

**STORMWATER DRAINAGE  
CAPITAL IMPROVEMENTS PLAN**

**TOWN OF SUNSET BEACH**

**BRUNSWICK COUNTY, NC**



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CONSULTING ENGINEERS  
SHALLOTTE, NORTH CAROLINA

**STORMWATER DRAINAGE  
CAPITAL IMPROVEMENTS PLAN**

**TOWN OF SUNSET BEACH**

**BRUNSWICK COUNTY, NC**

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**JUNE 2017**

**PROJECT NO. 15.01917**

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- 1. PRIORITY RANKING FOR PIPE PROJECTS**
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A Capital Improvements Plan (CIP) has been developed to identify and prioritize needed repairs and upgrades to the stormwater drainage system owned and operated by the Town of Sunset Beach. This plan also includes measures to improve water quality. Results from the Stormwater Management Model (SWMM), combined with the results from the drainage system survey and condition assessment, were used to develop a list of storm drainage system improvement projects. Basic information was collected for each project, including quantities of pipe and/or junction boxes needed, pavement repair area, driveway repair area, and other associated quantities. Project components, such as perforated pipe, dry wells, and infiltration trenches were incorporated into individual plans to address water quality. This information was used to develop planning-level cost estimates for each identified project. Similar project development information was assimilated for large scale maintenance and restoration of multiple segments of the Town's drainage easement network.

Projects were given a ranking based on public safety and consequences of the no-action scenario and a priority list has been developed to guide scheduling. Projects are compiled into annual lists based on priority with total cost for each year. Both 10-year and 5-year implementation schedules are included.

The CIP also includes equipment purchases and other measures to facilitate implementation of the plan and long term system maintenance and management. This CIP has been developed as a stand-alone document and is attached as an addendum to the 2017 Stormwater Management Plan (2017 SMP). Background information relating to the collection and analysis of data used to identify and prioritize projects, as well as the description and results of the stormwater modeling effort, can also be found in the 2017 SMP.

Based on the findings from various field data collection and stormwater modeling efforts, an extensive list of recommended projects has been incorporated into this Capital Improvements Plan (CIP). The CIP list of projects has been prioritized and separated into annual projects lists for both 5-year and 10-year implementation periods. Recommended CIP projects fall into three categories:

1. Stormwater drainage system structural repairs and upgrades.
2. Stormwater drainage easement network major maintenance and rehabilitation.
3. System maintenance equipment and service contracts.

Individual repairs to the pipe system and easement network are based on specific problems identified at various locations. These repairs are aggregated by catchment area and combined into projects. The individual repairs were identified and placed on the CIP list for a variety of reasons, including:

1. Reported flooding related to inadequate or failed drainage system components.
2. Visual evidence of deterioration where some type of failure has occurred or is imminent. This includes corroded, crushed or collapsed corrugated metal pipes (CMP's) and, severely cracked or broken concrete or plastic pipes.
3. Visual evidence of underground problems with pipe system such as land subsidence over pipe, excessive standing water in pipes, and interior blockages in smaller pipes (15" and smaller).
4. Stormwater model (SWMM) shows flooding at pipe junctions during the 30-year simulation.
5. SWMM shows pipes flowing full and surcharged during 30-year simulation.
6. Pipe size is less than 15".
7. Pipe material is either CMP or Corrugated Plastic Pipe (CPP) with inside corrugation.
6. Areas of standing water in pipes or junction boxes.
7. Areas with excessive sediment accumulation in pipes or boxes.
8. Areas with evidence of active soil erosion around structures caused by water entering or leaving the system.
9. Areas within stormwater drainage easements with standing water, caused by poor drainage or debris blockages.
10. Areas within stormwater drainage easements that have become over-grown with vegetation.

11. Areas within stormwater drainage easements that were blocked or obstructed by fences, out-buildings, or other homeowner related activities inside the easement.
12. Corroded and unstable stormwater inlet grates.
13. Areas identified through video inspection of stormwater pipes.

For each pipe system and easement project a sheet is provided to show recommended actions and the approximate location of each. Also included are descriptions of problems depicted with photos and profile views (for many), a description of the proposed actions, and an itemized cost estimate sheet. CIP pipe system projects are described in Appendix A and Easement projects are in Appendix B. Typical details for pipe installations, asphalt repairs, infiltration pipes, and other features are included. Detailed descriptions of maintenance equipment recommendations and GIS system maintenance services are also included (Appendices C and D).

### **3.0**

### **PRELIMINARY PROJECT COST ESTIMATE**

Preliminary cost estimates are shown for each project area and are based on conceptual project layouts. Estimates were developed using unit costs derived from typical materials costs and similar projects in eastern and coastal North Carolina. Cost estimate sheets for each project: consider quantities of pipe and/or junction boxes needed; pavement repair area, driveway repair area, property repair; and other associated quantities. Many of the conceptual layouts incorporate infiltration measures to address water quality concerns and mitigate peak flows. Standard details are provided for structures, pipe installation, and asphalt repair. Minimum pipe diameter is 15". All pipes are high-density polyethylene (HDPE), except where loading requires the use of reinforced concrete pipe (RCP). Cost estimates include allowances for design, permitting, contractor mobilization, and demolition or removal of existing structures. Cost estimates are not based on engineered designs and do not consider complications caused by adjacent utilities or other unknown circumstances.

#### 4.1 Decision Matrix

With any multi-year Capital Improvements Plan it is necessary to develop criteria by which to prioritize the implementation of recommended projects. Such a process is needed to prevent arbitrary or preferential implementation of planned activities, and to document the original reasoning when circumstances change several years down the line. Recommended pipe system and drainage easement projects are prioritized using a simple Low-Medium-High rating. In general, projects needed to address identified public health and safety concerns are rated higher than projects focused more on nuisance issues or necessary upgrades.

For drainage easement projects, the high priority projects are those that will address known frequent flooding problems around existing houses. Medium priority projects focus on drainage corridors that carry higher flows and that have areas of standing water caused by obstructions, overgrown vegetation or that require substantial grading. Low priority projects generally address easements carrying lower flows or that function but have become overgrown.

For pipe system projects, a scoring system was used to evaluate projects based on several common types of identified problems. This method was selected to provide greater objectivity because many sections of storm drainage pipe experience multiple problems. The number of points allocated for each condition is based on the relative severity of the identified condition with respect to public safety and the anticipated consequences of no-action or delayed-action. The scoring system is described below:

1. Identified failure: 6 pts – pipe collapse, complete blockage, ground subsidence (sink-hole potential) Public Safety Concern.
2. Reported frequent flooding area: 5 pts
3. Identified severe material degradation: 4 pts – bottom corroded, partially crushed, separation at joints. This condition is short of failure, but failure would be likely if no action is taken.
4. Identified moderate material degradation: 3 pts – similar to 3, but less severe. This category does not include maintenance related problems.
5. Modeled flooding or capacity problem: 2 pts – based on results of SWMM 30-yr., 24-hr. simulation.
6. Components sub-standard: 1 pt – for each of the following:
  - i. Pipe diameter less than 15”
  - ii. Pipe material either CMP or CPP

- iii. Angles in pipe line outside of junction box
- iv. Changes in pipe material or pipe size outside of junction box
- v. Negative slope in line of pipe

Proposed CIP pipe system projects receive points for each applicable item without multiple counts of the same problem. Larger projects involving multiple sections of pipe receive a weighted average so as not to automatically score higher than the small projects. Scoring for each CIP project is tabulated and included in the CIP. See Table 1 on Page 6 for a summary of the rating system findings.

**Table 1 - Priority Ranking for Pipe Projects**

Catchment	Priority Value	Priority Rank	Est. Cost
3	11	High	\$12,863.67
7	8	High	\$177,814.93
29	8	High	\$19,267.71
36	7	Medium	\$22,571.83
26	6	Medium	\$175,536.00
15	5	Medium	\$59,057.27
2	5	Medium	\$14,491.17
8	5	Medium	\$6,325.23
22	5	Medium	\$12,018.82
32-1	5	Medium	\$44,352.00
32	5	Medium	\$18,726.95
1	5	Medium	\$169,912.08
37	5	Medium	\$46,147.74
6	4	Medium	\$394,023.38
35	4	Medium	\$12,368.17
17	3	Low	\$17,658.62
18	3	Low	\$47,229.96
39	3	Low	\$53,625.34
5	3	Low	\$197,106.40
16	2	Low	\$23,721.59
23	2	Low	\$18,848.33

A total of 46 projects were identified and included in the CIP plan for implementation over either a 5-year or 10-year buildout schedule. The estimated total cost of these projects is roughly \$1,772,380.00. The list includes the recommended purchase of maintenance equipment. It is anticipated the recommended equipment for servicing the stormwater infrastructure will be an initial year purchase, thus the CIP Year-1 projection reflects this this estimated \$575,000 expense. The list also includes an annual line item for a maintenance service contract for the GIS system, which adds \$40,000 per year for the 5-year and 10-year schedules. Using these values, the projected average annual cost to implement this plan for the 10-year scenario would be approximately \$274,738 per year and \$509,476 per year for the 5-year scenario. These values do not account for any interest expense.

The following 5-year and 10-year project schedules were developed based on project priority rankings and the goal to balance annual expenditures to meet and targets for each scenario. See Table 2.

