



**HUMISTON
& MOORE
ENGINEERS**
COASTAL
ENGINEERING DESIGN
AND PERMITTING

5679 STRAND COURT
NAPLES, FLORIDA 34110
FAX: 239 594 2025
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March 15, 2019

Todd Schneider
APM Custom Homes
939 Chalmers Drive, Suite 2
Marco Island, FL, 34145

Re: Flushing Analysis for Marine Garage
1224 Orange Court, Marco Island
HM File No. 28-044

Dear Mr. Schneider,

This letter presents the results of a flushing analysis for a proposed marine garage at the property located at 1224 Orange Court on Marco Island, Florida. A copy of this report will be provided as technical support to our application when filed with the Florida Department of Environmental Protection (DEP) and US Army Corps of Engineers (USACE). The attached **Figure 1** shows the location of the subject property and the proposed project which consists of a marine garage to be excavated from upland and connected to Butterfly Waterway. Butterfly Waterway is a manmade canal which is approximately 100' wide and 425' long with direct connection to Factory Bay and the Gulf of Mexico via Capri Pass/Big Marco Pass.

The proposed marine garage will be approximately 29' wide and extend 77' to 82' deep into the upland property as shown on the attached plans prepared by Dave Wainscott Designs, dated 9-12-18. Three different design bottom elevations were assessed to determine the flushing characteristics of each of the proposed basin for each design depth.

Methodology

A detailed flow model, RMA2 (Donnell et al 2005) was set up and run to determine the hydrodynamics near the project area. A local high resolution mesh was generated using tidal boundary conditions based upon the nearest active NOAA tide gage, located at Naples, FL (8725110). The predicted tides for January, 2019 were downloaded to provide a smooth record of astronomical tides for modeling and eliminate the effects of winds and waves on the nearshore flow cycle. The period from January 9 through January 13 was selected to provide a representative typical tide, being approximately mid-way between Spring and Neap Tides.

The boundary conditions were selected at remote locations from the area of interest to provide accurate simulation of the circulation at the project site forced by water level fluctuations at the remote boundaries. This numerical modeling procedure is done to eliminate the potential for boundary condition effects influencing the solution at the project site. The tidal boundary was set at the entrance to Factory Bay, which is assumed to experience a similar tide range as the Gulf of Mexico through the broad, direct inlet at Capri Pass/Big Marco Pass. **Figure 2** shows the RMA2 mesh, model limits, and the boundary condition highlighted in blue along the northern edge of the model.

The model was used to compute water level fluctuations and flow in the project area and prepare inputs for the flushing analysis. **Figure 3** shows the Factory Bay boundary condition, and calculated water surface

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Humiston & Moore Engineers
Project Location: 1224 Orange Court, Marco Island, FL
Project Number: 28-044

elevations in Factory Bay and Butterfly Waterway. The water surface at the entrance to Factory Bay and within Butterfly Waterway is nearly coincident throughout the model duration. This is considered reasonable given the broad and relatively deep geometry of Factory Bay and its direct connection to relatively short Butterfly Waterway.

The RMA2 model results were then used to conduct a flushing analysis using the RMA4 model (Letter et al 2003). The model is set to simulate the flushing of a conservative constituent, (a constituent that doesn't go through chemical or biological transformation). The model computes the pollutant concentration change over time at the site based upon the initial pollutant concentration and local hydrodynamics, considering advection and dispersion. Advection refers to the movement of the constituent due to the movement of the water surrounding it. Dispersion represents the mechanical mixing of a constituent due to the turbulence and irregular movement of particles within the flowing water.

Results

The Florida Department of Environmental Protection (DEP) has established a guideline pursuant to Section 373.4131, Florida Statutes, as specified in the Applicant's Handbook Volume I, "General and Environmental" incorporated in Rule 62-330, Florida Administrative Code, that requires a conservative constituent must flush from proposed marinas or modified bays in less than 96 hours.

The RMA4 model was run from a hot start file with a 100% concentration within the proposed garage cut. The model then simulates the exchange of this concentration with adjacent waters beginning at time zero. **Figure 4** shows calculated concentrations in the proposed marine garage at 0 hours and 10 hours simulation time. Figure 4 also provides a graph of concentration at the end of the slip. The time to flush below 10% of initial concentration is indicated on the graph in red. Flushing time for -5' MLW was 17.3 hours, -6' MLW was 18.7 hours and -7' MLW was 19.7 hours.

This analysis shows the proposed project would flush a hypothetical constituent to concentration of less than 10% within approximately 20 hours or less at design depths as low as -7' MLW. This falls within the 96 hour guideline. If you have any further questions or concerns, please do not hesitate to call.

Sincerely yours,

HUMISTON & MOORE ENGINEERS



Matthew Fleming, M.Sc.

Attachments

Figures 1, 2, 3, and 4

Plans: 1224 Orange Court by Dave Wainscott Designs. Dated 9-12-18

References

- Donnell, Barbara P., Letter, Joseph V., McAnally, W. H., (2005), "Users Guide for RMA2 Version 4.5," US Army, Engineer Research and Development Center USAE Waterways Experiment. Station, Vicksburg, MS.
- Letter, Joseph V., Donnell, Barbara P., (2003), "Users Guide for RMA4 Version 4.5", US Army, Engineer Research and Development Center USAE Waterways Experiment. Station, Vicksburg, MS.

