Gulfstream
DESIGN GROUP

Project Summary and Design Recommendations

Revison # 1

Pelican Reef Residential Subdivision

Prepared for:

Pelican Reef
Homeowners Association, Inc.
3942 AIA S., St. Augustine, Fl.

Michael P. Whelan, P.E. Fl. No. 55496 Date
CA# 71395

Project # 18-024
Dated: November 14, 2018

906 Anastasia Blvd., Suite A, St. Augustine, Florida 32080
904-794-4231 • www.gulfstreamdesign.co m
Civil Site Design • Permitting • Land Development • Consulting
CA# 30431

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Section 1.0 INTRODUCTION

Gulfstream Design Group, LLC (GDG) was requested to observe the Pelican Reef residential subdivision. A site observation was completed on July 2018, Attachment A. We completed a second site observation on October 2018, after a rain event, Attachment B. These observations have been utilized to assist in recognition with the site concerns and challenges. The site has been identified in the Figure 1, the location map, shown in Figure 1, below. It was noted in the original contract that the Pelican Reef project site was not constructed in accordance with the approved plans with the addition of deficient maintenance by the home owners and the Homeowner's Association.

The following report outline the observations, and recommendations for the project site. We have completed Task1 as part of the Initial Site Investigation and Task 3 of the Recommended Solutions for the project site. At this time, this information is strictly the opinion of Gulfstream Design Group based on visible observations and engineering documents.

1.1 LOCAL LAND USE MAP

Figure 1 illustrates the local land uses within and adjacent to the project area.

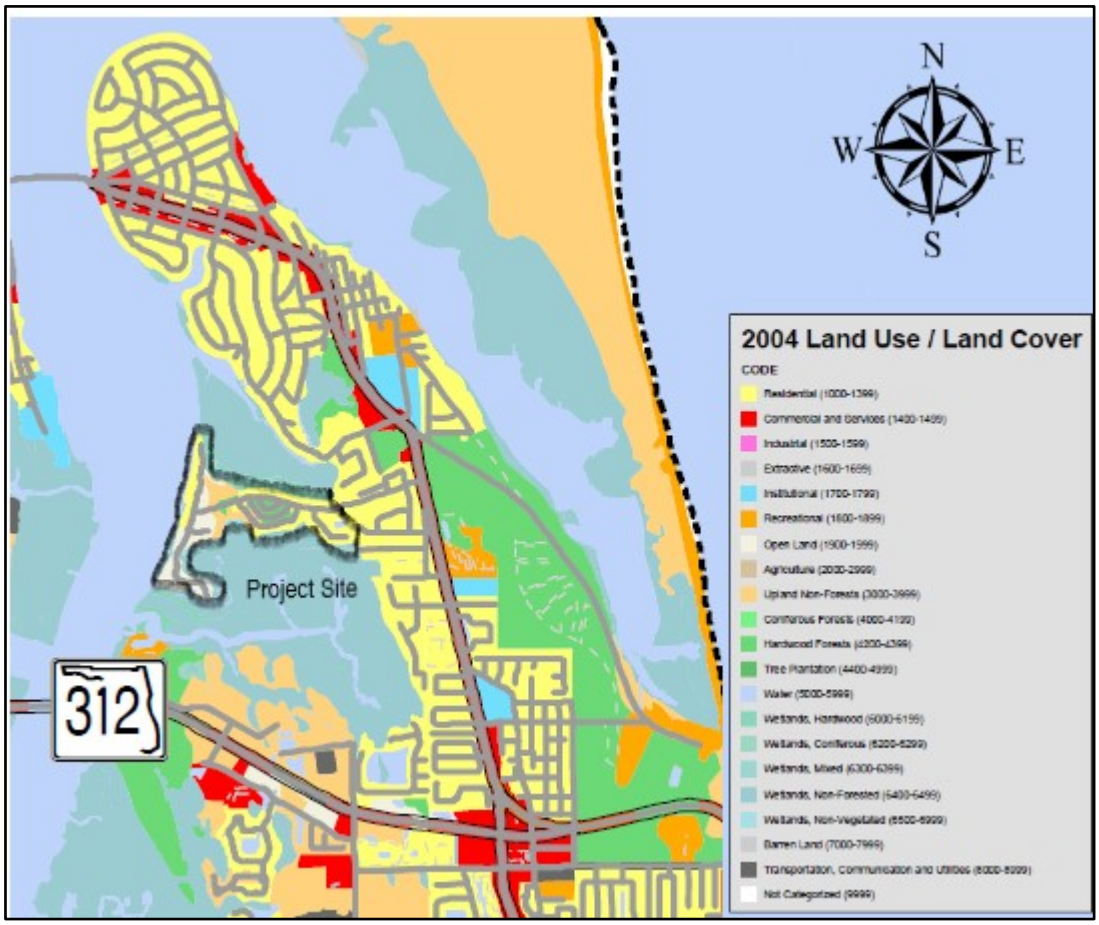


Figure 1: Segment of 2004 Landcover from St. Johns County, illustrating project site

1.2 LOCAL AERIAL MAP

We have enclosed a segment of the 2016 aerial photograph of the project site taken from the St. Johns County's Property Appraiser's Office, and is illustrated in Figure 2.

Figure 2: 2016 Aerial photograph of the project site.

1.3 LOCAL AERIAL MAP

We have enclosed a segment of the 2016 floodplain and aerial photograph of the project site taken from the St. Johns County's Property Appraiser's Office, and is shown in Figure 3. It is important to note that a majority of the project site is within the Matanzas River floodplain.

Figure 3: 2016 Local Floodplain designation on the aerial photograph taken from St. Johns County Property Appraiser's website. and the project site.

Section 2.0 OPTIONS OVERVIEW

Pelican Reef needs a consistent right-of-way and drainage system, as well as the reduction of standing water within the system. Below is a list of various options related to general drainage improvement.

2.1 IMPROVEMENTS TO EXISTING INFRASTRUCTURE

The existing storm water collection system was designed with the intent of reducing residential flooding and utilized the offsite conveyance. We have analyzed the existing stormwater system and can see that the existing stormwater system is limited in the volume that can be utilized. We want to explore to the ability to improve the existing infrastructure by increasing the temporary storage volume of the existing system and reducing the amount of stormwater entering the system. These improvements have been identified in Section 3.0 by Location

2.2 TEMPORARY STORAGE

The hydraulic grade line describes a measurement of the existing water level at the downstream discharge, while accounting for the influence of storage and losses within the system assessed from a certain distance. The following will detail potential improvements to the existing system which will decrease both the volume and rate at which the runoff reaches the downstream outfall. We will provide these improvements by examining the swale storage and culvert capacity.

2.3 SWALE STORAGE

The topographical survey of the property has identified the culverts materials, sizes, and invert control elevations. The significant differences noted between the average bottom of swale elevation and the invert elevations of the associated driveway culverts indicates that additional storage volume can be excavated from the swale. This excavation work would uncover the existing culverts, remove overgrowth, and reduce the potential for stormwater flow restrictions.

The swale can also be excavated lower than the existing culverts to provide an overall consistent hydraulic grade line, which is needed throughout the project limits. Lowering the hydraulic grade line effectively lowers the surface water elevation during peak stormwater events, and the additional height of the berm and the associated volume with the lowered invert of the associated swales would allow increased temporary storage volume and additional pollutant removal within the swale. The excavated fill materials, where suitable, would be utilized to construct the backslope berm to tie back into existing residential grades.

2.4 CULVERTS SIZING

Typical culverts sizing to a downstream invert accounts for additional runoff volume from each sub-basin upstream. As more runoff enters the system to be conveyed to the downstream point, the culverts sizing is increased to account for larger upstream flows. There are several piped culvert systems to which the culverts sizing is decreased from the upstream culvert sizes prior to any discharge, and therefore flow of water in turn is restricted from upstream.

There are culvert sizes ranging from 4-inches to 18-inches throughout the stormwater system. We suggest that no culvert less than 12-inch diameter be proposed for future installation. In addition, the downstream section, nearest the project outfalls be a minimum of 18-inch diameters. To relieve the upstream backflow, increasing the culvert sizes would provide additional storage to drawdown the backflow and convey the runoff downstream.

2.5 CONVEYANCE

Poor conveyance of the systems stormwater runoff has led to temporary ponding and unintentional sheet flow to areas not originally designed to retain stormwater runoff. Typically, defined high and low points direct the runoff along the roadway to the intended swale system and ultimately the headwalls in this scenario, as the downstream discharge locations. Through the various stages of construction, without a master system between the individual properties, each contains independent sub-basins to which ponding stormwater is being insufficiently conveyed.

2.6 SWALE DESIGN

As previously described, with the culverts being constructed independently at various times and locations since the initial construction of Pelican Reef, the swale system appears to be connected by the culvert elevations rather than a consistent flow line to a downstream discharge. The system should be designed from the downstream elevation developing a consistent slope along the swale system. This would ultimately end at a high point culverted driveway, or the upstream boundary of the sub-basin.

2.7 CULVERT DESIGN

Culvert design would typically follow the same flow line as the roadside swale system. Ideally, the culverts would need to be reconstructed to convey stormwater towards the direction of the downstream discharge and with the proposed flow line. Given that majority of the development has been constructed, modifications to existing driveway entrances would be an item of conflict with the homeowners. Should the culverts not be adjusted with the flow line of the swale, temporary storage will be provided but in the form of ponding along the roadside.

2.8 SEDIMENTATION AND DEBRIS

The most cost efficient and effective improvement to assist in conveyance would be consistent maintenance and operation of the existing system. Existing culverts have been overgrown with existing vegetation, grass, and planting within the swales. Inlet grates and sumps have been filled with sediment and must be pumped frequently after excessive flooding events. Gulfstream Design Group will recommend a thorough operation and maintenance plan to be consistently implemented, in section 4.4 Maintenance and Operation.

2.9 STORMWATER MANAGEMENT FACILITY

Construction of a wet retention facility is the standard stormwater management design to reduce runoff and provide pollutant removal in the form of infiltration. Standards retention facilities have also advanced for applications such as Pelican Reef, where limited developable area requires innovative techniques for an effective solution. An underground exfiltration system could be constructed under sod, pavement, or concrete areas, such as the existing roadway. The system would also be open on the bottom for infiltration and provide additional pollutant removal. This would require additional maintenance and frequent cleaning following extreme flooding events.

2.10 PERMITTING

The Pelican Reef right-of-way and associated homeowners fall under the authority of the City of St. Augustine municipal review, and St. Johns River Water Management District (SJRWMD) in regard to stormwater management and water quality.

2.10.1 CITY OF ST. AUGUSTINE

The City of St. Augustine defines the permitting thresholds for stormwater. The City's Land Development Code (LDC) specifies that a permit shall be required to modify the grade of any properties within the county. A Site Plan Modification of the existing approved site plans is required to update the grading permit for the subdivision. Additional design specifications and standards are detailed in the LDC, several of which pertain to standing water and reduction of mosquito breeding areas.