**CAPITAL IMPROVEMENTS PLAN - PROJECTS LIST  
10-YEAR BULDOUT**

Catchment	Priority Rank	Est. Cost	Year
3	High	\$12,863.67	1
29	High	\$19,267.71	1
DE-1	High	\$2,931.64	1
DE-2	High	\$21,954.71	1
DE-3	High	\$23,257.66	1
DE-4	High	\$3,570.08	1
DE-6	High	\$1,954.43	1
DE-7	High	\$2,684.08	1
36	Medium	\$22,571.83	1
Vacuum Truck	Equipment	\$380,000.00	1
Camera System	Equipment	\$80,000.00	1
Street Sweeper	Equipment	\$115,000.00	1
GIS Maintenance	Program	\$40,000.00	1
<b>Year 1 Total</b>		<b>\$726,055.81</b>	
7	High	\$177,814.93	2
GIS Maintenance	Program	\$40,000.00	2
<b>Year 2 Total</b>		<b>\$217,814.93</b>	
15	Medium	\$59,057.27	3
2	Medium	\$14,491.17	3
8	Medium	\$6,325.23	3
22	Medium	\$12,018.82	3
DE-10	Medium	\$14,123.98	3
DE-5	Medium	\$4,690.62	3
37	Medium	\$46,147.74	3
32	Medium	\$18,726.95	3
GIS Maintenance	Program	\$40,000.00	3
<b>Year 3 Total</b>		<b>\$215,581.78</b>	
1	Medium	\$169,912.08	4
GIS Maintenance	Program	\$40,000.00	4
<b>Year 4 Total</b>		<b>\$209,912.08</b>	
26	Medium	\$175,536.00	5
GIS Maintenance	Program	\$40,000.00	5
<b>Year 5 Total</b>		<b>\$215,536.00</b>	
6	Medium	\$394,023.38	6 & 7
GIS Maintenance	Program	\$80,000.00	6 & 7
<b>Year 6/7 Total</b>		<b>\$474,023.38</b>	
ROW-1	Medium	\$23,440.10	8
<b>ROW-2</b>	<b>Medium</b>	<b>\$45,483.38</b>	<b>8</b>
DE-12	Medium	\$25,199.05	8
DE-15	Medium	\$1,302.95	8
DE-16	Medium	\$2,736.20	8
DE-18	Medium	\$14,808.03	8
DE-22	Medium	\$8,006.63	8
DE-23	Medium	\$7,817.70	8
32-1	Medium	\$44,352.00	8
35	Medium	\$12,368.17	8
GIS Maintenance	Program	\$40,000.00	8
<b>Year 8 Total</b>		<b>\$225,514.21</b>	
5	Low	\$197,106.40	9
GIS Maintenance	Program	\$40,000.00	9
<b>Year 9 Total</b>		<b>\$237,106.40</b>	
16	Low	\$23,721.59	10
17	Low	\$17,658.62	10
18	Low	\$47,229.96	10
39	Low	\$53,625.34	10
23	Low	\$18,848.33	10
DE-8	Low	\$2,465.58	10
DE-9	Low	\$2,905.58	10
DE-11	Low	\$2,032.60	10
DE-13	Low	\$2,032.60	10
DE-14	Low	\$2,032.60	10
DE-17	Low	\$3,765.53	10
DE-19	Low	\$5,622.23	10
DE-20	Low	\$846.92	10
DE-21	Low	\$3,048.90	10
GIS Maintenance	Program	\$40,000.00	10
<b>Year 10 Total</b>		<b>\$225,836.38</b>	
<b>TOTAL FOR FULL IMPLEMENTATION</b>		<b>\$2,747,380.97</b>	

**CAPITAL IMPROVEMENTS PLAN - PROJECTS LIST  
5-YEAR BULDOUT**

Catchment	Priority Rank	Est. Cost	Year
3	High	\$12,863.67	1
7	High	\$177,814.93	1
29	High	\$19,267.71	1
DE-1	High	\$2,931.64	1
DE-2	High	\$21,954.71	1
DE-3	High	\$23,257.66	1
DE-4	High	\$3,570.08	1
DE-6	High	\$1,954.43	1
DE-7	High	\$2,684.08	1
15	Medium	\$59,057.27	1
36	Medium	\$22,571.83	1
Vacuum Truck	Equipment	\$380,000.00	1
Camera System	Equipment	\$80,000.00	1
Street Sweeper	Equipment	\$115,000.00	1
GIS Maintenance	Program	\$40,000.00	1
<b>Year 1 Total</b>		<b>\$962,928.01</b>	
26	Medium	\$175,536.00	2
2	Medium	\$14,491.17	2
8	Medium	\$6,325.23	2
22	Medium	\$12,018.82	2
1	Medium	\$169,912.08	2
GIS Maintenance	Program	\$40,000.00	2
<b>Year 2 Total</b>		<b>\$418,283.30</b>	
6	Medium	\$394,023.38	3
GIS Maintenance	Program	\$40,000.00	3
<b>Year 3 Total</b>		<b>\$434,023.38</b>	
37	Medium	\$46,147.74	4
ROW-1	Medium	\$23,440.10	4
ROW-2	Medium	\$45,483.38	4
DE-5	Medium	\$4,690.62	4
DE-10	Medium	\$14,123.98	4
DE-12	Medium	\$25,199.05	4
DE-15	Medium	\$1,302.95	4
DE-16	Medium	\$2,736.20	4
DE-18	Medium	\$14,808.03	4
DE-22	Medium	\$8,006.63	4
DE-23	Medium	\$7,817.70	4
35	Medium	\$12,368.17	4
32	Medium	\$18,726.95	4
32-1	Medium	\$44,352.00	4
18	Low	\$47,229.96	4
GIS Maintenance	Program	\$40,000.00	4
<b>Year 4 Total</b>		<b>\$356,433.46</b>	
17	Low	\$17,658.62	5
39	Low	\$53,625.34	5
5	Low	\$197,106.40	5
16	Low	\$23,721.59	5
23	Low	\$18,848.33	5
DE-8	Low	\$2,465.58	5
DE-9	Low	\$2,905.58	5
DE-11	Low	\$2,032.60	5
DE-13	Low	\$2,032.60	5
DE-14	Low	\$2,032.60	5
DE-17	Low	\$3,765.53	5
DE-19	Low	\$5,622.23	5
DE-20	Low	\$846.92	5
DE-21	Low	\$3,048.90	5
GIS Maintenance	Program	\$40,000.00	5
<b>Year 5 Total</b>		<b>\$375,712.82</b>	
<b>TOTAL FOR FULL IMPLEMENTATION</b>		<b>\$2,547,380.97</b>	

For each Project included in the CIP, an evaluation is provided to identify where conventional materials and techniques could be replaced by Low Impact Development (LID) strategies in order to create increased infiltration or filtration potential for flows within or entering the system. A separate line item in each cost estimate is added for water quality enhancements.

There are three measures evaluated for use in this study, though additional measures could be added during the design phase for each project. The three measures included are:

1. **Perforated Pipe Infiltration Trenches:** Involves replacing standard HDPE pipe with perforated HDPE of the same diameter in areas where soils have high infiltration potential and estimated pipe depth allows sufficient distance above the seasonal high water table. Pipes are installed in a fabric lined trench with a minimum 6-12 inch washed gravel bed.
2. **Dry Well or Bioretention Measure:** To be installed at inlet structures in soils with high infiltration potential. Inlet elevations are set to allow for a depressed zone around grate for stormwater to collect and filter into a gravel bed surrounding the inlet structure.
3. **Infiltration Swale:** To be installed in areas of high infiltration potential where concentrated flow approaches an inlet structure. Measures consists of an excavated linear trench, back-filled with material with high infiltration characteristics. The surface of the trench can be grassed.

Stormwater management involves much more than initial installation of pipes and other components of the conveyance system. Without a program of regular inspections and maintenance, components and systems are likely to fail prematurely, leading to expensive repairs and unplanned construction activities. To facilitate the Town's stormwater maintenance program, equipment and service items are included in the CIP. More detailed descriptions of each item are located in Appendix C. It is also recommended that the Town maintain properly trained personnel to manage program and perform certain specialized activities.

McGill Associates has coordinated with Town Public Works staff to clarify their stormwater maintenance needs and develop recommendations in the following areas:

Cleaning roadways, sidewalks and other paved areas is important preventative maintenance in the upkeep of a functional stormwater system. To prevent sediment from accumulating on paved areas and washing into stormwater structures or clogging pervious pavers it is recommended that the Town purchase a street sweeper to perform regular maintenance of sidewalks and roadways.

The ability to evaluate existing stormwater facilities is an important tool for preventative maintenance. To adequately see into longer runs of storm drainage pipes is valuable to determine if a pipe requires maintenance cleaning or if more severe problems are developing that will require more substantial work immediately or in the future. A mobile camera unit that can be used to inspect and document underground stormwater system conditions is recommended to facilitate regular inspections of the Town's stormwater pipe network.

Proper maintenance of stormwater inlets, pipe conveyances and outlet structures is needed to prevent avoidable flood problems and related damage or public safety concerns during storm events. Removal of accumulated sediment from inlet structures and pipes can be efficiently accomplished using a combination hydro-vacuum truck capable of breaking up and removing accumulated material without digging and potentially damaging nearby buried utilities or other structures. A combination hydro-vacuum truck can also perform maintenance activities in much less time and with much less disruption to traffic than by other means. To perform these important maintenance functions the purchase of a combination hydro-vacuum truck is recommended.

The development of any comprehensive Stormwater Management Plan and associated Capital Improvement Plan (CIP) involves the acquisition and processing of large amounts of data. A major component of this project has been to build a working database for the information collected and integrate this with the Town's Geographic Information System (GIS). The goal was to develop a system for the Town that included accurate base data for the stormwater

drainage system and CIP. Going forward, the intended use of the GIS is to serve as a data management and analysis tool for tracking a broad range of stormwater drainage system information and activities including: maintenance; repairs; complaints; impervious area; location and specific details about all system components; and various water quality measures. For this system to function as intended for the long term, regular management and maintenance will be required. It is recommended that appropriately trained staff and/or sub-contracted services be utilized for GIS database management.