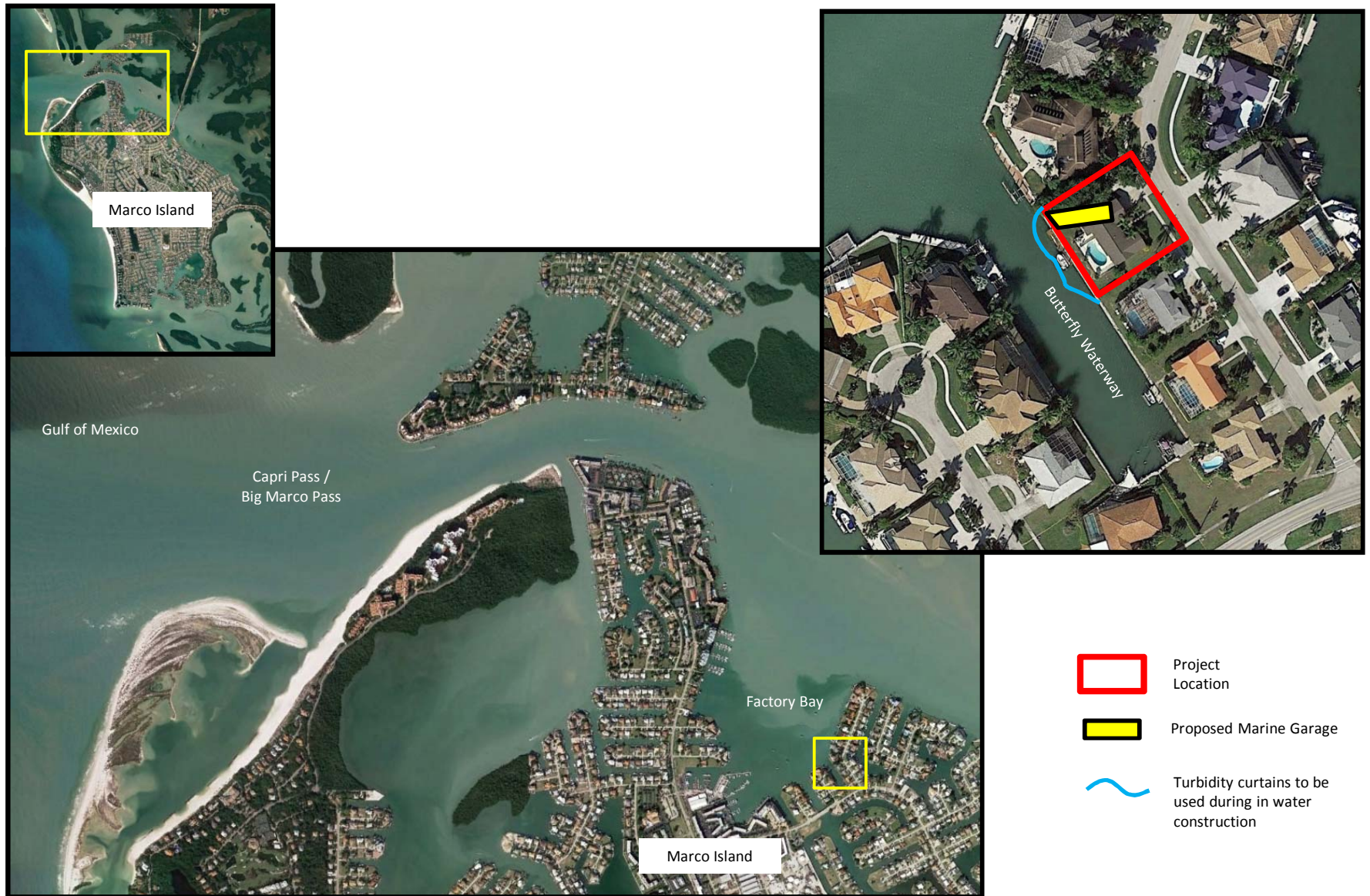
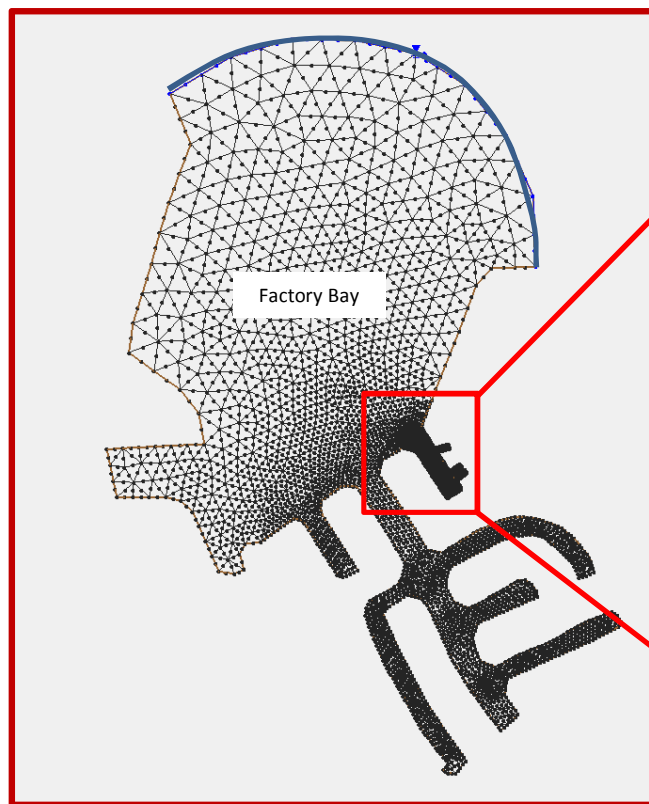
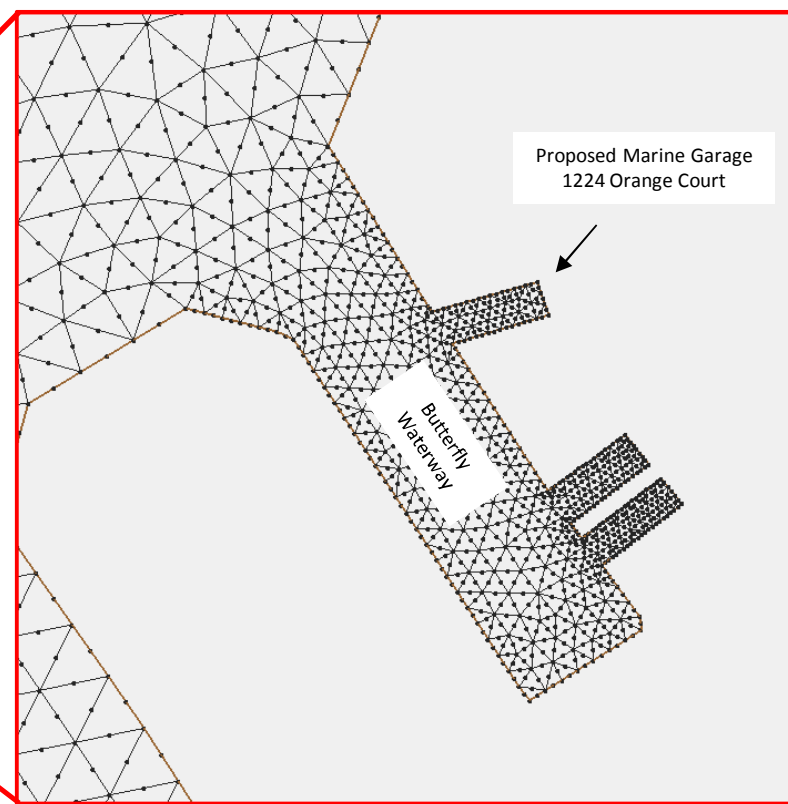