2.10.2 ST. JOHNS RIVER WATER MANAGEMENT DISTRICT (SJRWMD)

The St. Johns River Water Management District (SJRWMD) governs water quality standards for Northeast Florida and permitting associated. As previously mentioned, revision of the existing SJRWMD Permit may be required. Any changes to the existing system which may influence the rate of runoff would exceed the permitting thresholds set forth.

Section 3.0 GDG REVIEW CRITERIA

Through the analysis of the Pelican Reef's drainage issues and potential improvements, the main concern will be a balance between existing development and future construction with an ultimate goal of achieving a cost efficient and effective conveyance system. Given these conditions, the following are the recommendations made by Gulfstream Design Group which incorporate both cost and convenience of construction associated.

3.1 SWALE

Improvements to the existing swale that is within the easement maintained by the Homeowner's Association, while retaining existing downstream discharge locations, are the most efficient and effective of those included in these recommendations. Consistency between individual lot construction and existing culverts is essential to maintaining an operational conveyance system for Pelican Reef.

3.2 FLOW LINE ESTABLISHMENT

We are using the survey data collected by I.M.S. to develop a flow line establishment with the location drainage areas and the drainage easement. Once these flowlines have been established, the surrounding vacant lots should follow the proposed lines to carry stormwater flows.

3.3 CULVERT CONSTRUCTION

In order to analyze the effects and extent of concerns, a review of the local hydraulic grade lines was made. As anticipated, majority of the culverts were constructed without considering the overall direction of flow, sizing with progressive increases with added flow into the system, and obstructions such as sedimentation and the existing swale grades in general. Where no houses or lots have been developed, the swale design would be suggested at the recommended flow line elevations to maintain overall master conveyance. Driveways would be effectively culverted, and additional storage volume would be provided within the excavated area.

The majority of the culverts within Pelican Reef have been installed in correctly for a variety of reasons. The list includes;

1) Undersized culverts, we observed culverts ranging from 4" to 18" throughout the project.
2) There culverts do not have enough cover to support the vehicle loads, and the culverts have been crushed, effectively reducing the pipes cross-sectional area.
3) The culverts have been sloped in the wrong direction.
4) The culvert material is not suitable for the stormwater use;
    a. Poly Vinyl Chloride (PVC) pipe without proposer cover,
    b. Corrugated metal pipe (CMP) that is rusted and corroding,
    c. Reinforced Concrete Pipe (RCP) that is Spalding from steel reinforcement corrosion due to exposure to saltwater, and
    d. High Density Poly Ethylene (HDPE) that has been continuously exposed to ultra-violet (UV) light.

Undeveloped lots should assume a 12-inch diameter culvert unless otherwise justified by these numbers for sizing and capacity.

3.4 SWALE VS. CULVERTED SYSTEMS

The most effective recommendation would be to minimize existing culverts and maximizing swale excavation. By designing a consistent flow line, the ponding behavior typically required to transfer to the next downstream sub-basin would be minimized. This would also relieve several of the homeowners' concerns relating to mosquito breeding areas and bacterial buildup associated.

Due to the increase in the average flow line elevations throughout the project area, the required improvements may be too extensive and costly to perform to each culvert already constructed. Although raising the existing profile would be the most functional alternative, it is not the most feasible given the current progress of the construction. Considering the costs associated with the demolition and reconstruction of the existing storm water infrastructure, additional solutions have also been evaluated for cost efficiency. These include those previously described, utilizing inlets to connect.

3.5 CONCEPTUAL DESIGN

To maximize the value of this project we are focusing on making modifications to the existing roadway system to increase the swale volume and quantity of stormwater passing through the system during a stormwater event. We are also attempting to minimize the volume of off-site (private) stormwater discharges into the system.

3.6 SWALE EVALUATION

We evaluated the swales in the following criteria.

3.6.1 FLOW LINE ABOVE SWALE AND SURROUNDING GRADE.

When the flow line is above the swale and surrounding grade, the existing stormwater flows escape the current swale volume and are not contained. Additional material needs to be added to the sides of these swales, developing a berm that will contain the flows (public) and not allow the flows to escape into the surrounding property private). The construction of a berm to the higher than the flow line will increase the swale volume and contain the stormwater flows within the public right -of-way.

3.6.2 FLOW LINE WITHIN SWALE.

When the flow line is within the swale and below the surrounding grade, the existing stormwater flows are contained within the current swale volume and can convey the stormwater flows to the discharge point. This the ideal situation, and the swale should be maintained to keep the calculated volume and quantity moving through the swale section.

3.6.3 FLOW LINE BELOW SWALE.

When the flow line is below the swale and below the surrounding grade, the existing stormwater flows are not contained within the current swale volume and cannot convey the stormwater flows to the discharge point. These swales need to be excavated to contain the stormwater flows.

The excavation of a berm to the higher than the flow line will increase the swale volume and contain the stormwater flows within the public right -of-way and keep the stormwater flows from the private land to be maintained separately.

How the flow travels through the culverts, ultimately is controlled by subcritical (inlet) and supercritical (outlet) flows and the design discharge is based on the geometrical characteristics of the culvert and should be optimized went able. This conceptual design may be adjusted as additional information becomes available.

3.7 CULVERT EVALUATION

We evaluated the culverts with the following criteria.

3.7.1 CULVERT ABOVE THE FLOW LINE

When the flow line is above the culvert, the culvert is submerged. In this condition, the culvert might become hydraulically short, or creating a hydraulic jump within the culvert, slowing down the velocity of the water through the culvert, and reducing the overall quantity of flow contained by the culvert.

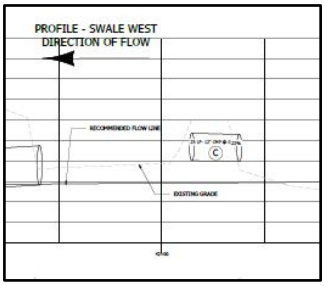


Figure 4: Culvert above Flow Line

3.7.2 FLOW LINE WITHIN CULVERTS

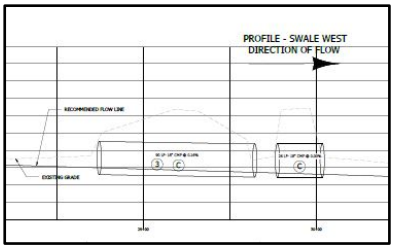


Figure 5:Flow Line within culvert

When the flow line is within the culvert, the culvert is vented and both the inlet and the outlet are not submerged. In this condition, the culvert can the flow at the maximum velocity with the flow within the culvert being mostly laminar. This is the ideal culvert situation for this project.

3.7.3 CULVERT BELOW FLOW LINE

When the flow line is below the culvert, the culvert is unused and does not connect the stormwater flows to pass through the culvert. These culverts need to be field adjusted and lowered into a new elevation compatible with the proposed hydraulic grade line.

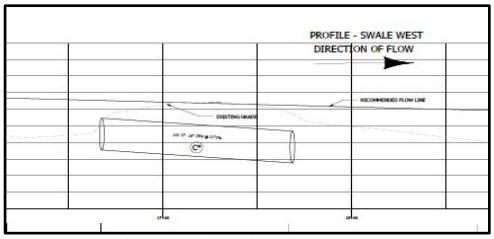


Figure 6: Culvert Below Flow line

3.8 DEVELOPMENT OF REVIEW CRITERIA

The Gulfstream team, then evaluated each section of the flow line in both the culvert and swales throughout the site. These criteria will provide substantial improvement to the quantity of stormwater flows for the project relative to the overall costs. The evaluation of the stormwater system was made with the following assumptions;

a. If the slope of the culvert is in the opposite direction of flow line slope, the culvert should be replaced.

b. If the flow line within the swale is below the swale bottom, the swale shall be excavated to the hydraulic grade line elevation. This excavated material would be used in other areas of the project.

c. If the flow line is above the swale, the excavated material will be used to create berms that will contain the stormwater flows within the swale.

d. If the flow lines are within the swale or culverts, the swale or culvert shall be cleaned, to verify that stormwater flows would be able to pass through the structures.

This information was used to develop the engineering cost for stormwater project. We have developed our opinion of costs utilizing the Florida Department of Transportation's (FDOT), Basis of Estimates, combined with recent contractor bids within the area, and bidding information collected by Gulfstream Design Group, LLC. We have assumed general conditions costs of 8% of unit cost. General conditions costs include construction administration costs, bid bonds, performance bonds, insurance, dust control, and jobsite housekeeping.

3.9 MAINTENANCE AND OPERATION

The most important aspect of an effective stormwater system is the consistent maintenance and operation of the system to ensure its efficiency. The following Table 3.9.1 is a summary of the activities required and the frequencies in which they should be performed

Table 3.9.1 Stormwater Facility Inspection Frequencies

Facility Type	Inspection Frequency	Timing
Management Facilities		
Ponds (Detention, Water Quality)	Annually	March - October
Control Structures (Swales, Manholes, Piping)	Annually	March - October
Conveyance System		
Catch Basins: <High priority area>	Annually	March - October
Roadside Swales	Annually	March - October
Culverts	Annually	March - October

3.10 INFRASTRUCTURE INSPECTION ACTIVITIES

The following best management practices (BMP's) apply to the maintenance of the stormwater collection and conveyance system, including catch basins and manholes, outfalls, culverts, swales, and drywells. Regular inspection and cleaning of catch basins and manholes should reduce the need for frequent cleaning of storm sewer culverts.

3.10.1 OPERATIONAL BMP'S ACTIVITIES

The following recommendations are made for the project's operational best management practices (bmp's)

a. Regularly inspect catch basins and outfalls according to the inspection schedule outlined in this O&M Plan to determine maintenance. Complete maintenance activities as identified during inspections.
b. Clean catch basins and manholes when sediment and debris exceed 60 percent of the sump depth or when sediment has accumulated to within 6 inches of the lowest culvert invert.
c. Clean storm sewer culverts when accumulated sediment and debris exceeds 20 percent of the culvert diameter.

d. Clean roadside swales when accumulated sediment and debris exceeds 20 percent of the design depth.
e. Conduct swale cleaning during low water periods, minimizing the disturbance of existing vegetation.
f. If required, test and dispose of sediment and debris according to the Waste Disposal Protocol in Appendix B.
g. Manage a “hot spot” list of frequent flooding locations. Conduct spot checks of those locations following major precipitation events, exceeding 1. inches of rainfall in any 24-hour period.
h. Implement Illicit Discharge Detection and Elimination Program to regularly inspect outfalls for evidence of unreported spills, illicit connections, or illegal dumping.
i. If feasible, stencil drywell and catch basin grates with, “Dump No Waste - Drains to Wetlands/Ocean."
j. Prioritize, schedule, and complete repairs and replace damaged components of the stormwater conveyance system identified during inspections.

3.10.2 STORMWATER MANAGEMENT FACILITY INSPECTION ACTIVITIES

The following BMPs apply to the maintenance of stormwater management facilities, including detention and infiltration ponds, underground tanks and vaults, treatment swales, oil/water separators, and proprietary treatment devices.