### 7.1 Potential Stormwater Funding Mechanisms

As with all projects, finding ways to fund improvements is one of the key factors affecting the viability of proposed improvements. There are two primary funding sources for stormwater infrastructure projects: Local Municipality and State Agencies. The following is a brief overview of each of these funding opportunities for proposed Sunset Beach projects:

#### 7.1.1 Local Municipality

Local municipality funding would generally take on one of two forms; either a capital budget line item or the development of a stormwater utility.

For capital budget funding, the Town would need to consider the proposed CIP and determine to what extent they could fund projects within the Town's Annual Budget. Funding would therefore flow through taxes collected by the Town's current taxing authority.

The other methodology for funding stormwater infrastructure at the local level is through the development of a stormwater utility. Residential rates are generally either based on a flat rate or a tiered rate. Non-residential or commercial properties may be based on an Equivalent Residential Unit (ERU). As an example, the City of Wilmington charges a flat single-family residential fee of \$7.66/month for their stormwater utility. Commercial fees are based on \$7.66 for every 2,500 S.F. of impervious area (1 ERU).

#### 7.1.2 State Agency

There are two primary state-level funding sources in North Carolina: The Clean Water State Revolving Fund (CWSRF) and the Clean Water Management Trust Fund (CWMTF).

##### CWSRF:

Local governments are eligible for funding through CWSRF funds, which are primarily distributed as 0% interest loans. Loan amounts up to \$30 million dollars are possible; however, projects funded through CWSRF funds must be part of green infrastructure projects. Projects must include stormwater Best Management Practices (BMPs). The program will also fund ancillary construction such as conveyance devices but the BMP must be a substantiated portion of the project's funding needs. CWSRF funds can also be used to perform stream restoration projects.

BMPs constructed with CWSRF funds must be in compliance with the State’s Stormwater BMP manual. The BMPs (either singular or as a part of a series of devices) must provide the following reduction levels:

- At least 35% total nitrogen, and
- At least 35% total phosphorus reduction, and
- At least 85% total suspended solids (TSS) reduction.

#### CWMTF:

Projects can be funded with grant money from CWMTF. To qualify for funding, the projects must be considered “innovative”. There is no specific definition of what an innovative project is within the funding guidelines. Projects would need to deviate from the standard “pipe and pond” mode of treatment. Inclusion of pervious paving, bioretention zones, infiltration zones, and proprietary devices could be examples of devices that could be funded through these grants.

Funding for land acquisition, where easements do not currently exist, is also available through CWMTF. The land could be used for treatment or preservation measures. The presumption would be that the land would be obtained for the purpose of improving the quality of receiving waters.

In addition to the above funding opportunities, the Town should consider private/public partnerships with its citizens. Rain barrel and rain garden programs have proven popular in many communities and can contribute to the Town’s overall goal of managing stormwater volume and quality. Incentives could also be put into place that would encourage the use of pervious paving materials or developing with disconnected impervious areas to minimize runoff and pollutant transfer.

### **7.1.3 Other Funding**

In 2014 the Duke Energy Foundation announced a \$10 million fund for projects benefiting waterways in the Carolinas and downstream of certain facilities owned by Duke Energy in Virginia, Tennessee and Georgia. The program is known as the Duke Energy Foundation – Water Resource Fund. Monies from the fund are available for projects that are a direct benefit to the following: improve water quality, quantity and conservation; enhance fish and wildlife management habitats; expand public use and access to waterways; and increase citizens’ awareness about their roles in protecting water resources. As with other programs identified above, the funds wouldn’t likely be available for replacement of stormwater piping unless there

was a direct benefit to water quality. Projects that include construction of BMPs, waterway protection/enhancement, or recreational access are more likely to be funded.

**TOWN OF SUNSET BEACH, NC**  
**STORMWATER DRAINAGE CAPITAL IMPROVEMENTS PLAN**  
**JUNE 2017**

**LIST OF APPENDICES**

**APPENDIX A - CIP PIPE PROJECTS**

**APPENDIX B - CIP DRAINAGE EASEMENT PROJECTS**

**APPENDIX C - RECOMMENDED EQUIPMENT**

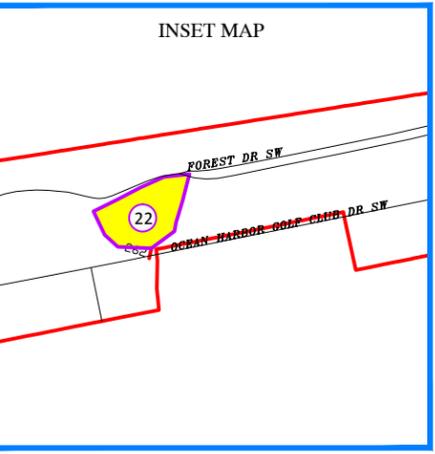
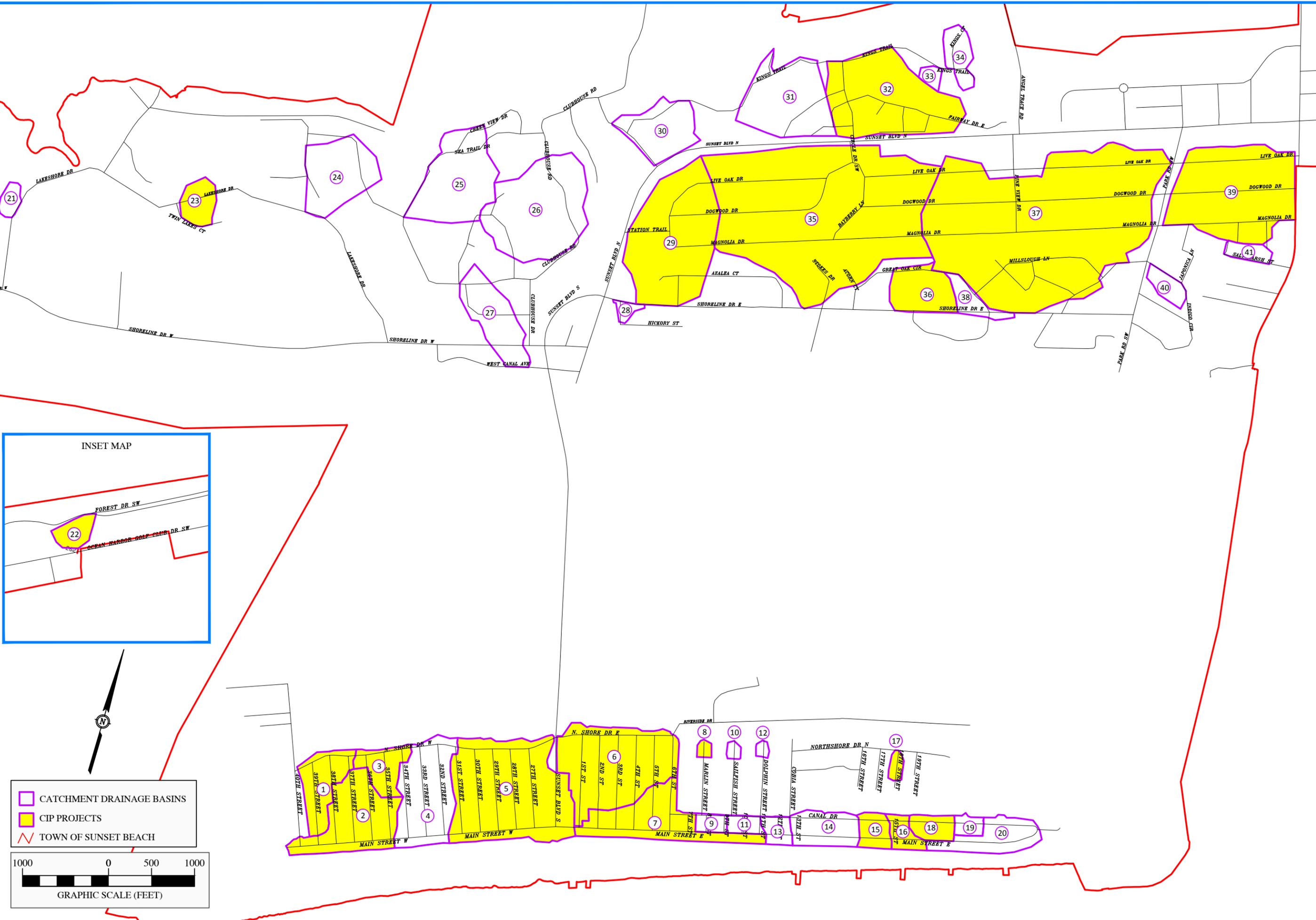
**APPENDIX D - GIS MAINTENANCE AGREEMENT**

**APPENDIX A**

**CIP PIPE PROJECTS**

STORMWATER DRAINAGE STUDY  
**TOWN OF SUNSET BEACH**  
 BRUNSWICK COUNTY, NORTH CAROLINA

FIGURE 1.  
 CIP PROJECT  
 OVERVIEW MAP  
 FEBRUARY 2017



CATCHMENT DRAINAGE BASINS  
 CIP PROJECTS  
 TOWN OF SUNSET BEACH

1000 0 500 1000  
 GRAPHIC SCALE (FEET)

## Catchment 1 – CIP Project

Location. West Main Street and 36<sup>th</sup> Street.