Figure 1: Project Location



RMA2 Mesh Domain



Butterfly Waterway and
Proposed Marine Garage Slip



Figure 2: Model Domain Showing Location of Proposed Marine Garage

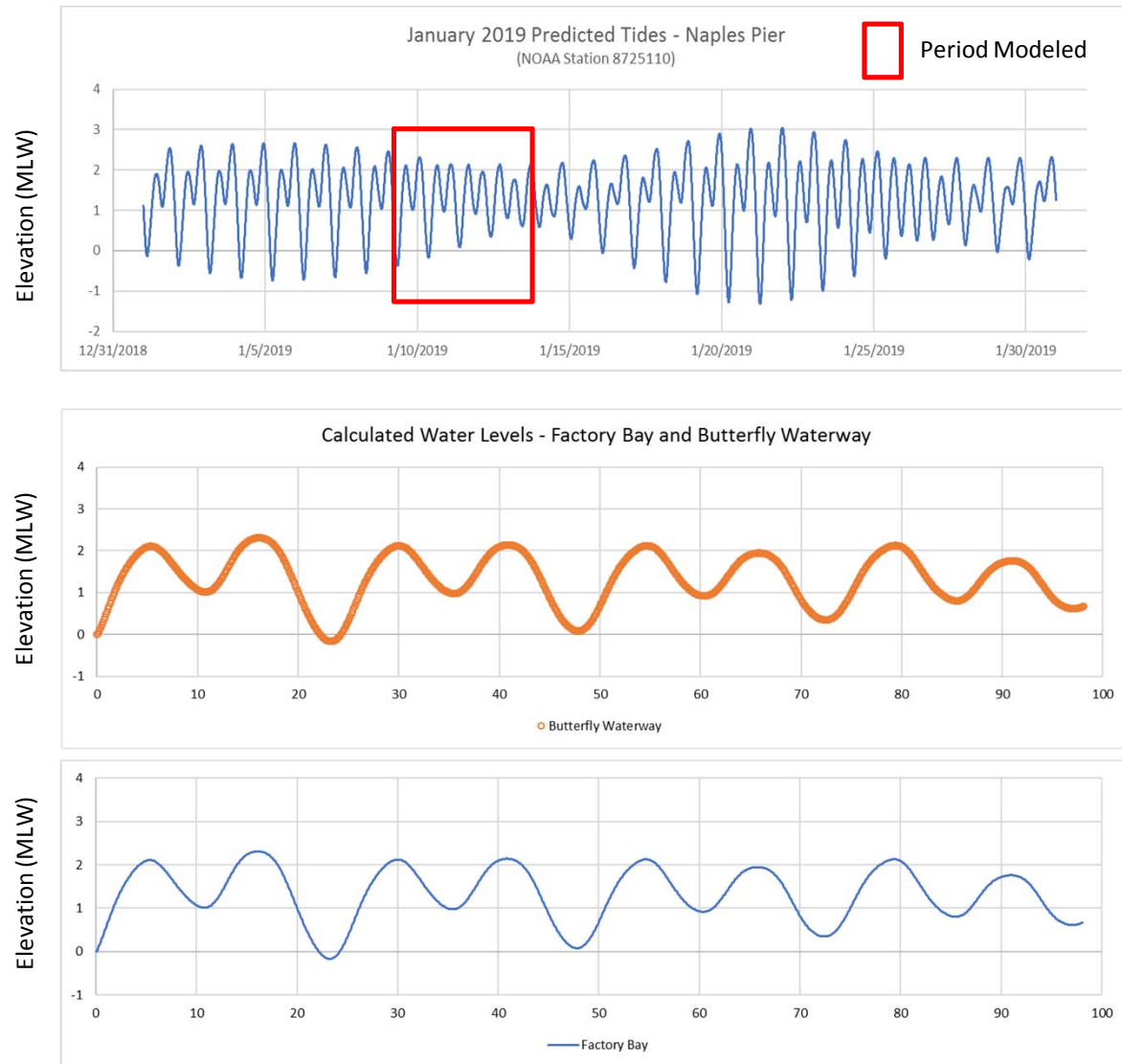
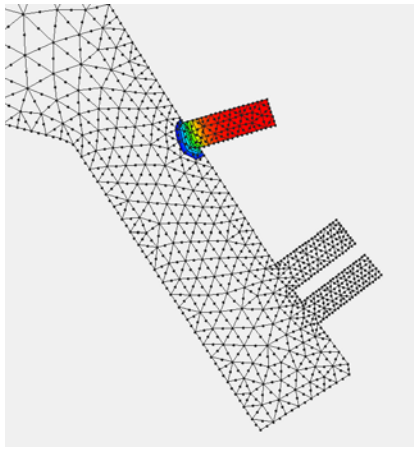


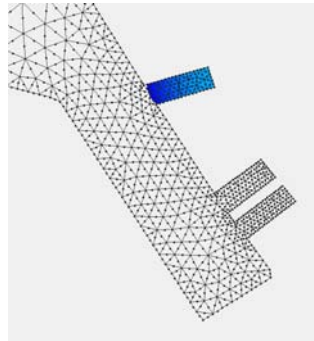
Figure 3: Boundary Condition and Calculated Water Levels