MAINTENANCE OF OPERATIONAL BMPS

a. Regularly inspect stormwater management facilities according to the inspection schedule outlined in this O&M Plan to determine maintenance. Complete maintenance activities as identified during inspections.
b. Remove sediment when it exceeds the sediment storage depth (typically 12 inches) in ponds or when it exceeds 15 percent of the vault storage depth or tank diameter.
c. Remove sediment when it exceeds a depth of 2 inches in treatment swales.
d. Conduct drive-by inspections of all stormwater management facilities following major precipitation events, exceeding 1. inches of rainfall in any 24-hour period.

MAINTENANCE OF VEGETATIVE MANAGEMENT BMPS

a. If needed, mow vegetation in ponds and swales at least once per year to prevent the establishment and buildup of woody vegetation. Once this vegetation is established, I watering can be completed.
b. If vegetation is removed and soil is exposed during sediment removal consider seeding and mulching the area as soon as possible after cleaning.
c. Mechanical methods of vegetation removal should be considered before the use of herbicides.

Section 4.0 RECCOMMENDATIONS FOR REPAIRS AND MAINTENANCE

There are multiple locations where there have been repeated stormwater challenges within the project site. These locations have been identified on the Project site Map shown on the location map, in Attachment B.

Various methods of water drainage do exist on the project site, including culverts, swales on one side of the road, swales on both side of the road, multiple drainage easements with outfalls to the surrounding wetlands. Much of the existing corrugated metal culverts has received sediments from the surrounding area, in some cases over 80% filled, reducing the discharge of stormwater flows, and/or the existing conveyance system have reached the end of their useful life.

4.1 DRAINAGE AREA 1

The first location of the concern is on Spartina Avenue, opposite of the stormwater treatment pond.

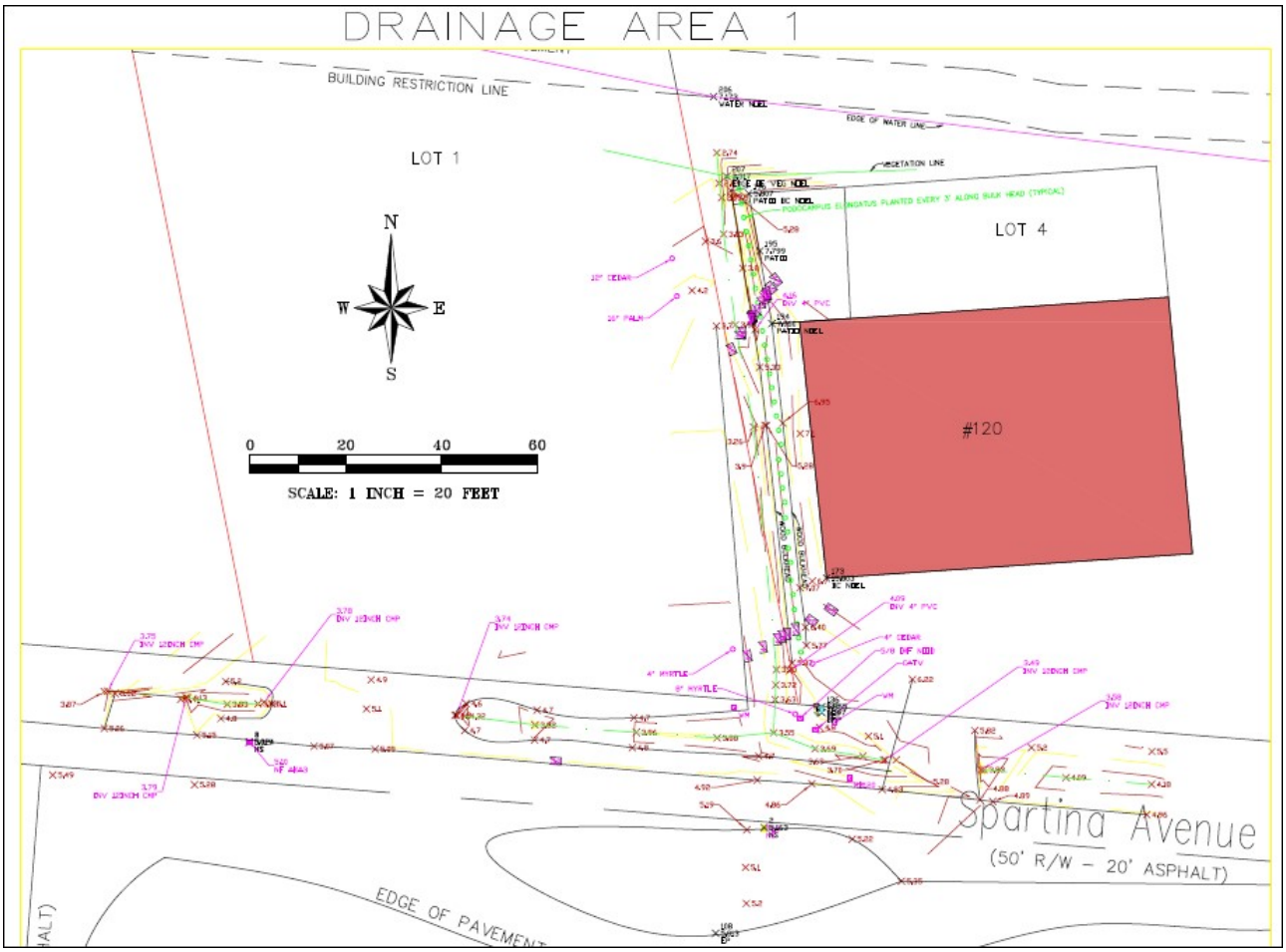


Figure 8: Drainage Area 1

There is an existing easement between Lots 1 and 4, that runs from the Spartina Avenue to the wetland. There is a concrete catch basin structure within the Spartina Avenue that collects the local stormwater flows. Adjacent to the catch basin is a high point, that redirects the stormwater flows away from the catch basin, See Figure 9 below. There is a high spot in the swale which is directly t causes the stormwater flows from the culverts to not flow downhill. This highpoint is shown in Figure 9. We also were able to find the discharge

end of the drainage pipe within the wetlands, see Figure 10. The discharge was clogged with vegetation, and flows were somewhat contained due to the vegetation and sediment within the drainage pipe.

Figure 9: 2018.10.26 18-024- Pelican Reef -116

Figure 10: 2018.10.26 18-024- Pelican Reef -121

Figure 11: 2018.10.26 18-024- Pelican Reef -114

4.1.1 SUGGESTED REPAIRS FOR DRAINAGE AREA 1

For Drainage Area 1, we make the following recommendations.

a. Flush and vacuum clean the +/- 120-foot storm drain line from catch basins to the wetland. This will allow the condition of the pipe and record that the pipe is clear, for the length of the pipe.

b. The culvert discharge pipe should have a headwall installed, to protect the upland, and a scour pad to dissipate the stormwater flow energy. This work can be completed with concrete rip-rap bags to be assembled in the field. The concrete rip-rap can be hand carried and assembled without heavy equipment.

c. The slope of the three lots eastward along the northside of Spartina Drive to flow eastward towards the catch basin in Lot 4, See Figure 11.

d. The driveway culvert in Lot 1, needs to be jet cleaned and inspected to verify that the whole cross-sectional area is available for use.

e. The swales adjacent to the catch basin should be sloped to the catch basin at a 1% slope toward the discharge catch basin.

4.2 DRAINAGE AREA 2

The Drainage Area 2 illustrates the watershed connection to the Drainage Area 1, to the stormwater pond. This swale is connected to a catch basin that discharges in the stormwater pond.

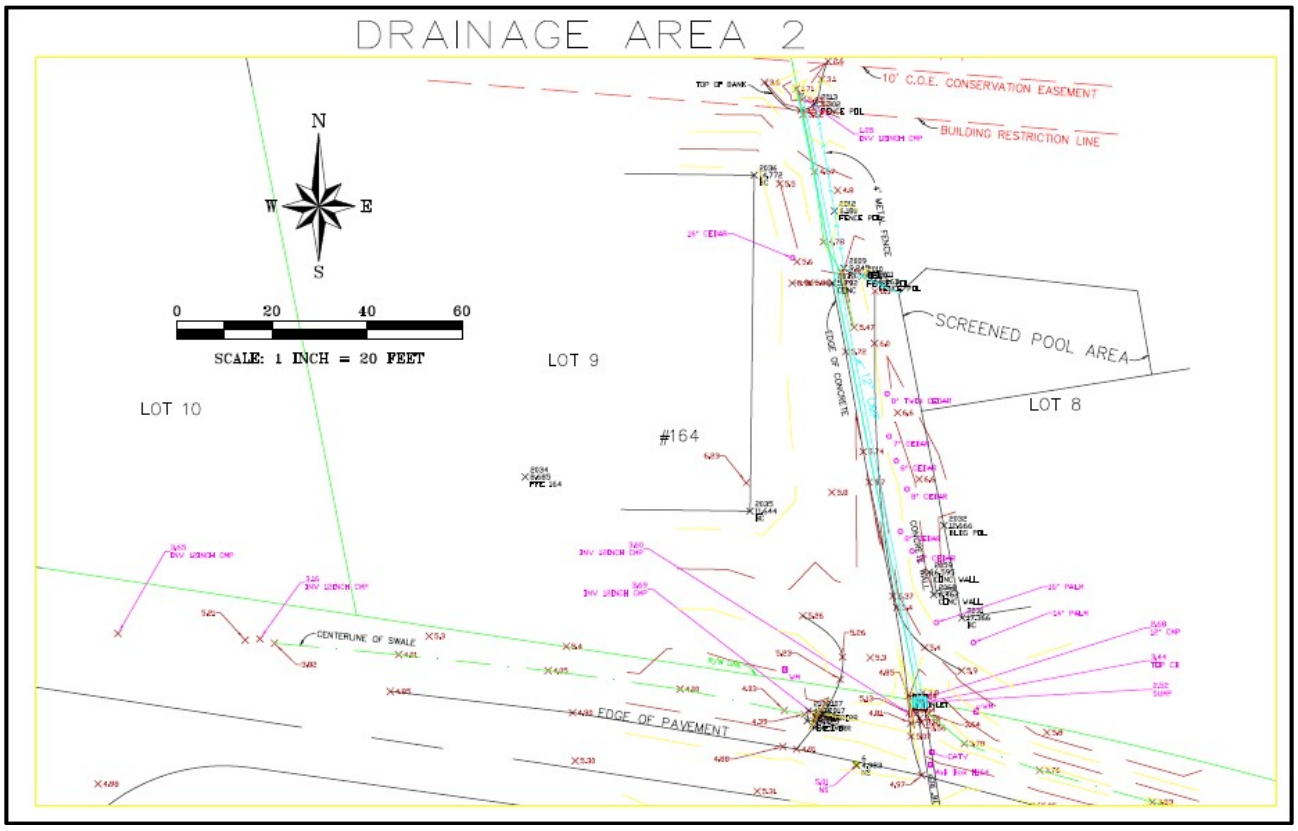


Figure 12: Drainage Area 2

The stormwater pond, shown in Figure 12, where discharge pipe is underwater. The scale collects stormwater flows into the collection catch basin.