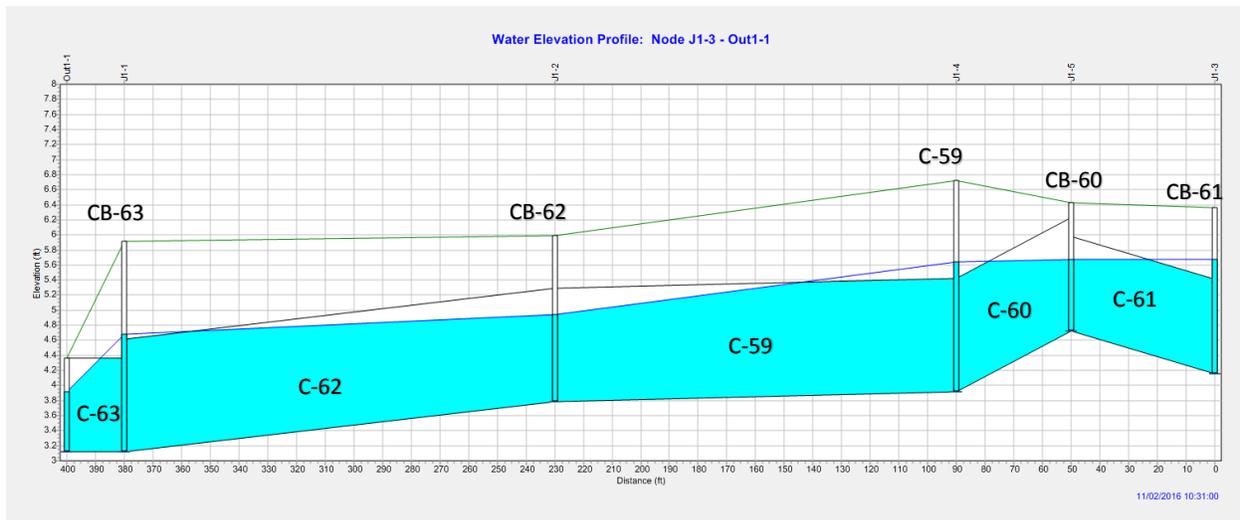
Description of Problem. Modeled and flooding problems identified along existing pipe system from Main Street West and 36<sup>th</sup> Street to outfall at Bull Creek include:

- C-55 – 8” CPP: undersized, substandard pipe material; model indicates flooding at inlet.
- C-56 – 15” CMP: negative slope causing backwater and capacity loss; model indicates minor flooding at inlet. Minimal cover over pipe at 38<sup>th</sup> Street crossing.
- C-57 – 15” CMP: CB-57 is substandard being too shallow and contributes to upstream flooding; model indicates minor flooding at inlet.
- C-60 & C-61 – Flooding reported in area; C-61 has a negative slope; C-60 is substandard pipe material with minimal cover at Main Street crossing.
- C-63 – 15” CMP is downsized from upstream pipe and undersized for modeled peak flows; causes surcharge in upstream pipe.

Recommended Actions. Eliminate negative slopes in pipes and address flooding problem at CB-61. Replace entire run of pipe from CB-55 to outfall pipe in addition to side drainage from CB-61 to CB-59. Add two new catch basins at intersection of Main St. W and 36<sup>th</sup> St to eliminate bend in pipe. Replace all CMP with HDPE or RCP at road crossings. Seven (7) sections of existing pipe to be replaced with perforated HDPE and set in #57 stone, totaling 220-linear feet, to act as a water quality measure by allowing stormwater infiltration.

Estimated Cost. \$169,912.08

Priority. Medium



**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

McGill Associates

**CATCHMENT 1**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 3,516.25
2	Demolition (Existing Asphalt Road, Asphalt Driveway)	264	SY	\$ 8.00	\$ 2,112.89
3	15" HDPE	195	LF	\$ 25.00	\$ 4,875.00
4	18" HDPE	470	LF	\$ 27.00	\$ 12,690.00
5	15" HDPE (Perforated, in #57 stone)	40	LF	\$ 62.00	\$ 2,480.00
6	18" HDPE (Perforated, in #57 stone)	180	LF	\$ 67.00	\$ 12,060.00
7	18" RCP	210	LF	\$ 35.00	\$ 7,350.00
8	Catch Basin with Grate	11	EA	\$ 2,000.00	\$ 22,000.00
9	Existing Pipe Removal	1,095	LF	\$ 8.00	\$ 8,760.00
10	Existing Structure Removal	9	EA	\$ 500.00	\$ 4,500.00
11	Asphalt Road Repair	246	SY	\$ 125.00	\$ 30,791.67
12	Gravel Driveway Repair	117	SY	\$ 70.00	\$ 8,166.67
13	Asphalt Driveway Repair	18	SY	\$ 80.00	\$ 1,422.22
14	Miscellaneous Private Property Repair	12	LOT	\$ 200.00	\$ 2,400.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	<b>\$ 123,124.70</b>
	Contingency (15 %)				\$ 18,468.70
<b>TOTAL CONSTRUCTION ESTIMATE</b>					<b>\$ 141,593.40</b>

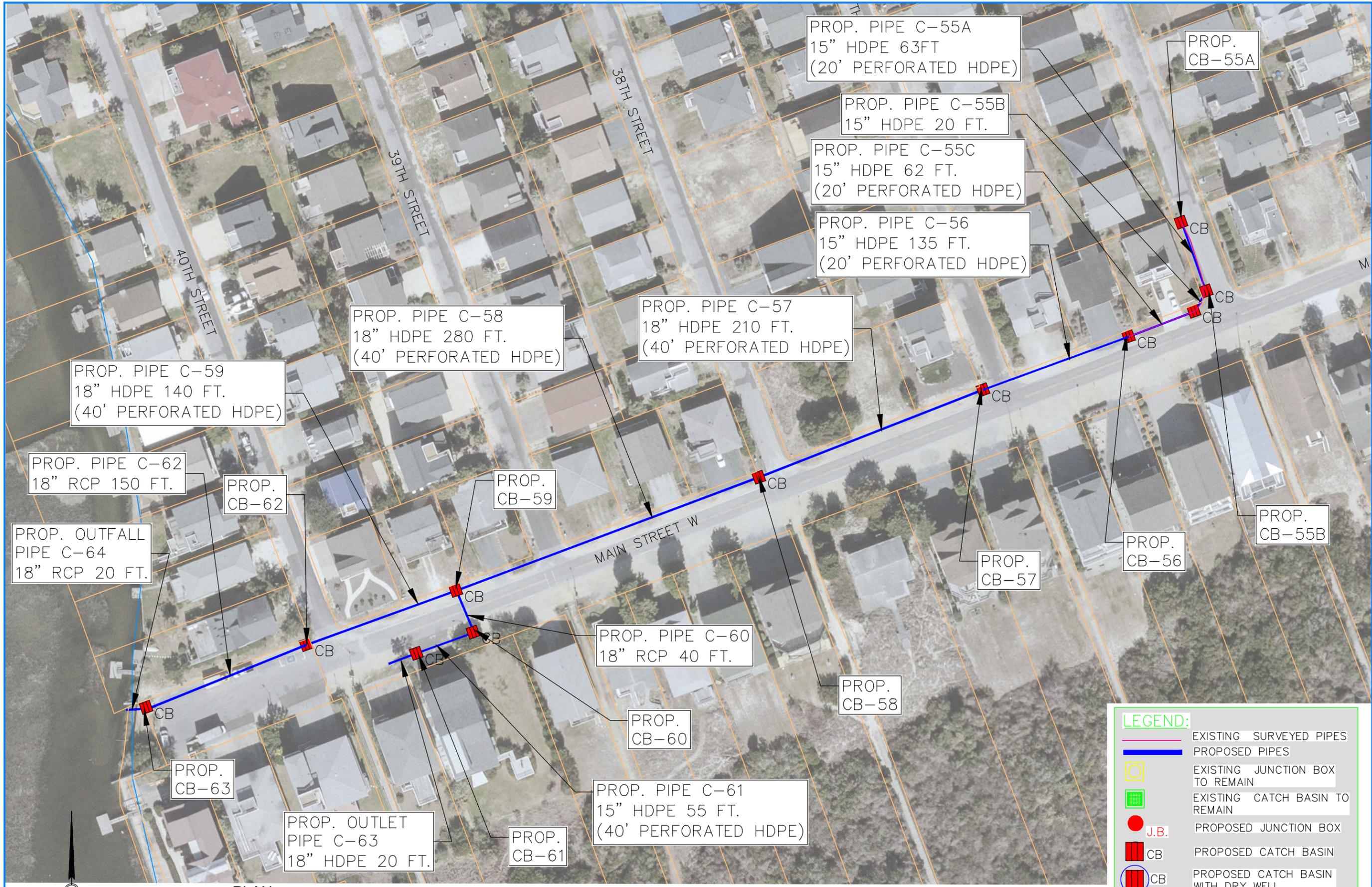
<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
1	Surveying, Geotechnical, Design, Permitting (20%)				\$ 28,318.68

**TOTAL COST ESTIMATE** \$ 169,912.08

**NOTE:**

- 1) Drainage easement acquisition cost is **not included**.
- 2) The cost of clearing, grading and stabilization is **not included**, but is estimated to be approximately **\$10/sy**.

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PROP. PIPE C-55A  
15" HDPE 63FT  
(20' PERFORATED HDPE)

PROP. PIPE C-55B  
15" HDPE 20 FT.

PROP. PIPE C-55C  
15" HDPE 62 FT.  
(20' PERFORATED HDPE)

PROP. PIPE C-56  
15" HDPE 135 FT.  
(20' PERFORATED HDPE)

PROP. PIPE C-57  
18" HDPE 210 FT.  
(40' PERFORATED HDPE)

PROP. PIPE C-58  
18" HDPE 280 FT.  
(40' PERFORATED HDPE)

PROP. PIPE C-59  
18" HDPE 140 FT.  
(40' PERFORATED HDPE)

PROP. PIPE C-62  
18" RCP 150 FT.