Time = 0 h

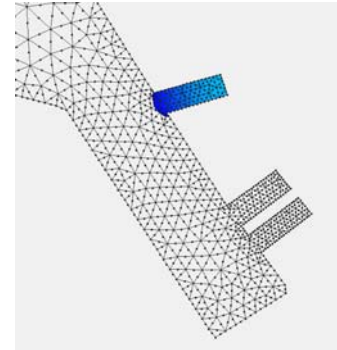
Bottom Elevation

-5' MLW



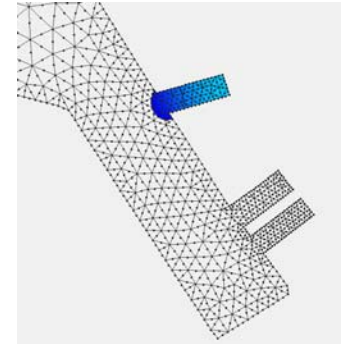
Time = 10 h

-6' MLW

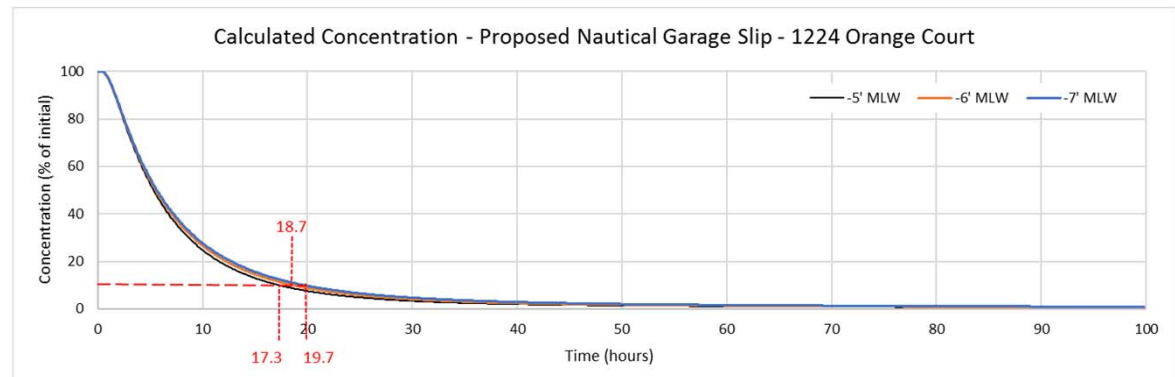
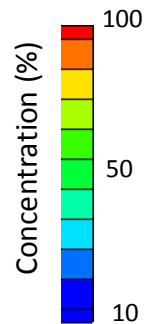


Time = 10 h

-7' MLW



Time = 10 h



Note: Concentrations below
10% shown as white



Figure 4: Analysis Results, Constituent Concentration



SITE PLAN



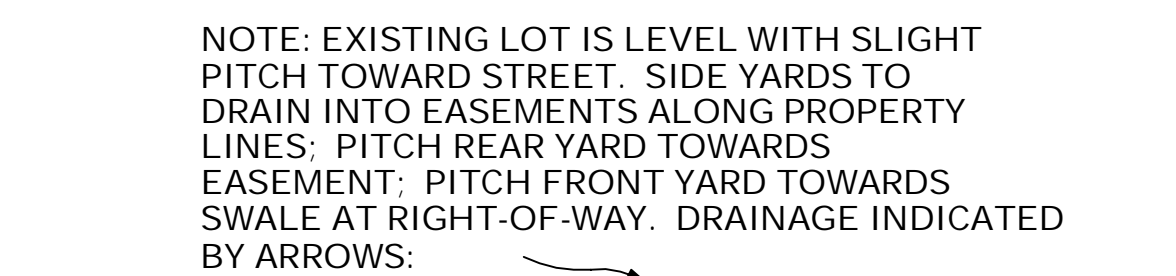
239-353-1815 FAX: 239-353-3405

3825 BECK BLVD #702, NAPLES, FL 34114

APM BUILDERS

OF SHEET

NOTE: AN AS-BUILT MEASUREMENT OF THE IMPERVIOUS CALCULATIONS MAY BE REQUIRED TO BE SUBMITTED AND CERTIFIED ALONG WITH THE FINAL SURVEY BY THE SURVEYOR TO THE CITY OF MARCO.



LOT-----4
BLOCK----128
UNIT-----4
1224 ORANGE COURT
MARCO BEACH SUBDIVISION
CITY OF MARCO ISLAND, FL.

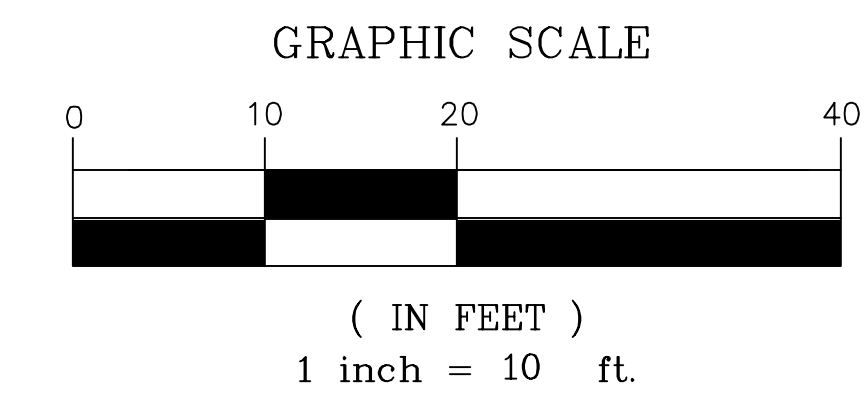
NOTE: EXISTING LOT IS LEVEL WITH SLIGHT PITCH TOWARD STREET. SIDE YARDS TO DRAIN INTO EASEMENTS ALONG PROPERTY LINES; PITCH REAR YARD TOWARDS EASEMENT; PITCH FRONT YARD TOWARDS SWALE AT RIGHT-OF-WAY. DRAINAGE INDICATED BY ARROWS:

NOTE: PER COLLIER COUNTY LAND DEVELOPMENT CODE
DIVISION 2.4, A MINIMUM OF (2) CANOPY TREES ARE REQUIRED:
LOT AREA = 11,000 SF
 $\frac{11,000}{2,500 \text{ SF PER TREE (MAX)}}$
= 4.4 4 REQUIRED TREES

MINIMUM OF (2) TREES TO BE 10 FT IN HEIGHT, 1 3/4" CALIPER @ 12" ABOVE GRADE, AND 4 FT SPREAD; BALANCE TO BE MINIMUM OF 8 FT HEIGHT, 1 1/2" CALIPER, 3 FT SPREAD; ONE PALM TREE MAXIMUM TO SATISFY REQUIRED LANDSCAPING. SUGGESTED SPECIES: FICUS, GUMBO-LIMBO, LIVE OAK, AND MAHOGANY; MINIMUM OF (3) TREES TO BE NATIVE TO SOUTH FLORIDA.