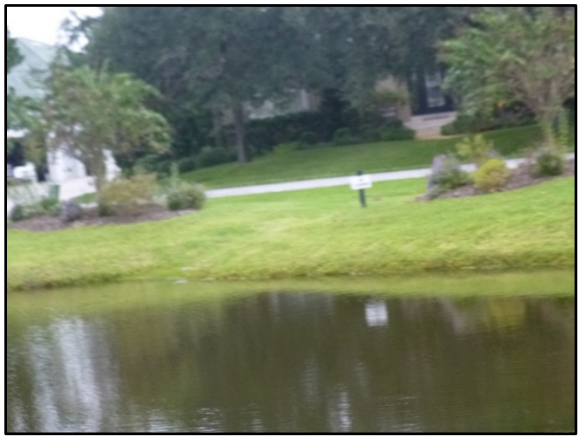


Figure 13: 2018.10.26 18-024- Pelican Reef -176

Figure 14: 2018.10.26 18-024- Pelican Reef -177

4.2.1 SUGGESTED REPAIRS FOR DRAINAGE AREA 2

For Drainage Area 2, we make the following recommendations.

a. Flush and vacuum clean the +/- 100-foot storm drain line from catch basins to the retention pond on the southside of Spartina Drive, as shown in Figure 12 and 13.

b. The swale shown in Figure 13, should be cleared, and that the upstream slopes to the catch basin.

c. The swales adjacent to the catch basin should be sloped to the catch basin at a 1% slope toward the discharge catch basin.

4.3 DRAINAGE AREA 3

The Drainage Area 3 illustrates the watershed connection to the Matanzas River from Pelican Reef Drive. This swale is connected to a catch basin that discharges in the stormwater pond and shown in Figure 17.

Figure 15:2018.06.13 - 18-024 - Pelican Reef - 16

Figure 16: 2018.06.13 - 18-024 - Pelican Reef - 17

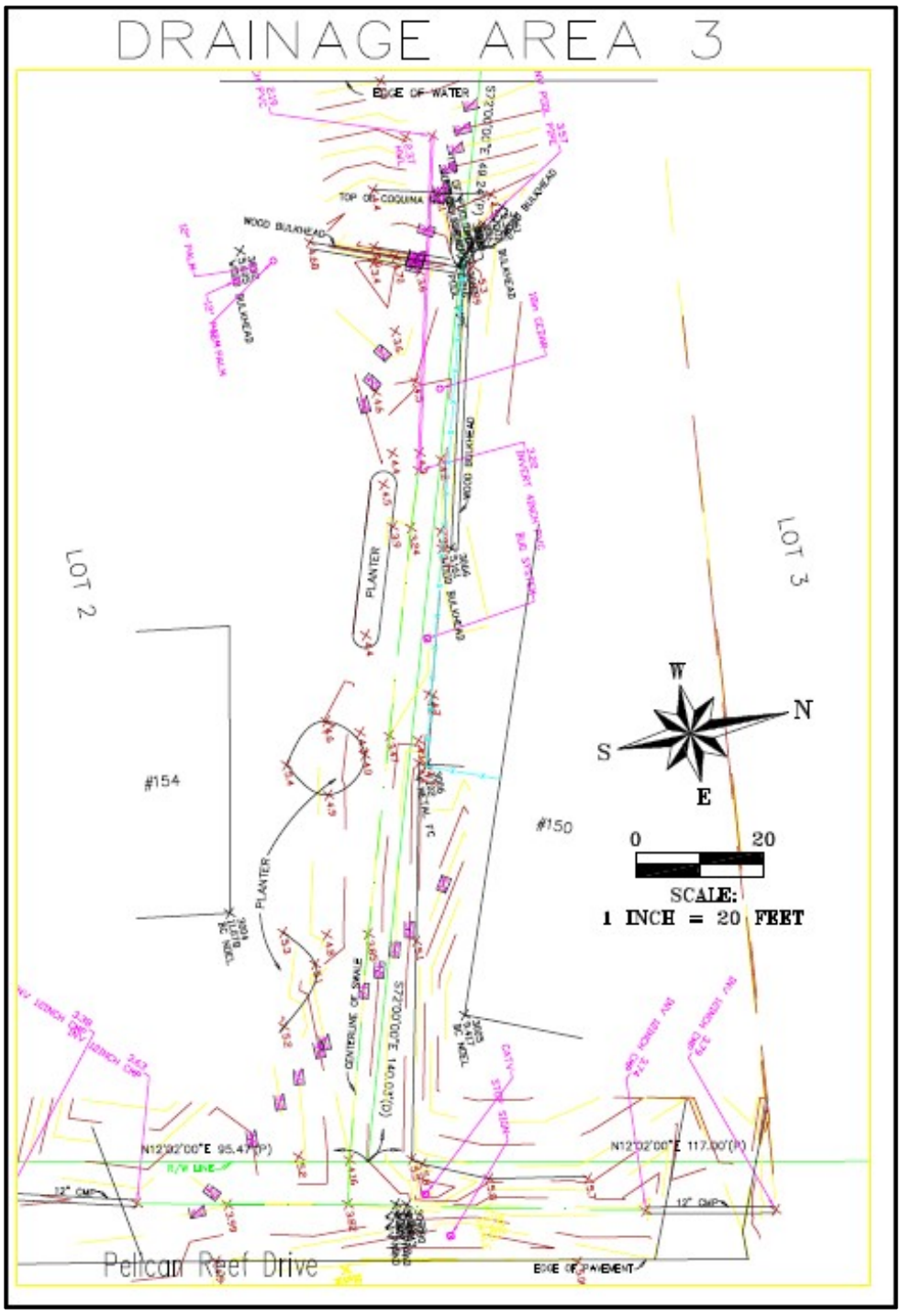


Figure 17: Discharge Area #3.

Figure 18: 2018.06.13 - 18-024 - Pelican Reef - 18

Figure 19: 2018.06.13 - 18-024 - Pelican Reef - 21

The swales on the east side of Pelican Reef Drive collection from the both north and south, to the drainage swale that discharges to the Matanzas River.

4.3.1 SUGGESTED REPAIRS FOR DRAINAGE AREA 3

For Drainage Area 3, we make the following recommendations.

a. The existing trees and landscaping hinder the stormwater discharges into the Matanzas River. Removal of the trees within the drainage swales needs to be completed. This should be a requirement of the homeowner's association.

b. The swales along Pelican Reef Drive need to be cleared, so that north and south swales flow towards the Matanzas River Discharge. The swales should be excavated so that they have a 1% slope to the discharge swale. In addition, the vegetation (sod) needs to cut down to allow the stormwater flows to enter the center channel of the swales.

4.4 DRAINAGE AREA 4

The Drainage Area 4 illustrates the watershed connection to the Matanzas River from Pelican Reef Drive, and is shown in Figure 20. This drainage easement has been blocked with a raise grades, and vegetation, and there are areas with mulch and erosion. There is a box in the middle of the swale by the drain causing drainage issues by blocking swale flow. A pool drains blocked discharge swale, and adds more water to a blocked system.

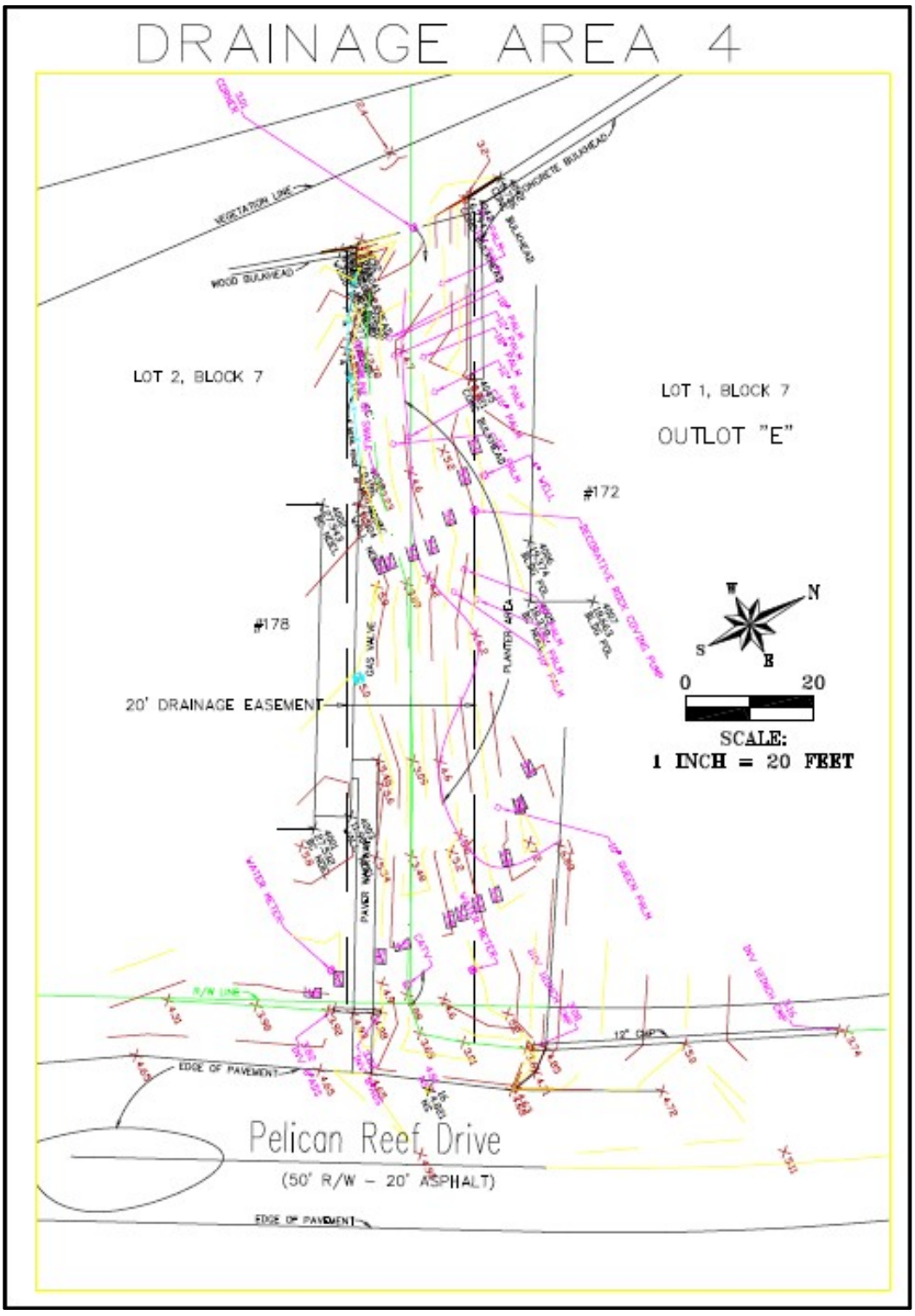


Figure 20: Drainage Area #4

Figure 21: 2018.06.13 - 18-024 - Pelican Reef - 22

Figure 22: 2018.06.13 - 18-024 - Pelican Reef - 24

Figure 23: 2018.06.13 - 18-024 - Pelican Reef - 25

Figure 24:2018.06.13 - 18-024 - Pelican Reef - 26

Figure 25: 2018.06.13 - 18-024 - Pelican Reef - 29

Figure 26: 2018.06.13 - 18-024 - Pelican Reef - 30

Figure 27: 2018.06.13 - 18-024 - Pelican Reef - 31

Figure 28: 2018.06.13 - 18-024 - Pelican Reef - 32

Figure 29: 2018.06.13 - 18-024 - Pelican Reef - 33

Figure 30: 2018.06.13 - 18-024 - Pelican Reef - 34

4.4.1 SUGGESTED REPAIRS FOR DRAINAGE AREA 4

For Drainage Area 4, we make the following recommendations.

a. The existing trees and landscaping hinder the stormwater discharges into the Matanzas River. Removal of the trees within the drainage swales needs to be completed. This should be a requirement of the homeowner's association.

b. The swales along Pelican Reef Drive need to be cleared, so that north and south swales flow towards the Matanzas River Discharge. The swales should be excavated so that they have a 1% slope to the discharge swale. In addition, the vegetation (sod) needs to cut down to allow the stormwater flows to enter the center channel of the swales.

c. The existing drainage pipe should be jetted clean to determine if the pipe is not obstructed, and maintains flow throughout the pipe. All roots and vegetation should be removed from the discharge of the pipe.

d. The pool discharge should be removed and discharged where the flows will not enter the drainage awake.