PROP. OUTFALL  
PIPE C-64  
18" RCP 20 FT.

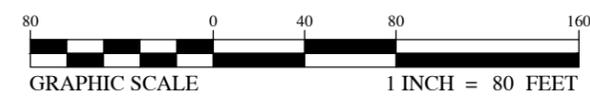
PROP. PIPE C-60  
18" RCP 40 FT.

PROP. PIPE C-61  
15" HDPE 55 FT.  
(40' PERFORATED HDPE)

PROP. OUTLET  
PIPE C-63  
18" HDPE 20 FT.



PLAN



**LEGEND:**

	EXISTING SURVEYED PIPES
	PROPOSED PIPES
	EXISTING JUNCTION BOX TO REMAIN
	EXISTING CATCH BASIN TO REMAIN
	J.B. PROPOSED JUNCTION BOX
	PROPOSED CATCH BASIN
	PROPOSED CATCH BASIN WITH DRY WELL

NO.	DATE	BY	REVISION DESCRIPTION



STORMWATER DRAINAGE STUDY  
**TOWN OF SUNSET BEACH**  
BRUNSWICK COUNTY, NORTH CAROLINA

JOB NO.: 15.01917  
DATE: FEB., 2017  
DESIGNED BY: XXX  
CADD BY: ZL  
DESIGN REVIEW:  
CONST. REVIEW:  
Recommended  
Actions\_Revised  
2-24-17.dwg

RECOMMENDED ACTION  
LAYOUT PLAN  
CATCHMENT 1

SHEET  
**C-101**

## Catchment 2 – CIP Project

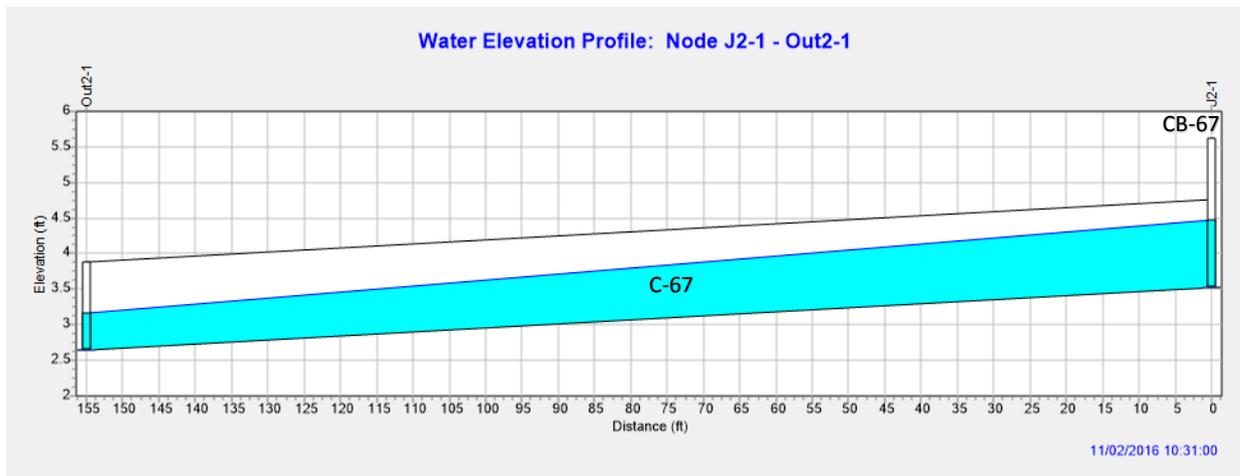
Location. North Shore Drive West; pipe crosses private property.

Description of Problem. C-67 – 15" CPP is partially blocked by sediment and appears damaged, possibly by recent sewer line work. Subsidence was noted along the surface above the pipe indicative of leaking water. C-67 is substandard pipe material.

Recommended Actions. Replace CB-67; replace C-67 with 15" HDPE. A 40-linear foot section of the replacement pipe to be perforated HDPE set in #57 stone, to act as a water quality measure by allowing stormwater infiltration. A dry well to be installed at inlet structure CB-67 to act as a water quality measure, allowing additional stormwater infiltration.

Estimated Cost. \$14,491.17

Priority. Medium



**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

McGill Associates

**CATCHMENT 2**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 305.85
2	15" HDPE	115	LF	\$ 25.00	\$ 2,875.00
3	15" HDPE (Perforated, in #57 stone)	40	LF	\$ 62.00	\$ 2,480.00
4	Catch Basin with Grate	1	EA	\$ 2,000.00	\$ 2,000.00
5	Existing Pipe Removal	155	LF	\$ 8.00	\$ 1,240.00
6	Existing Structure Removal	1	EA	\$ 500.00	\$ 500.00
7	Dry Well	1	EA	\$ 900.00	\$ 900.00
8	Miscellaneous Private Property Repair	1	LOT	\$ 200.00	\$ 200.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	<b>\$ 10,500.85</b>
	Contingency (15 %)				\$ 1,575.13
<b>TOTAL CONSTRUCTION ESTIMATE</b>					<b>\$ 12,075.98</b>

<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
<b>1</b>	Surveying, Geotechnical, Design, Permitting (20%)				\$ 2,415.20

**TOTAL COST ESTIMATE** \$ 14,491.17

NOTE:

- 1) Drainage easement acquisition cost is **not included**.
- 2) The cost of clearing, grading and stabilization is **not included**, but is estimated to be approximately **\$10/sy**.

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PROP. PIPE C-67  
15" HDPE 155 FT.  
(40' PERFORATED HDPE)

PROP. CB-67  
DRY WELL

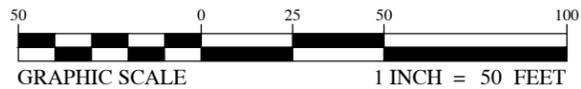
CB

N. SHORE DR W

37TH STREET



PLAN



**LEGEND:**

-  EXISTING SURVEYED PIPES
-  PROPOSED PIPES
-  EXISTING JUNCTION BOX TO REMAIN
-  EXISTING CATCH BASIN TO REMAIN
-  J.B. PROPOSED JUNCTION BOX
-  CB PROPOSED CATCH BASIN
-  CB PROPOSED CATCH BASIN WITH DRY WELL

NO.	DATE	BY	REVISION DESCRIPTION



STORMWATER DRAINAGE STUDY  
**TOWN OF SUNSET BEACH**  
BRUNSWICK COUNTY, NORTH CAROLINA

JOB NO.: 15.01917  
DATE: MARCH, 2017  
DESIGNED BY: XXX  
CADD BY: ZL  
DESIGN REVIEW:  
CONST. REVIEW:  
Recommended  
Actions\_ Revised  
2-24-17.dwg

RECOMMENDED ACTION  
LAYOUT PLAN  
CATCHMENT 2

SHEET  
**C-102**

### Catchment 3 – CIP Project

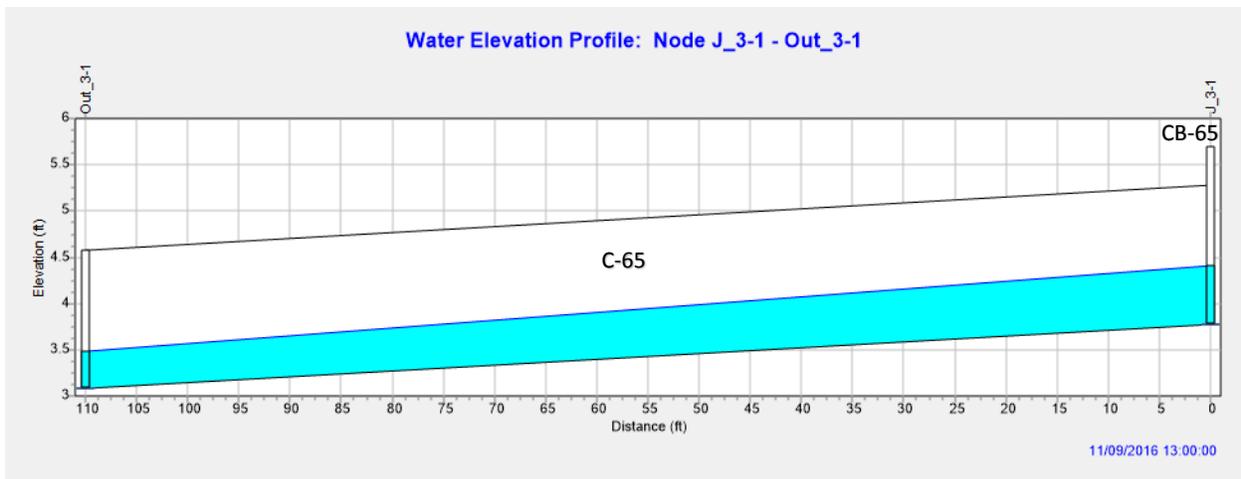
Location. North Shore Drive West; pipe crosses private property.

Description of Problem. C-65 – 18” CPP is partially blocked by sediment and appears damaged, possibly by recent sewer line work. Flooding reported in area. C-65 is substandard pipe material.

Recommended Actions. Replace CB-65; replace C-65 with 18” HDPE. A 40-linear foot section of replacement pipe to be perforated HDPE set in #57 stone, to act as a water quality measure by allowing stormwater infiltration. A dry well to be installed at inlet structure CB-65 to act as a water quality measure, allowing additional stormwater infiltration.