BUILDING OCCUPANCY: SINGLE FAMILY RESIDENCE (GROUP R3)	
LIVE LOADS (PSF): FIRST FLOOR 50 PSF - SECOND FLOOR - 50 PSF	
BUILDING AREA: FIRST FLOOR - 295 SF - SECOND FLOOR - 3,785 SF	
TOTAL AREA (AC)	4,080 SF
TOTAL AREA (NON-AC)	1,716 SF
TOTAL AREA UNDER ROOF	5,796 SF

FEMA FLOOD ZONE: AE 8 PER FIRM MAP OF 05-16-2012
GRADE ELEV. OF LOWEST FLR. 5.87' N.A.V.D. LOCATED @ GARAGE
ELEVATION OF FIRST HABITABLE FLR. 23.67' N.A.V.D.
HEIGHT OF BUILDING ABOVE GRADE: 25'-6" NO. OF STORIES 2
TYPE OF CONSTRUCTION (FBC CLASSIFICATION): V UNPROTECTED
PARKING SUMMARY: SPACES REQUIRED 2 SPACES PROVIDED
NOTE: THESE PLANS WERE PREPARED IN COMPLIANCE WITH
SECTION R301 OF THE FLORIDA BUILDING CODE-RESIDENTIAL
(FBC, 6th EDITION), AS AMENDED BY ORDINANCE NO. 15-16,
MARCO ISLAND, FLORIDA
CONNECT HOUSE TO EXISTING WATER & SEWER UTILITIES



IMPERVIOUS AREA CALCULATIONS

PER CITY OF MARCO ORDINANCE SECTION 30.435, CHAPTER I-3

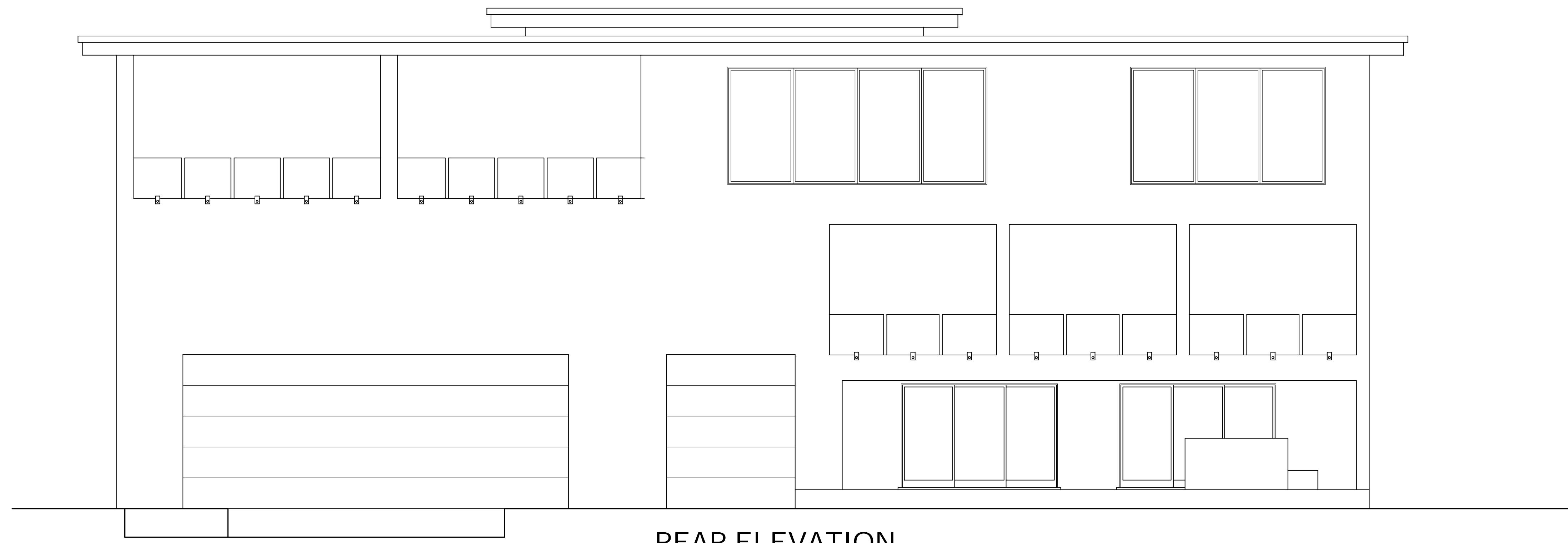
	FOOTPRINT OF HOME & POOL DECK	6,059 SF
	CAR NAUTICAL GARAGE AND GARAGE STORAGE	4,419 SF
	FOYER	298 SF
	MECH PAD	83 SF
	GROUND FLOOR TERRACE	569 SF
	ENTRY	53 SF
	POOL AND DECK	629 SF
	AREA FOR DRIVES & WALKWAYS	1,611 SF
	AREA FOR DRIVES & WALKWAYS TO BE PERVIOUS	1,611 SF
TOTAL IMPERVIOUS AREA		6,059 SF
TOTAL LOT AREA		11,827 SF
AREA OF CANAL SLIP		738 SF
TOTAL LOT AREA WITH SLIP		11,089 SF

IMPERVIOUS AREA % (6,059 SF / 11,089 SF)	54.56 %
MAXIMUM IMPERVIOUS AREA ALLOWED	67.00 %

NOTE: AN AS-BUILT MEASUREMENT OF THE IMPERVIOUS CALCULATIONS MAY BE REQUIRED TO BE SUBMITTED AND CERTIFIED ALONG WITH THE FINAL SURVEY BY THE SURVEYOR TO THE CITY OF MARCO.