4.5 DRAINAGE AREA 5

The Drainage Area 5 illustrates the watershed connection to the Matanzas River from Pelican Reef Drive and is shown in Figure 31. This drainage easement has been blocked with a raise grades, and vegetation, and there are areas with mulch and erosion. There is a box in the middle of the swale by the drain casing drainage issues by blocking flow and a pool drain blocked discharge.

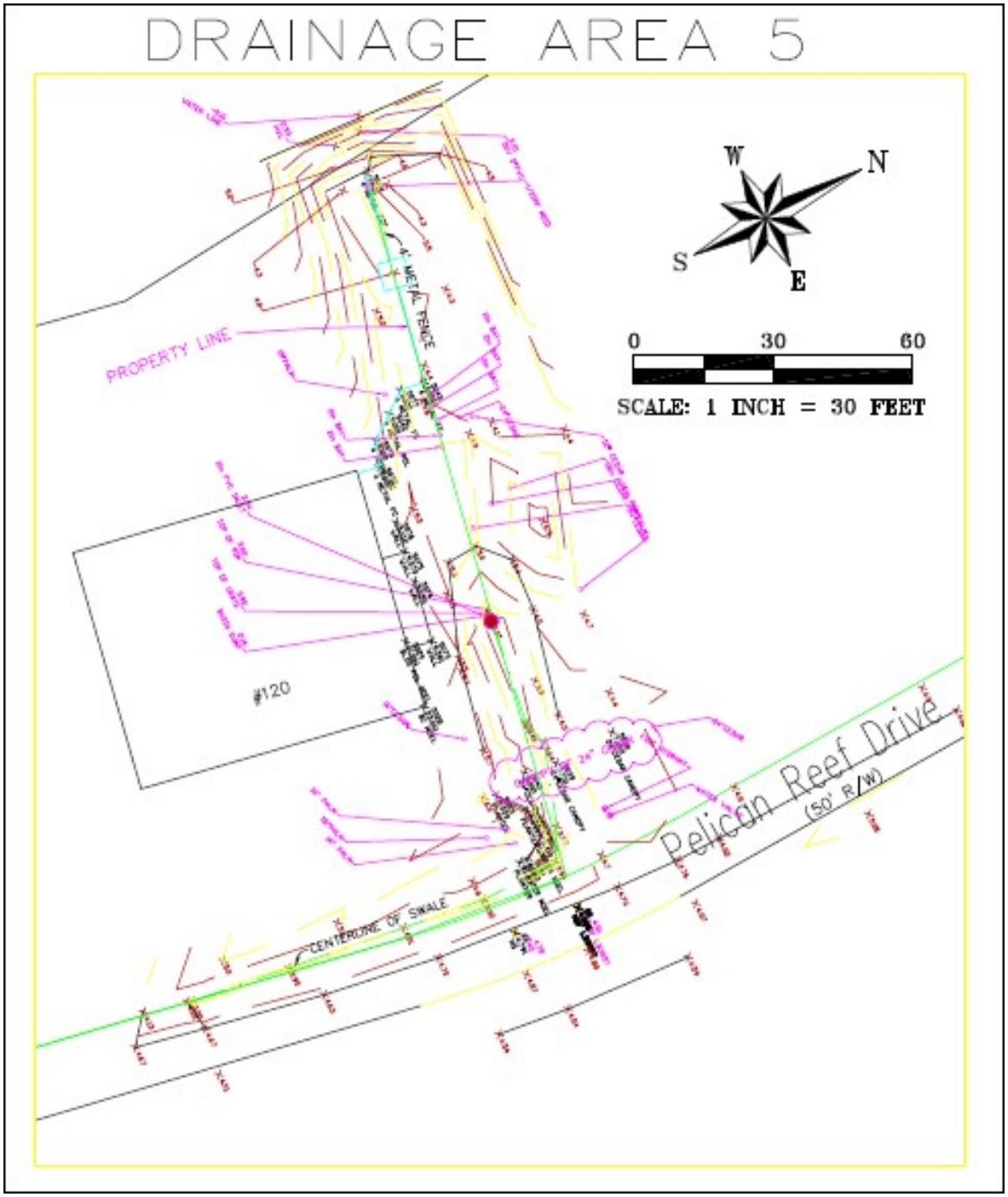


Figure 31: Drainage Area #5

4.5.1 SUGGESTED REPAIRS FOR DRAINAGE AREA 5

For Drainage Area 5, we make the following recommendations.

a. The existing trees and landscaping hinder the stormwater discharges into the Matanzas River. Removal of the trees within the drainage swales needs to be completed. This should be a requirement of the homeowner's association.

b. The swales along Pelican Reef Drive need to be cleared, so that north and south swales flow towards the Matanzas River Discharge. The swales should be excavated so that they have a 1% slope to the discharge swale. In addition, the vegetation (sod) needs to cut down to allow the stormwater flows to enter the center channel of the swales.

c. The existing drainage pipe should be jetted clean to determine if the pipe is not obstructed, and maintains flow throughout the pipe. All roots and vegetation should be removed from the discharge of the pipe.

4.6 DRAINAGE AREA 6

The Drainage Area 6 illustrates the watershed connection to the Matanzas River from Pelican Reef Drive in Figure 34. This drainage easement has been blocked with a raise grades, and vegetation, and there are areas with mulch and erosion.

Figure 12: 2018.10.26 18-024- Pelican Reef -140

Figure 23: 2018.10.26 18-024- Pelican Reef -141

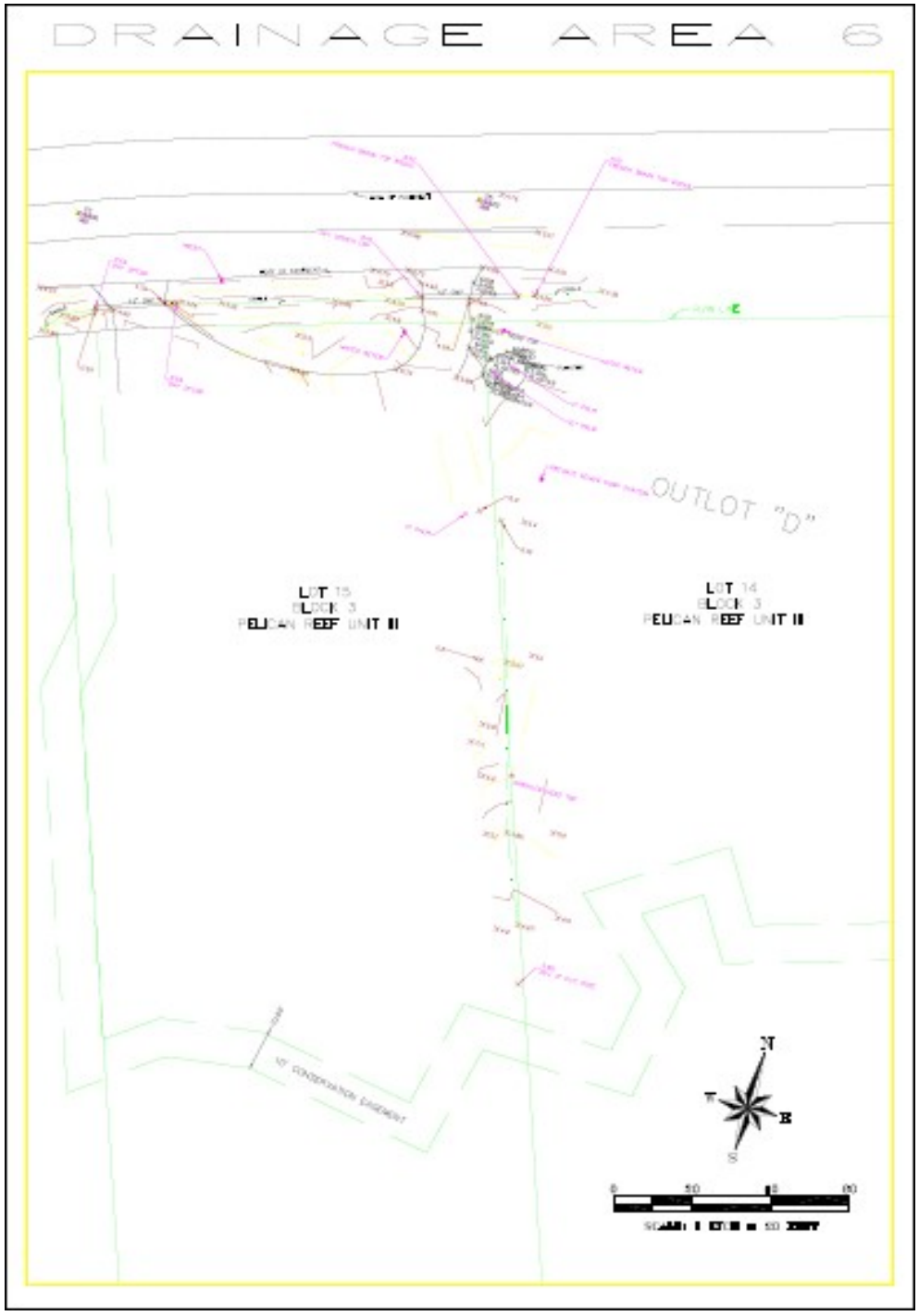


Figure 34 Drainage Area #6

4.6.1 SUGGESTED REPAIRS FOR DRAINAGE AREA 6

For Drainage Area 6, we make the following recommendations.

a. The swales along Pelican Reef Drive need to be cleared, so that north and south swales flow towards the Matanzas River Discharge. The swales should be excavated so that they have a 1% slope to the discharge swale. In addition, the vegetation (sod) needs to cut down to allow the stormwater flows to enter the center channel of the swales.