Estimated Cost. \$12,863.67

Priority. High



**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

McGill Associates

**CATCHMENT 3**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 271.50
2	18" HDPE	70	LF	\$ 27.00	\$ 1,890.00
3	18" HDPE (Perforated, in #57 stone)	40	LF	\$ 67.00	\$ 2,680.00
4	Catch Basin with Grate	1	EA	\$ 2,000.00	\$ 2,000.00
5	Existing Pipe Removal	110	LF	\$ 8.00	\$ 880.00
6	Existing Structure Removal	1	EA	\$ 500.00	\$ 500.00
7	Dry Well	1	EA	\$ 900.00	\$ 900.00
8	Miscellaneous Private Property Repair	1	LOT	\$ 200.00	\$ 200.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	<b>\$ 9,321.50</b>
	Contingency (15 %)				\$ 1,398.23
<b>TOTAL CONSTRUCTION ESTIMATE</b>					<b>\$ 10,719.73</b>

<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
<b>1</b>	Surveying, Geotechnical, Design, Permitting (20%)				\$ 2,143.95

**TOTAL COST ESTIMATE** \$ 12,863.67

NOTE:

- 1) Drainage easement acquisition cost is **not included**.
- 2) The cost of clearing, grading and stabilization is **not included**, but is estimated to be approximately **\$10/sy**.

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PROP. PIPE C-65  
18" HDPE 110 FT.  
(40' PERFORATED HDPE)

PROP.  
CB-65,  
DRY WELL

CB

**LEGEND:**

	EXISTING SURVEYED PIPES
	PROPOSED PIPES
	EXISTING JUNCTION BOX TO REMAIN
	EXISTING CATCH BASIN TO REMAIN
	J.B. PROPOSED JUNCTION BOX
	CB PROPOSED CATCH BASIN
	CB PROPOSED CATCH BASIN WITH DRY WELL



PLAN



NO.	DATE	BY	REVISION DESCRIPTION



STORMWATER DRAINAGE STUDY  
**TOWN OF SUNSET BEACH**  
BRUNSWICK COUNTY, NORTH CAROLINA

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CONST. REVIEW:  
Recommended  
Actions\_Revised  
2-24-17.dwg

RECOMMENDED ACTION  
LAYOUT PLAN  
CATCHMENT 3

SHEET  
**C-103**

## Catchment 5 – CIP Project

Location. North Shore Drive West, West Main St., East Main St., 30<sup>th</sup> St., 29<sup>th</sup> St., 28<sup>th</sup> St., and 27<sup>th</sup> St.

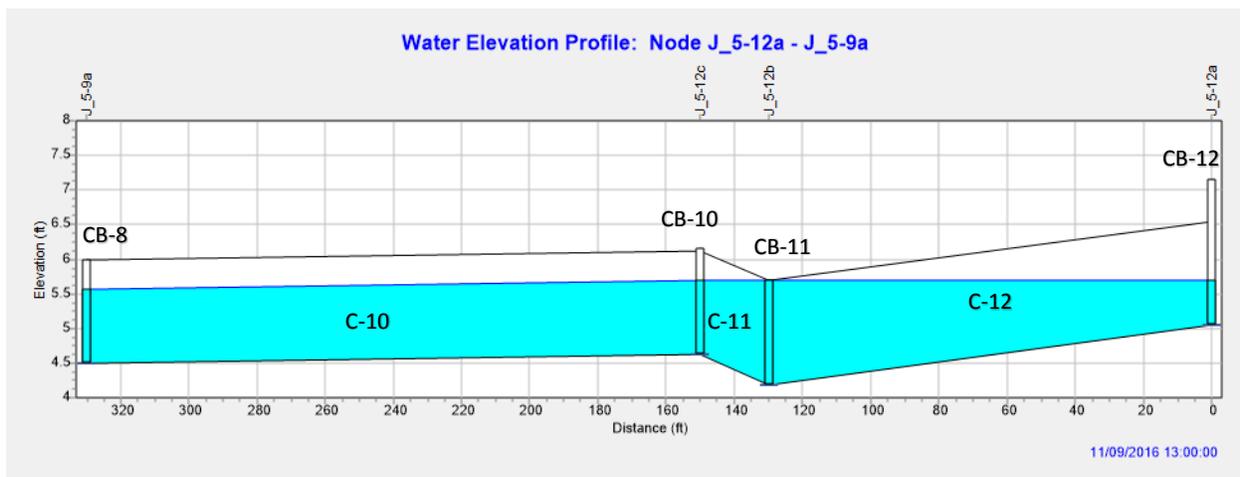
Description of Problem. Modeled problems identified along existing pipe system from East Main Street to West Main Street and along 27<sup>th</sup>, 28<sup>th</sup>, 29<sup>th</sup> and 30<sup>th</sup> Streets.

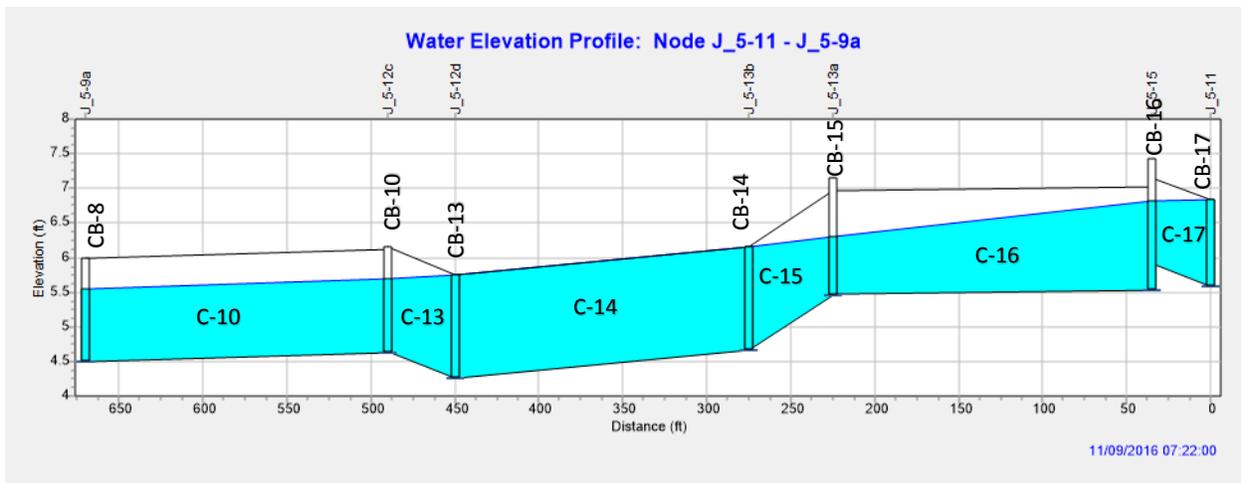
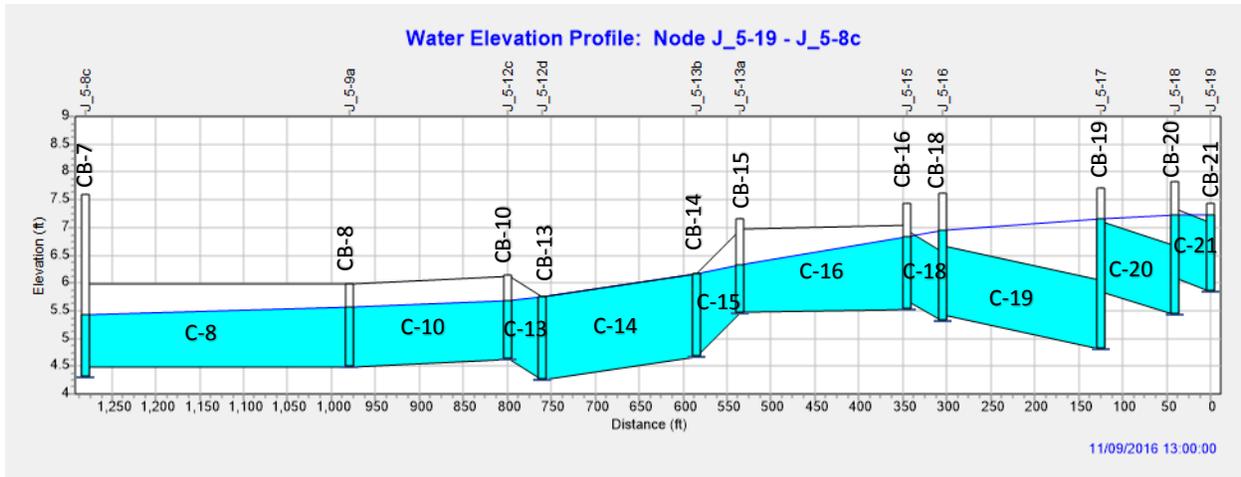
- C-21 – 15” RCP: negative slope causing backwater and capacity loss; model indicates surcharge; minimal cover at Main Street crossing.
- C-20, C-19 & C-18 – 15” RCP: negative slope causing backwater and capacity loss; model indicates surcharge.
- C-17 – 15” RCP: negative slope causing backwater and capacity loss; model shows minor flooding at the inlet; minimal cover at Main Street crossing.
- C-16 – 18” HDPE: no noted problems with section of pipe; downstream sag in the system will require C-16 to be replaced in order to fix the overall problem.
- C-15 – 18” CPP: sag below CB-15 causing backwater and capacity loss.
- C-14 – 18” CPP: CB-14 located in a slump; model shows C-14 flows at full capacity during a 50-year storm.
- C-13 – 18” CPP: negative slope causing backwater and capacity loss; pipe at full capacity during a 50-year storm.
- C-12 – 18” CPP: sag below CB-12 causing backwater and capacity loss.
- C-11 – 18” CPP: negative slope causing backwater and capacity loss; pipe at full capacity during a 50-year storm.
- C-3 – 18” CPP: video inspection and visual assessment indicate pipe separation, deformation settling and blockage; backwater in the pipe system.

