be kept as part of County records.