4.7 DRAINAGE AREA 7

The Drainage Area 7 illustrates the watershed connection to the Matanzas River from Pelican Reef Drive as shown in Figure 34. This drainage easement has been blocked with a raise grades, and vegetation, and there are areas with mulch and erosion.

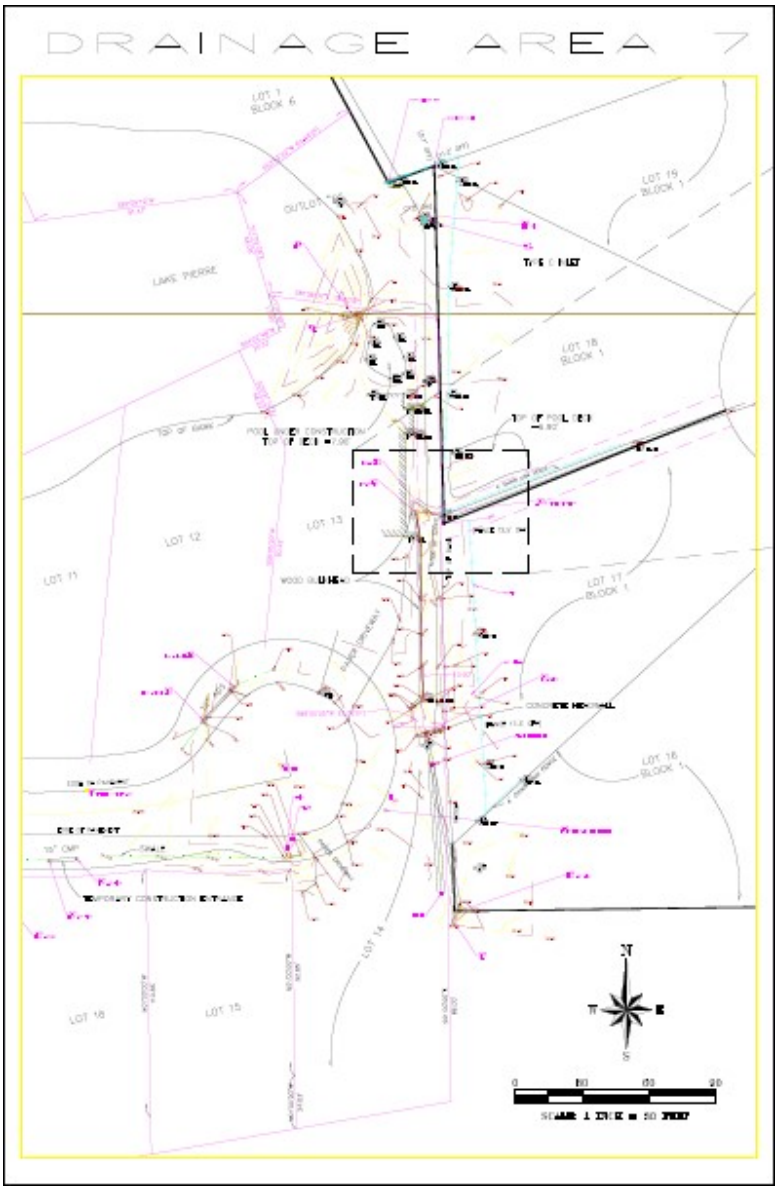


Figure 34 Drainage Area #7

4.7.1 SUGGESTED REPAIRS FOR DRAINAGE AREA 7

For Drainage Area 7, we make the following recommendations.

a. Flush and vacuum clean the +/- 120-foot storm drain line from catch basins structure. This will allow the condition of the pipe and record that the pipe is clear, for the length of the pipe.

b. Clean the catch basin and the pipe from the swale to the Lake Pierre discharge. Install concrete rip=rap headwall on the intake pipe from swale.

c. The swales adjacent to the catch basin should be sloped to the catch basin at a 1% slope toward the discharge wetland.

4.8 UNIT COSTS FOR REPAIR RECOMMENDATIONS

We have developed our opinion of costs utilizing the Florida Department of Transportation's (FDOT), Basis of Estimates, combined with recent contractor bids within the area, and bidding information collected by Gulfstream Design Group, LLC. We have assumed general conditions costs of 8% of unit cost. General conditions costs include administrative costs, bid bonds, performance bonds, insurance, dust control and housekeeping. See Attachment D for the Engineers Opinion of Probable Cost.

The Maintenance and Repair items evaluated were broken into five specific tasks;

a. Replace the Existing Culvert Pipe Task with Catch Basin Installation;
b. Clean the Existing Pipe;
c. Install a Concrete Rip-Rap Headwall;
d. Swale Excavation and Cleaning;
e. Installation of a Duck-Billed Tidal Check Valve; and
f. *Sod Restoration*.

The *Replace the Existing Culvert Pipe Task with Catch Basin Installation*, is the construction task to remove and replace undersized, clogged, or culverts that slope in the opposite direction of the hydraulic grade line. This task's cost includes the excavation of the existing pipe, removal of pipe, backfill, compaction, and the installation of new 18-inch diameter High Density Poly-Ethylene Pipe (HDPE) with the appropriate cover, and restoration to the existing conditions. We have estimated installation costs for these tasks to be $85.00 per l.f.

The Catch Basin installation will be the installation of a 24 x 36 -inch catch basin with a rim and grate. The catch basins structure will have openings for the inverts, as well a knock-out holes for the connection of rainwater leaders from the adjacent property. The knock-out holes are precast wall sections that have been cut into the proposed catch basin structures so that the contractor can easily remove for connection. This task will include excavation, dewatering, backfill, compaction, grouting of the pipe connection, and installation of rainwater leader with grouting. The installation of the catch basin will $1,500.00 for each structure.

Catch basins installed within a swale will have the top of the catch basins raised approximately 2-inches above the invert of the swale. The top of the structure will act similar to a weir and allow the stormwatr to have treatment within the swales, prior to discharge to the surrounding area.

This system shall be water-tight. The project's drainages system is currently inundated with ground water, and inhibiting the system flow.

Figure 35, below illustrates the proposed catch basin and culvert installation connections.

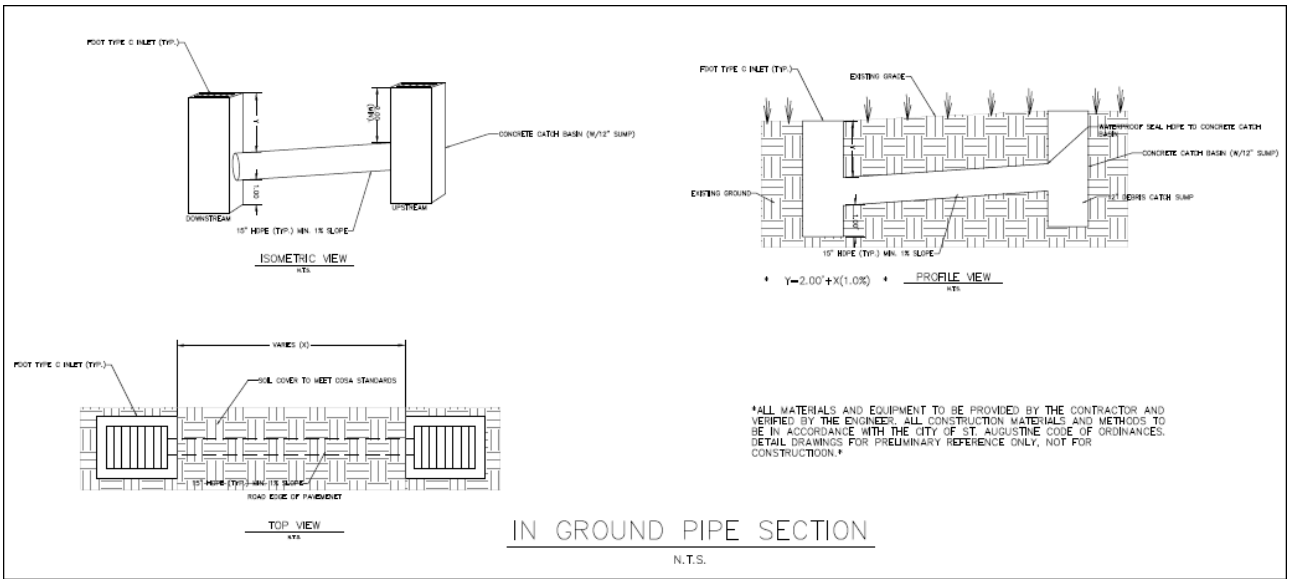


Figure 35: Sketch of In ground pipe sections

The *Clean the Existing Pipe* is the construction task to remove blockages and clogs in the culverts piping. This task's cost includes the cleaning of the existing pipe by a jet-head for each pipe. Any manhole or catch basin structure attached the line will also be cleaned and inspected. We have estimated installation costs for these tasks to be $35.00 per l.f.

The *Install a Concrete Rip-Rap Headwall* is the construction task to provide erosion and sedimentation protection to the pipe discharges. This task's cost includes the installation of a concrete rip-rap bags to form a headwall and scour pad. We have estimated installation costs for these tasks to be $350.00 per l.f.

The *Swale Excavation and Cleaning* is the construction task to remove blockages and clogs in the existing stormwater swales. This task cost includes the cleaning of the existing swales. All obstacles in the swale will be removed if possible, as well as landscaping. The swales would then be graded to slope towards the stormwater discharges at a 1% slope. We have estimated installation costs for these tasks to be $50.00 per l.f. This swale is to be installed within 10 l.f. of the Edge of Pavement, within the H.O.A. easement.

The *Install a Duck-Billed Tidal Check Valve* is the construction task to install the valve at the discharge end of the culvert system. This valve shall be attached to culvert end, and supported with the concrete rip-rap bags, similar to the headwall construction. We have estimated installation costs for these tasks to be $6,000.00 each.

The *Sod Restoration* is the construction task to restore the 10 l.f. H.O.A. easement to its previous conditions, with sod for all excavation and regrading work. This task including supplying the material, and installation of material. We have estimated installation costs for these tasks to be $2.75 per sq. yd installed. We have made an estimate of $10,000.00 for sod restoration, approximately 3,200 l.f. of 10 l.f. wide sod placement.