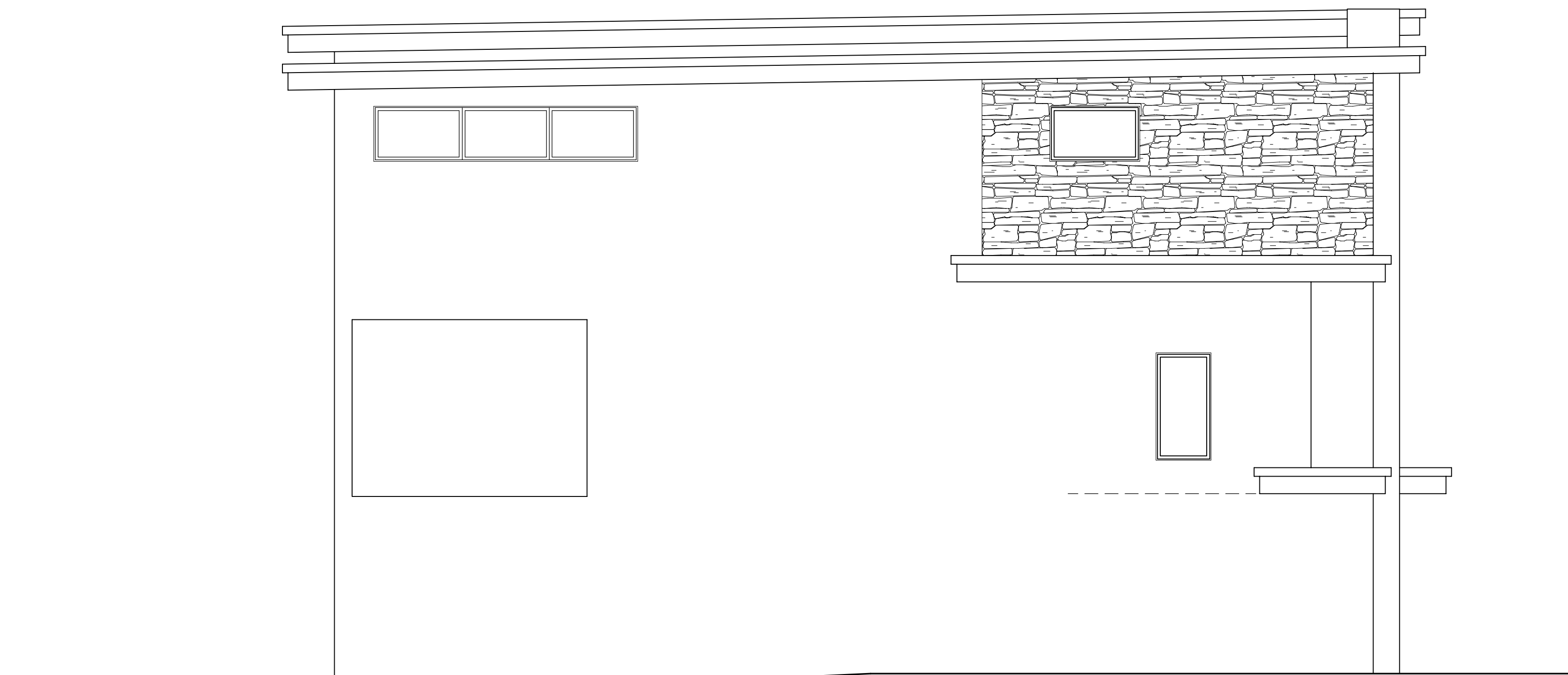
FRONT ELEVATION
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REAR ELEVATION
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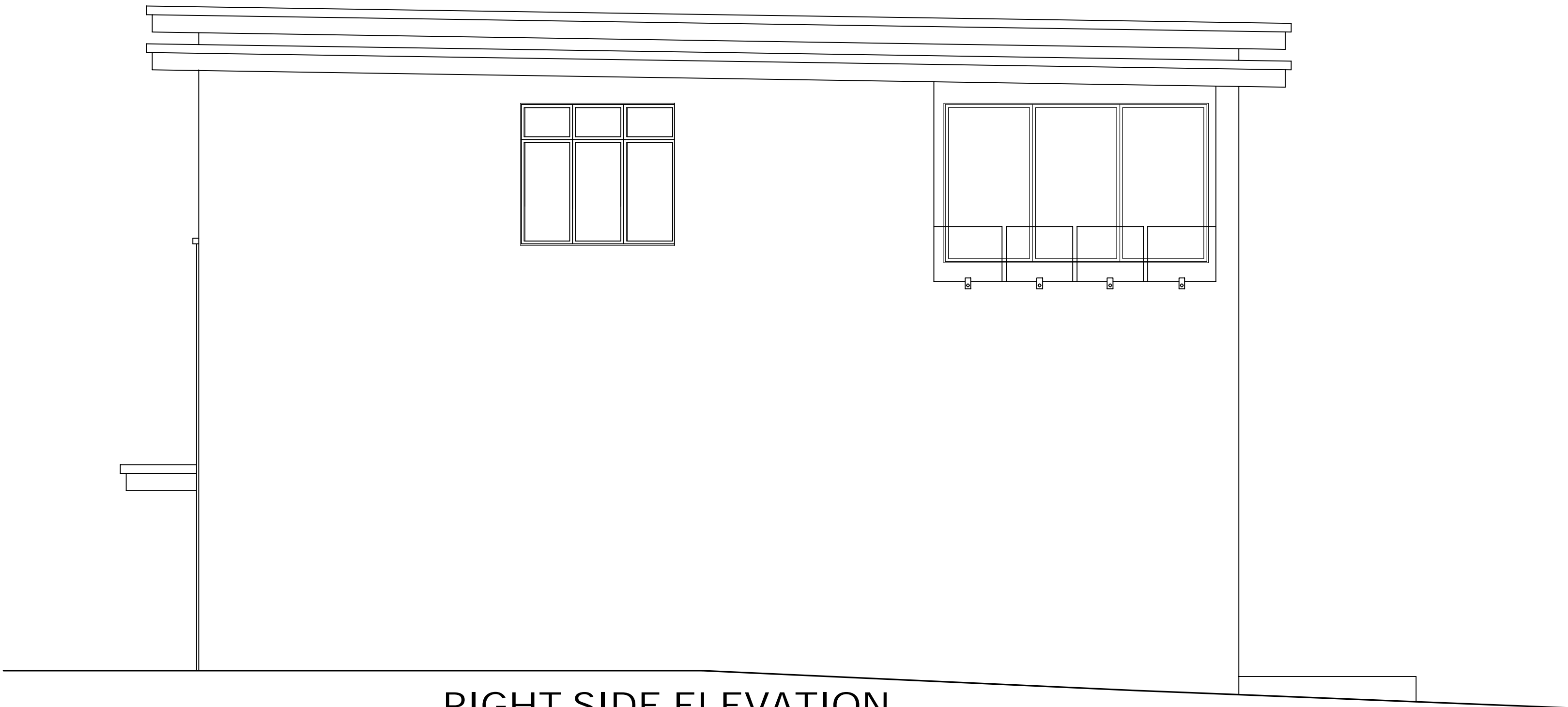
REVISIONS		BY
FRONT AND REAR ELEVATIONS		
Dave Wainwright		DESIGNS
3825 BECK BLVD #702, NAPLES, FL 34114		239-363-1815 FAX: 239-363-3405
1224 ORANGE COURT		APM BUILDERS
DATE: 09-12-2018		
SCALE: 3/16" = 1'-0"		
DRAWN: JG		
JOB: 2018-981		
SHEET: A2		
OF	SHEET	