Recommended Actions. Eliminate negative slopes in pipes. Replace entire run of pipe from CB-21 to JB-10 as well as two side drainages from CB-17 to CB-16 and CB-12 to JB-10 including related catch basins and junction boxes. Replace damaged pipe segment from JB-3 to CB-29. Replace all CPP with HDPE or RCP at road crossings. Five (5) sections of existing pipe to be replaced with perforated HDPE and set in #57 stone, totaling 320-linear feet, and one (1) dry well to be installed at inlet structure CB-3. These system retrofits will act as a water quality measures, allowing additional stormwater infiltration.

Estimated Cost. \$197,106.40

Priority. Low





**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

**McGill Associates**

**CATCHMENT 5**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 4,125.11
2	Demolition (Existing Asphalt Road, Asphalt Driveway)	312	SY	\$ 8.00	\$ 2,496.00
3	15" HDPE	205	LF	\$ 25.00	\$ 5,125.00
4	18" HDPE	569	LF	\$ 27.00	\$ 15,363.00
5	15" HDPE (Perforated, in #57 stone)	100	LF	\$ 62.00	\$ 6,200.00
6	18" HDPE (Perforated, in #57 stone)	220	LF	\$ 67.00	\$ 14,740.00
7	15" RCP	160	LF	\$ 32.00	\$ 5,120.00
8	Junction Box	5	EA	\$ 2,000.00	\$ 10,000.00
9	Catch Basin with Grate	11	EA	\$ 2,000.00	\$ 22,000.00
10	Existing Pipe Removal	1,254	LF	\$ 8.00	\$ 10,032.00
11	Existing Structure Removal	13	EA	\$ 500.00	\$ 6,500.00
12	Asphalt Road Repair	312	SY	\$ 125.00	\$ 39,027.78
13	Dry Well	1	EA	\$ 900.00	\$ 900.00
14	Miscellaneous Private Property Repair	6	LOT	\$ 200.00	\$ 1,200.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	<b>\$ 142,828.89</b>
	Contingency (15 %)				\$ 21,424.33
<b>TOTAL CONSTRUCTION ESTIMATE</b>					<b>\$ 164,253.22</b>

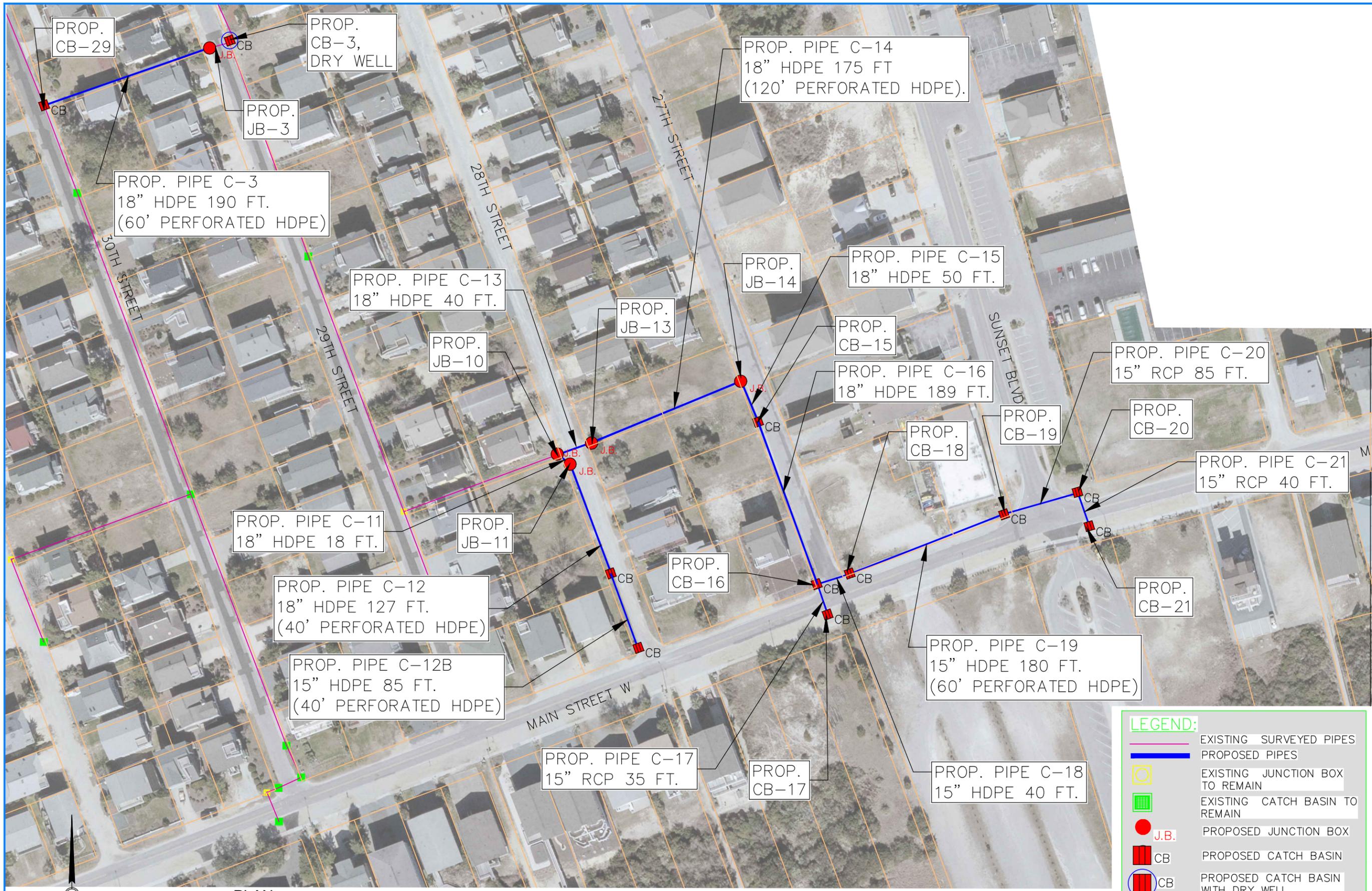
<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
<b>1</b>	Surveying, Geotechnical, Design, Permitting (20%)				\$ 32,850.64

<b>TOTAL COST ESTIMATE</b>					<b>\$ 197,103.87</b>
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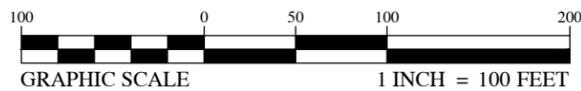
NOTE:

- 1) Drainage easement acquisition cost is **not included**.
- 2) The cost of clearing, grading and stabilization is **not included**, but is estimated to be approximately **\$10/sy**.

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PLAN



**LEGEND:**

	EXISTING SURVEYED PIPES
	PROPOSED PIPES
	EXISTING JUNCTION BOX TO REMAIN
	EXISTING CATCH BASIN TO REMAIN
	J.B. PROPOSED JUNCTION BOX
	CB PROPOSED CATCH BASIN
	CB PROPOSED CATCH BASIN WITH DRY WELL

NO.	DATE	BY	REVISION DESCRIPTION



STORMWATER DRAINAGE STUDY  
**TOWN OF SUNSET BEACH**  
 BRUNSWICK COUNTY, NORTH CAROLINA

JOB NO.: 15.01917  
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 CADD BY: ZL  
 DESIGN REVIEW:  
 CONST. REVIEW:  
 Recommended  
 Actions\_ Revised  
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RECOMMENDED ACTION  
 LAYOUT PLAN  
 CATCHMENT 5

SHEET  
**C-104**

## Catchment 6 – CIP Project

Location. East Main Street, North Shore Drive East, 1<sup>st</sup> St., 2<sup>nd</sup> St., and 3<sup>rd</sup> St.

Description of Problem. Pipe collapses and broken lines were identified during video inspections throughout the pipe system. Excessive standing water and sand found in the system indicates infiltration problems due to cracks or separations in the pipes. C-80 has a negative slope causing backwater and capacity loss. No drainage easement for outfall pipe C-75 on the north side of North Shore Drive East.

Recommended Actions. Replace all pipes, catch basins and junction boxes in the pipe network. Eliminate the curved line on C-78 by following 3<sup>rd</sup> St. north and avoid crossing two private parcels. Eliminate two junction boxes and angles in the line on C-73 and C-77 by routing the pipes north along the shoulders of 1<sup>st</sup> and 2<sup>nd</sup> Streets. Add two new junction boxes at the intersections of 2<sup>nd</sup> and 3<sup>rd</sup> Streets with North Shore Drive East. Eliminate negative pipe slope on C-80. Obtain a drainage easement for C-75. Four (4) sections of existing pipe to be replaced with perforated HDPE and set in #57 stone, totaling 160-linear feet, and nine (9) dry wells to be installed at inlet structures. These system retrofits will act as a water quality measures, allowing additional stormwater infiltration.

Estimated Cost. \$394,023.38

Priority. Medium



Photo of excessive sediment at Facility 71 in Catchment 6. Photo of damaged pipe inlet at Facility 79 in Catchment 6.