4.9 UNIT COSTS FOR REPAIR RECOMMENDATIONS

We have completed an evaluation of the repair costs for each Drainage Area, by the type of work required, in Attachment D. The Full Engineer's Opinion of Probable Cost is shown in Attachment E. A summary is shown below in Table 4.9.1

Engineering Opinion of Probable Cost

Pelican Reef Stormwater Improvements- Revision #1

Summary

Drainage Area	Cost Per Area
Drainage Area 1	$28,100.00
Drainage Area 2	$16,850.00
Drainage Area 3	$7,875.00
Drainage Area 4	$10,500.00
Drainage Area 5	$7,000.00
Drainage Area 6	$10,500.00
Drainage Area 7	$14,350.00
Sod Restoration	$10,000.00
Project Total	$105,175.00
Contingency (10%)	$10,517.50
Project Overall Total Cost	$115,692.50

Table 4.9.1 Summary of Costs

END OF REPORT

ATTACHMENT A. GDG SITE OBSERVATION ON JUNE 13, 2018

SITE VISIT MEMORANDUM

To: **Pelican Reef**

From: **Gulfstream Design Group**

Date: **June 13th, 2018**

Re: **GDG 18-024, Pelican Reef** **Number Pages:**

A meeting was held on June 13th, 2018, at Pelican Reef regarding the 18-024, Pelican Reef project. The topic of this meeting was to discuss surveying work along with project status.

In attendance were:

Name	Representing	Name	Representing
Jason Forest	Forest Builders		
Brandon Sugart	IME Civil		
Angel Sugart	IME Civil		
Matt Lahti, P.E.	Gulfstream Design Group		
Justin Spicer	Gulfstream Design Group		

Items discussed included:

1. Location 1
   A. There is an easement along the bulkhead
   B. There is a high spot in the swale which is causing the flow from the culverts to not flow properly.
      a. Survey should show where the water stops are in all locations and any outstanding locations outside of the locations.
   C. The surveyor needs to have topographic cross sections of the road and the drainage easements leading to any outfalls.

D. Location 1 was at 120 to 128.
E. Pictures of Location 1:

2018.06.13 - 18-024 - Pelican Reef - 5

2018.06.13 - 18-024 - Pelican Reef - 6

2018.06.13 - 18-024 - Pelican Reef - 7

2. Location 2
   A. IME Civil, Forest Builders, and Gulfstream Design Group need to get ahold of the sewer detail in location 2.
      a. The piping at the sewer should not be there according to the approved plans, the whole neighborhood was supposed to have swales and only piping under roads and driveways.
   B. The pipe outfall is in the marsh causing backflow in the storm water system.
      a. There are large quantities of standing water around the Pelican Reef site and the reason is due to the backflow in the storm water system along with other types of blockages.
   C. IME Civil will need to have a cross section of where the swale dumps into the pond.
   D. Pictures of Location 2:

2018.06.13 - 18-024 - Pelican Reef - 8

2018.06.13 - 18-024 - Pelican Reef - 9

2018.06.13 - 18-024 - Pelican Reef - 10

2018.06.13 - 18-024 - Pelican Reef - 11

2018.06.13 - 18-024 - Pelican Reef - 12

2018.06.13 - 18-024 - Pelican Reef - 13

2018.06.13 - 18-024 - Pelican Reef - 14

2018.06.13 - 18-024 - Pelican Reef - 15

2018.06.13 - 18-024 - Pelican Reef - 16

2018.06.13 - 18-024 - Pelican Reef - 17

2018.06.13 - 18-024 - Pelican Reef - 18

2018.06.13 - 18-024 - Pelican Reef - 19

2018.06.13 - 18-024 - Pelican Reef - 20

2018.06.13 - 18-024 - Pelican Reef - 21

3. Location 3
   A. According to the approved set of plans there is supposed to be a pipe under the roadway so any water on the parcel across the street from the marsh can drain to the swale so the water can further drain into the marsh.
   B. Location 3 needs a topographic survey.
   C. Forest Builders wants the land the company is building on marked.
   D. There is an issue with drainage in the swale leading towards the marsh due to trees being inside the swale.
      a. Theses trees are to be cleared which will be good for peak storm events.
   E. Everyone in the Pelican Reef subdivision has a grinder pump leading to pressure being low in the area.
   F. Functionality will be restored based on the intent of the originally approved storm water system.
   G. Pictures of Location 3:

2018.06.13 - 18-024 - Pelican Reef - 22

2018.06.13 - 18-024 - Pelican Reef - 23

2018.06.13 - 18-024 - Pelican Reef - 24

4. Location 4
   A. There is a box in the middle of the swale by the drain casing drainage issues by blocking flow.
   B. The water outfall in this location is also to the marsh.
   C. There is an illegal pool drain outfalling into the marsh.
   D. Pictures of Location 4:

2018.06.13 - 18-024 - Pelican Reef - 25

2018.06.13 - 18-024 - Pelican Reef - 26

2018.06.13 - 18-024 - Pelican Reef - 27

2018.06.13 - 18-024 - Pelican Reef - 28

2018.06.13 - 18-024 - Pelican Reef - 29

2018.06.13 - 18-024 - Pelican Reef - 30

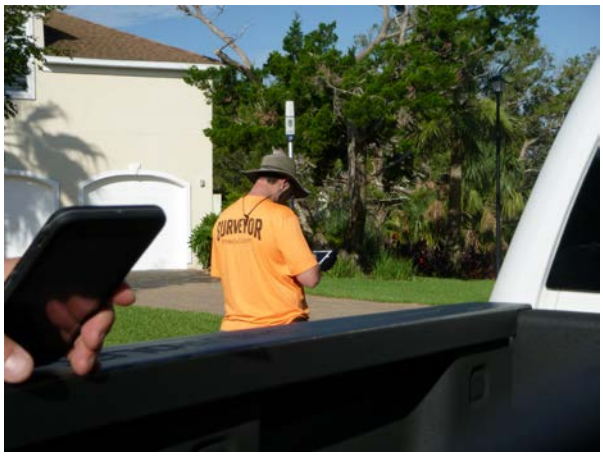
2018.06.13 - 18-024 - Pelican Reef - 31

2018.06.13 - 18-024 - Pelican Reef - 32

2018.06.13 - 18-024 - Pelican Reef - 33

2018.06.13 - 18-024 - Pelican Reef - 34

5. Addition Information
   A. Need as much of the survey done as possible for the meeting on Monday the 18th with the St. Johns River Water Management District (SJRWMD).
      a. Two (2) 24”x36” surveys with all 4 locations.
   B. Forest Builders noted that there are concerns that modifying existing property may create additional flooding in the Pelican Reef subdivision.
   C. There will be additional surveying of surrounding properties.



2018.06.13 - 18-024 - Pelican Reef - 1

2018.06.13 - 18-024 - Pelican Reef - 2

2018.06.13 - 18-024 - Pelican Reef - 3

2018.06.13 - 18-024 - Pelican Reef - 4

Action Items	Responsibility	Date Assigned	Date Due
Attend Meeting on Monday the 18th with the St. Johns River Water Management District (SJRWMD)	Gulfstream Design Group Forest Builders	June 13th, 2018	June 18th, 2018
Topographic Survey	IDE Civil	June 13th, 2018	June 18th, 2018

END OF MEMORANDUM

ATTACHMENT B. GDG RECOMMENDATIONS ON OCTOBER 29, 2018

Memorandum

To: Pelican Reef Homeowners Association.
Jason Forrest

From: Michael Whelan, P.E.
Gulfstream Design Group

Date: October 29, 2018

Re: GDG #18-024
Preliminary Stormwater Recommendation **Number Pages: 19**

On October 25 2018, Gulfstream Design Group, LLC performed site observation at the Pelican Reef Homeowners Association.

Please see the attached site observation photographs, See Attachment A.

We see that there are approximately 30 lots that need to have adjustments made within the right of way, that directly influence the hydraulic grade line. These right-of-way swales need to be excavated, to flow in the same direction as the hydraulic grade line, and in some cases the piping under the driveways need to be adjusted as well.

We also recommend that the piping system that discharges through the stormwater treatment pond on the eastern side of Pelican Reef be, jet cleaned and inspection. In addition, a headwall and scour pad need to be installed at the pipe end in the wetland.

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End of Memorandum

Gulfstream Design Group, LLC
906A Anastasia Blvd. | St. Augustine, FL 32080
Tel. 904.794.4231
www.gulfstreamdesign.com