LEFT SIDE ELEVATION

SCALE: 1/4" = 1'-0"




RIGHT SIDE ELEVATION

SCALE: 3/16" = 1'-0"

REVISIONS	BY

SIDE ELEVATIONS



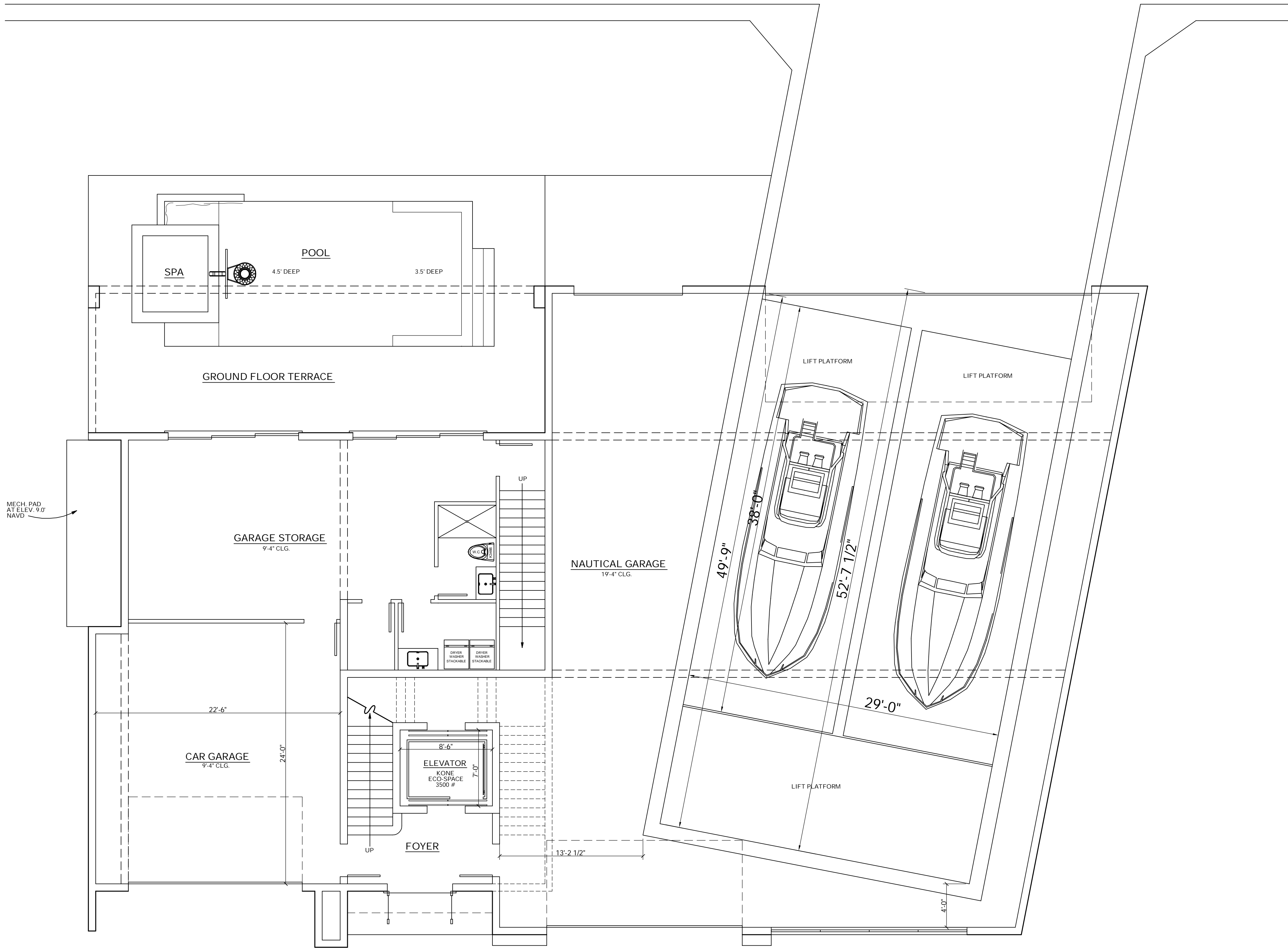
Dave Waincott
DESIGNS

239-353-1815 FAX: 239-353-3405

3825 BECK BLVD #702, NAPLES, FL 34114

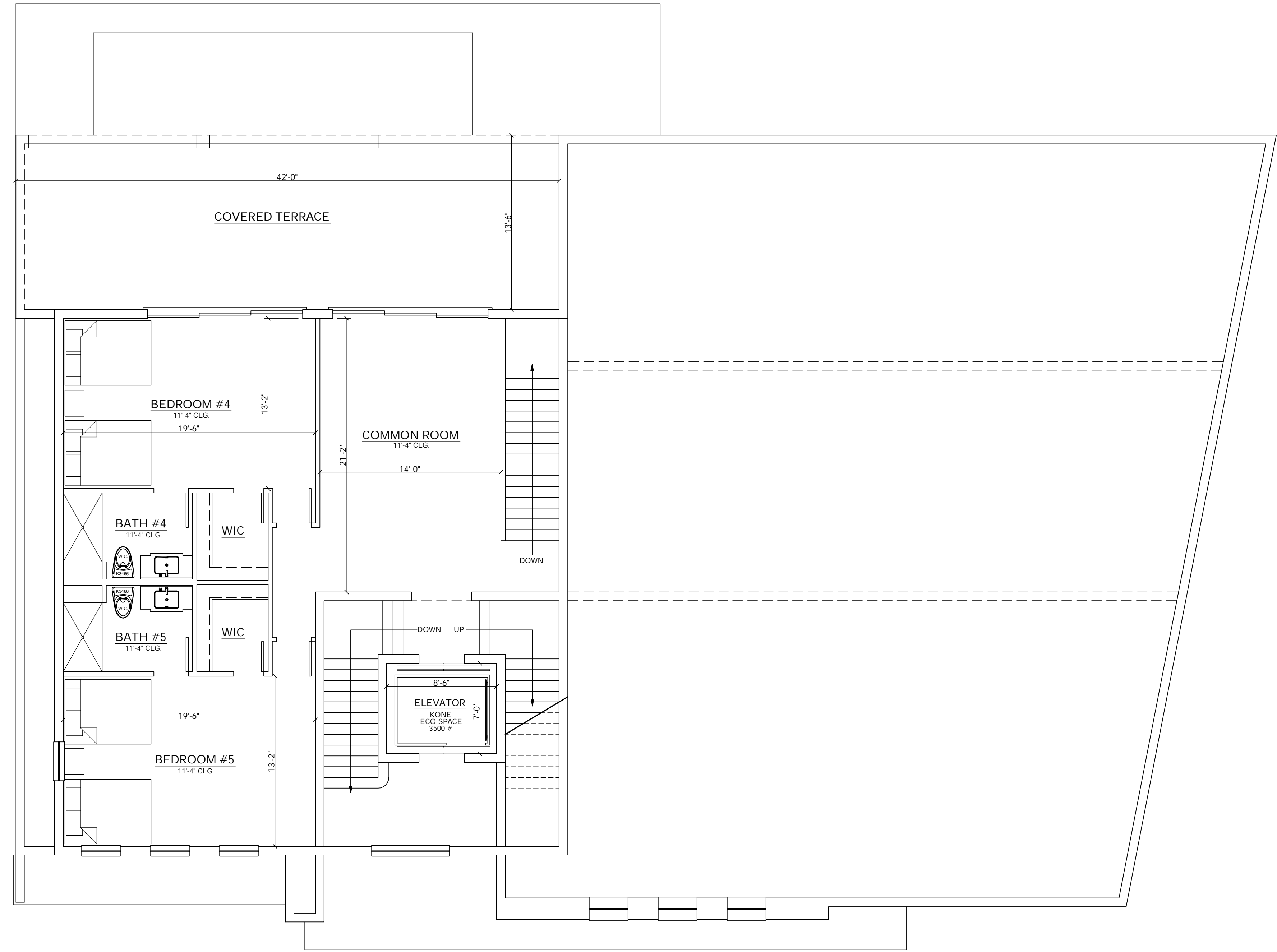
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APM BUILDERS

DATE: 09-12-2018
SCALE: 3/16" = 1'-0"
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JOB: 2018-981
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OF SHEET



GROUND FLOOR PLAN
SCALE: 3/16" = 1'-0"

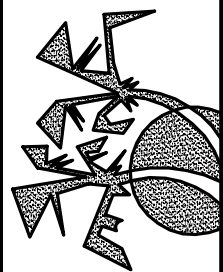
REVISIONS		BY
GROUND FLOOR PLAN		
1224 ORANGE COURT		
APM BUILDERS		
DATE: 09-12-2018		
SCALE: 3/16" = 1'-0"		