Attachment A

Site Observation on October 25, 2018

Figure 1: 2018.10.26 18-024- Pelican Reef -100

Figure 2: 2018.10.26 18-024- Pelican Reef -101

Figure 3: 2018.10.26 18-024- Pelican Reef -102

Figure 4: 2018.10.26 18-024- Pelican Reef -103

Figure 5: 2018.10.26 18-024- Pelican Reef -104

Figure 6: 2018.10.26 18-024- Pelican Reef -105

Figure 7: 2018.10.26 18-024- Pelican Reef -106

Figure 8: 2018.10.26 18-024- Pelican Reef -107

Figure 9: 2018.10.26 18-024- Pelican Reef -108

Figure 10: 2018.10.26 18-024- Pelican Reef -109

Figure 11: 2018.10.26 18-024- Pelican Reef -110

Figure 12: 2018.10.26 18-024- Pelican Reef -111

Figure 13: 2018.10.26 18-024- Pelican Reef -112

Figure 14: 2018.10.26 18-024- Pelican Reef -113

Figure 15: 2018.10.26 18-024- Pelican Reef -114

Figure 16: 2018.10.26 18-024- Pelican Reef -115

Figure 17: 2018.10.26 18-024- Pelican Reef -116

Figure 18: 2018.10.26 18-024- Pelican Reef -117

Figure 19: 2018.10.26 18-024- Pelican Reef -118

Figure 20: 2018.10.26 18-024- Pelican Reef -119

Figure 21: 2018.10.26 18-024- Pelican Reef -120

Figure 22: 2018.10.26 18-024- Pelican Reef -121

Figure 23: 2018.10.26 18-024- Pelican Reef -122

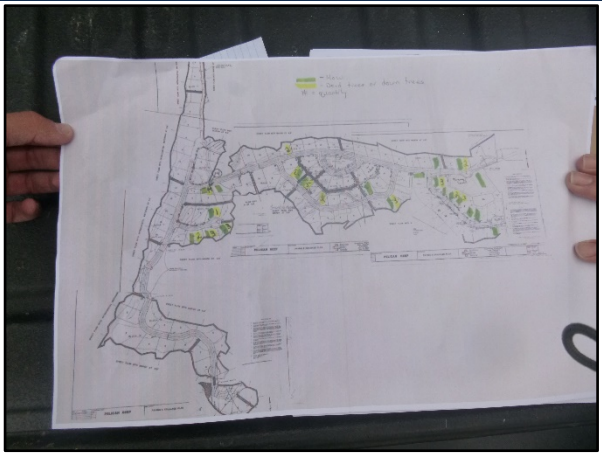

Figure 24: 2018.10.26 18-024- Pelican Reef -123

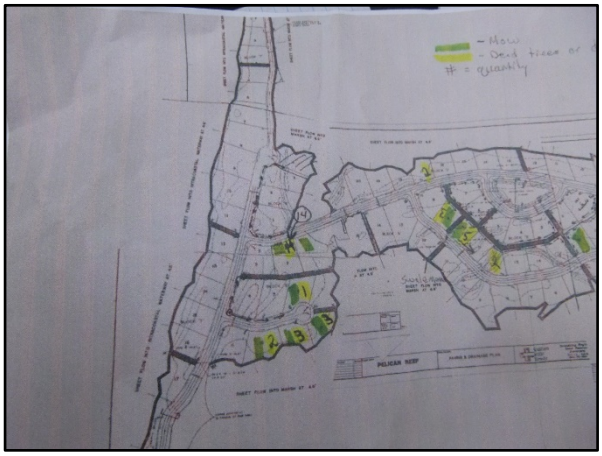

Figure 25: 2018.10.26 18-024- Pelican Reef -124

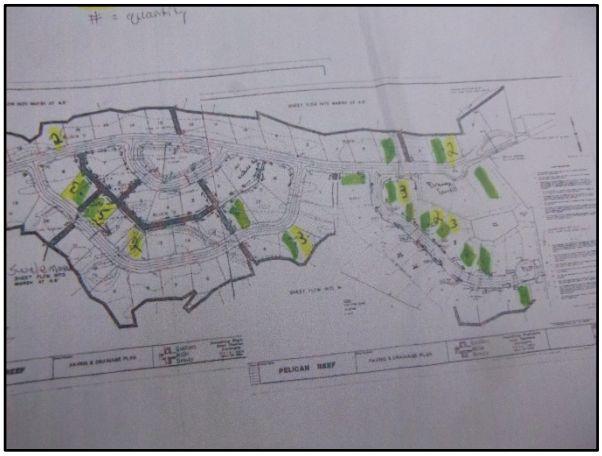

Figure 26: 2018.10.26 18-024- Pelican Reef -125

Figure 27: 2018.10.26 18-024- Pelican Reef -126

Figure 28: 2018.10.26 18-024- Pelican Reef -127

Figure 29: 2018.10.26 18-024- Pelican Reef -128

Figure 30: 2018.10.26 18-024- Pelican Reef -129

Figure 31: 2018.10.26 18-024- Pelican Reef -130

Figure 32: 2018.10.26 18-024- Pelican Reef -131

Figure 33: 2018.10.26 18-024- Pelican Reef -132

Figure 34: 2018.10.26 18-024- Pelican Reef -133

Figure 35: 2018.10.26 18-024- Pelican Reef -134

Figure 36: 2018.10.26 18-024- Pelican Reef -135

Figure 37: 2018.10.26 18-024- Pelican Reef -136

Figure 38: 2018.10.26 18-024- Pelican Reef -137

Figure 39: 2018.10.26 18-024- Pelican Reef -138

Figure 40: 2018.10.26 18-024- Pelican Reef -139

Figure 41: 2018.10.26 18-024- Pelican Reef -140

Figure 42: 2018.10.26 18-024- Pelican Reef -141

Figure 43: 2018.10.26 18-024- Pelican Reef -142

Figure 44: 2018.10.26 18-024- Pelican Reef -143

Figure 45: 2018.10.26 18-024- Pelican Reef -144

Figure 46: 2018.10.26 18-024- Pelican Reef -145

Figure 47: 2018.10.26 18-024- Pelican Reef -146

Figure 48: 2018.10.26 18-024- Pelican Reef -147

Figure 49: 2018.10.26 18-024- Pelican Reef -148

Figure 50: 2018.10.26 18-024- Pelican Reef -149

Figure 51: 2018.10.26 18-024- Pelican Reef -150

Figure 52: 2018.10.26 18-024- Pelican Reef -151

Figure 53: 2018.10.26 18-024- Pelican Reef -152

Figure 54: 2018.10.26 18-024- Pelican Reef -153

Figure 55: 2018.10.26 18-024- Pelican Reef -154

Figure 56: 2018.10.26 18-024- Pelican Reef -155

Figure 57: 2018.10.26 18-024- Pelican Reef -156

Figure 58: 2018.10.26 18-024- Pelican Reef -157

Figure 59: 2018.10.26 18-024- Pelican Reef -158

Figure 60: 2018.10.26 18-024- Pelican Reef -159

Figure 61: 2018.10.26 18-024- Pelican Reef -160

Figure 62: 2018.10.26 18-024- Pelican Reef -161

Figure 63: 2018.10.26 18-024- Pelican Reef -162

Figure 64: 2018.10.26 18-024- Pelican Reef -163

Figure 65: 2018.10.26 18-024- Pelican Reef -164

Figure 66: 2018.10.26 18-024- Pelican Reef -165

Figure 67: 2018.10.26 18-024- Pelican Reef -166

Figure 68: 2018.10.26 18-024- Pelican Reef -167

Figure 69: 2018.10.26 18-024- Pelican Reef -168

Figure 70: 2018.10.26 18-024- Pelican Reef -169

Figure 71: 2018.10.26 18-024- Pelican Reef -170

Figure 72: 2018.10.26 18-024- Pelican Reef -171

Figure 73: 2018.10.26 18-024- Pelican Reef -172

Figure 74: 2018.10.26 18-024- Pelican Reef -173

Figure 75: 2018.10.26 18-024- Pelican Reef -174

Figure 76: 2018.10.26 18-024- Pelican Reef -175

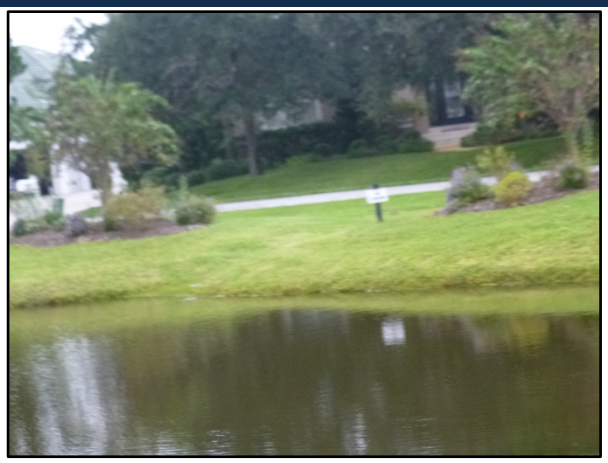

Figure 77: 2018.10.26 18-024- Pelican Reef -176

Figure 78: 2018.10.26 18-024- Pelican Reef -177

Figure 79: 2018.10.26 18-024- Pelican Reef -178

Figure 80: 2018.10.26 18-024- Pelican Reef -179

Figure 81: 2018.10.26 18-024- Pelican Reef -180

Figure 82: 2018.10.26 18-024- Pelican Reef -181

Figure 83: 2018.10.26 18-024- Pelican Reef -182

Figure 84: 2018.10.26 18-024- Pelican Reef -183

Figure 85: 2018.10.26 18-024- Pelican Reef -184

Figure 86: 2018.10.26 18-024- Pelican Reef -185

Figure 87: 2018.10.26 18-024- Pelican Reef -186

Figure 88: 2018.10.26 18-024- Pelican Reef -187

Figure 89: 2018.10.26 18-024- Pelican Reef -188

Figure 90: 2018.10.26 18-024- Pelican Reef -189

Figure 91: 2018.10.26 18-024- Pelican Reef -190

Figure 92: 2018.10.26 18-024- Pelican Reef -191

Figure 93: 2018.10.26 18-024- Pelican Reef -192

Figure 94: 2018.10.26 18-024- Pelican Reef -193

Figure 95: 2018.10.26 18-024- Pelican Reef -90

Figure 96: 2018.10.26 18-024- Pelican Reef -91

Figure 97: 2018.10.26 18-024- Pelican Reef -92

Figure 98: 2018.10.26 18-024- Pelican Reef -93

Figure 99: 2018.10.26 18-024- Pelican Reef -94

Figure 100: 2018.10.26 18-024- Pelican Reef -95

Figure 101: 2018.10.26 18-024- Pelican Reef -96

Figure 102: 2018.10.26 18-024- Pelican Reef -97

Figure 103: 2018.10.26 18-024- Pelican Reef -98

Figure 104: 2018.10.26 18-024- Pelican Reef -99

.

ATTACHMENT C. ENGINEER'S OPINION OF PROBABLE COST

Engineering Opinion of Probable Cost

Pelican Reef Stormwater Improvements= Revision #1

DRAFT

18-024

Drainage Area	*Length*	*Replace Pipe Culvert - 18" HDPE (LF)*	*Replace Pipe Culvert Cost $85/LF*	*Catch Basin Installation EA*	*Catch Basin Installation $1500/EA*	*Pipe Cleaning Quantity(LF)*	*Pipe Cleaning Cost $35/LF*	*Concrete Rip-Rap Headwall Quantity (Unit)*	*Concrete Rip-Rap Headwall Cost $350/Unit*	*Swale Excavation and Cleaning (LF)*	*Swale Excavation and Cleaning Cost $35/LF*	*Duck- Billed Tidal Check Valve (EA)*	*Duck- Billed Tidal Check Valve $6000 (EA)*
										Drainage Area 1 Total			***$28,100.00***
Drainage Area 1													
Clean and Flush	170					170.00	$5,950.00						
Install headwall	1							1	$350.00				
Install Duck Billed Tidal Valve												1	$6,000.00
Reslope drainage swale	200									250.00	$8,750.00		
Replace driveway culvert	30	30	$2,550.00										
Catch Basin	3			3.00	$4,500.00								
										Drainage Area 2 Total			***$16,850.00***
Drainage Area 2													
Clean and Flush	130					100	$3,500.00						
Install headwall	1							1	$350.00			1	$6,000.00
Reslope drainage swale	220									200	$7,000.00		
										Drainage Area 3 Total			***$10,500.00***
Drainage Area 3													
Remove Landscaping that is blocking the swale	100									100	$3,500.00		
Reslope drainage swale	200									200	$7,000.00		
										Drainage Area 4 Total			***$7,875.00***
Drainage Area 4													
Clean and Flush	50					50	$1,750.00						
Remove Landscaping that is blocking the swale	50									50	$1,750.00		
Reslope drainage swale	125									125	$4,375.00		
										Drainage Area 5 Total			***$7,000.00***
Drainage Area 5													
Clean and Flush	50					50	$1,750.00						
Remove Landscaping that is blocking the swale	50									50	$1,750.00		
Reslope drainage swale	100									100	$3,500.00		
										Drainage Area 6 Total			***$10,500.00***
Drainage Area 6													
Reslope drainage swale	275									300	$10,500.00		
										Drainage Area 7 Total			***$14,350.00***
Drainage Area 7													
Clean and Flush	175					150	$5,250.00			50	$1,750.00		
Install headwall	1							1	$350.00				
Reslope drainage swale	200									200	$7,000.00		
										Sod Restoration			**$10,000.00**
Sod Restoration													$ 10,000.00

			Total 18" HDPE Pipe Cost		Catch Basin Installation		Total Pipe Cleaning Cost		Total Concrete Rip-Rap Headwall Cost		Total Swale Excavation and Cleaning Cost		Duck- Billed Tidal Check Valve (EA)
			$2,550.00		$4,500.00		$18,200.00		$1,050.00		$56,875.00		$12,000.00
			Overall Project Cost				15% Contingency		Total w/ contingency				
			$105,175.00				$ 15,776.25		$ 120,951.25				

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