DRAWN: JG		
JOB: 2018-981		
SHEET: A4		
OF		SHEET
Dave Wainwright		
DESIGNS		
3825 BECK BLVD #702, NAPLES, FL 34114		
239-353-1815		
FAX: 239-353-3405		



FIRST FLOOR PLAN
SCALE: 3/16" = 1'-0"

REVISIONS	BY

FIRST FLOOR PLAN



Dave Waincott
DESIGNS

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1224 ORANGE COURT

APM BUILDERS

DATE: 09-12-2018
SCALE: 3/16" = 1'-0"
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JOB: 2018-981
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OF SHEET





SECOND FLOOR PLAN

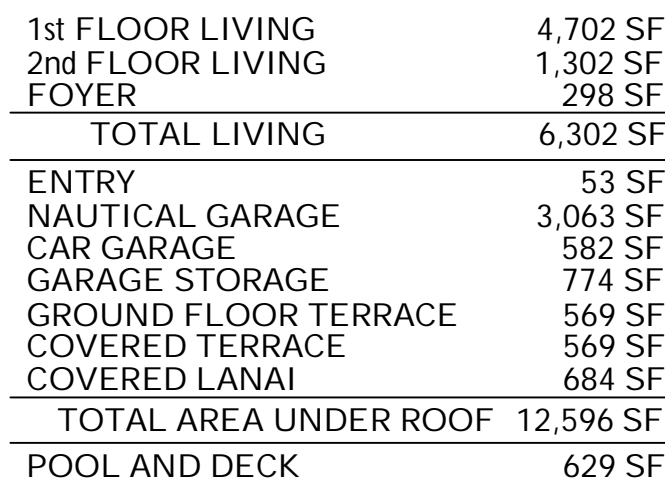


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3825 BECK BLVD #702, NAPLES, FL 34114

APM BUILDERS

OF SHEET



SCALE: 3/16" = 1'-0"