**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

**McGill Associates**

**CATCHMENT 6**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 8,310.41
2	Demolition (Existing Asphalt Road, Asphalt Driveway)	823	SY	\$ 8.00	\$ 6,584.89
3	15" HDPE	350	LF	\$ 25.00	\$ 8,750.00
4	18" HDPE	1,245	LF	\$ 27.00	\$ 33,615.00
5	18" HDPE (Perforated, in #57 stone)	160	LF	\$ 67.00	\$ 10,720.00
6	15" RCP	40	LF	\$ 32.00	\$ 1,280.00
7	18" RCP	605	LF	\$ 35.00	\$ 21,175.00
8	24"RCP	240	LF	\$ 42.00	\$ 10,080.00
9	Junction Box	4	EA	\$ 2,000.00	\$ 8,000.00
10	Catch Basin with Grate	9	EA	\$ 2,000.00	\$ 18,000.00
11	Existing Pipe Removal	2,640	LF	\$ 8.00	\$ 21,120.00
12	Existing Structure Removal	9	EA	\$ 500.00	\$ 4,500.00
13	Asphalt Road Repair	795	SY	\$ 125.00	\$ 99,416.67
14	Gravel Driveway Repair	335	SY	\$ 70.00	\$ 23,450.00
15	Asphalt Driveway Repair	28	SY	\$ 80.00	\$ 2,222.22
16	Dry Well	9	EA	\$ 900.00	\$ 8,100.00
17	Miscellaneous Private Property Repair	1	LOT	\$ 200.00	\$ 200.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	<b>\$ 285,524.19</b>
	Contingency (15 %)				\$ 42,828.63
<b>TOTAL CONSTRUCTION ESTIMATE</b>					<b>\$ 328,352.82</b>

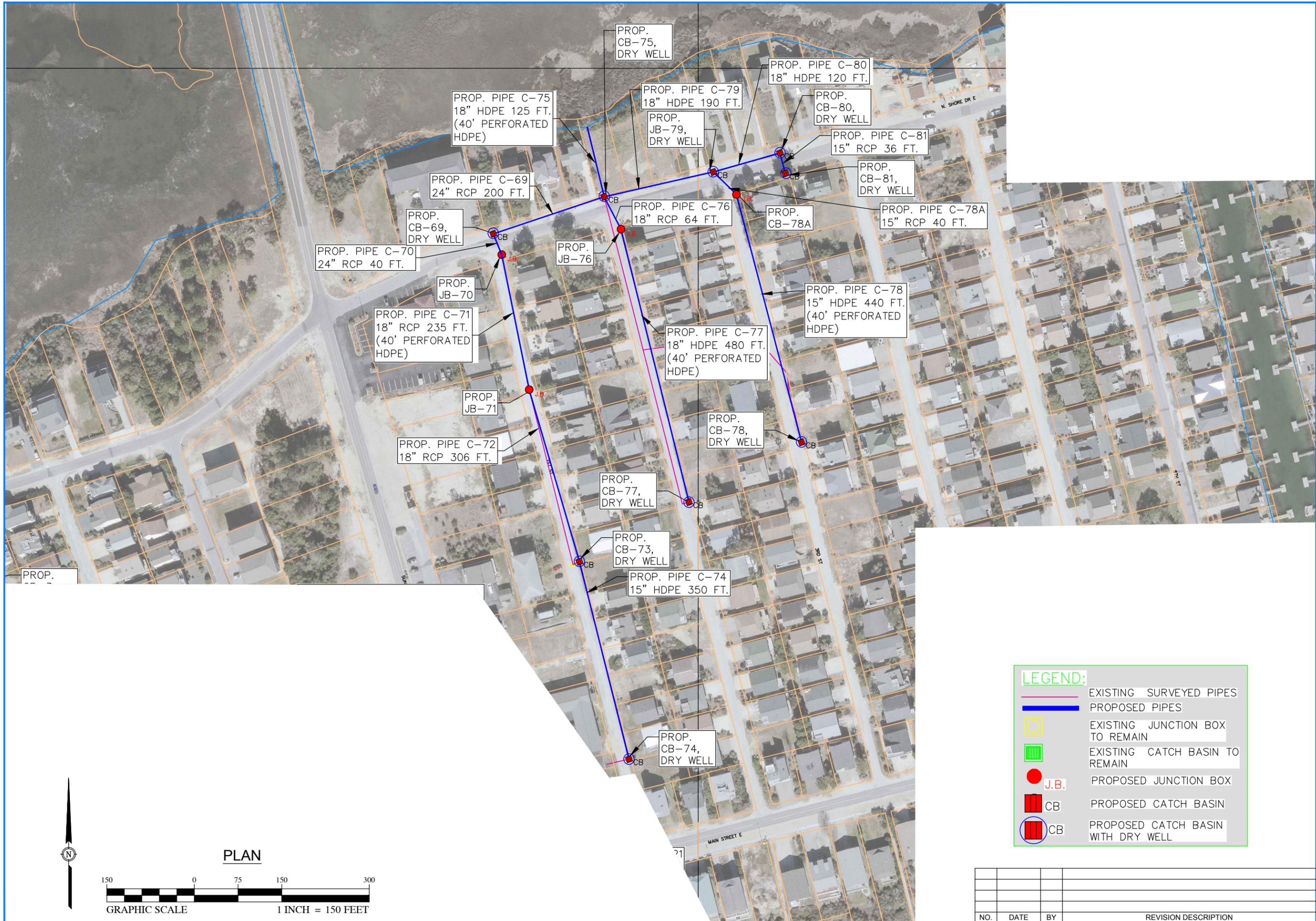
<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
<b>1</b>	Surveying, Geotechnical, Design, Permitting (20%)				\$ 65,670.56

**TOTAL COST ESTIMATE** \$ 394,023.38

NOTE:

- 1) Drainage easement acquisition cost is **not included**.
- 2) The cost of clearing, grading and stabilization is **not included**, but is estimated to be approximately **\$10/sy**.

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STORMWATER DRAINAGE STUDY  
**TOWN OF SUNSET BEACH**  
 BRUNSWICK COUNTY, NORTH CAROLINA

JOB NO.: 15.01917  
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 DESIGNED BY: XXX  
 CADD BY: ZL  
 DESIGN REVIEW: ZL  
 CONST. REVIEW: Recommended  
 Actions Revised  
 2-24-17.dwg

RECOMMENDED ACTION  
 LAYOUT PLAN  
 CATCHMENT 6

**LEGEND:**

- EXISTING SURVEYED PIPES
- PROPOSED PIPES
- EXISTING JUNCTION BOX TO REMAIN
- EXISTING CATCH BASIN TO REMAIN
- J.B. PROPOSED JUNCTION BOX
- CB PROPOSED CATCH BASIN
- CB PROPOSED CATCH BASIN WITH DRY WELL

NO.	DATE	BY	REVISION DESCRIPTION

## Catchment 7 – CIP Project

Location. East Main Street, 4<sup>th</sup> St., 5<sup>th</sup> St., 6<sup>th</sup> St., and Canal Dr.

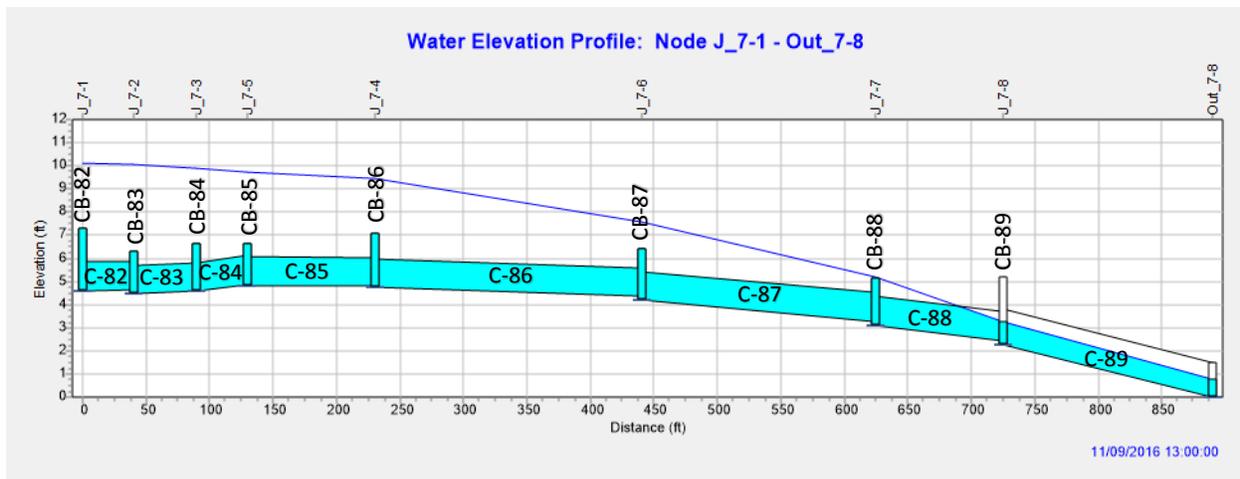
Description of Problem. Flooding reported along entire run of pipe from CB-82 to CB-88. Excessive sediment accumulation in pipes with some pipes entirely blocked; standing water in pipe sections.

- C-82 – 15" RCP: Model shows flooding at the pipe inlet.
- C-83 – 15" RCP: Negative pipe slopes between CB-83 and CB-85 causing backwater and capacity loss. Model shows flooding at the pipe inlet.
- C-84 – 15" RCP: Negative pipe slope causing backwater and capacity loss. Model shows flooding at the pipe inlet.
- C-85 – 15" HDPE: Unknown junction on C-85 before CB-86. Model shows flooding at the pipe inlet.
- C-86 – 15" CMP: Substandard pipe material. Model shows flooding at the pipe inlet. C-86 crosses two private parcels with no drainage easement.
- C-87 – 15" CMP: Substandard pipe material. Model shows pipe is surcharged. C-87 crosses two private parcels with no drainage easement.
- C-88 – 15" CMP: Substandard pipe material. Model shows pipe is surcharged.
- C-89 – 18" CMP: Substandard pipe material.

Recommended Actions. Replace all pipes and related catch basins; upsize pipes and replace all CMP with HDPE or RCP at road crossings. Eliminate C-86 and C-87 to avoid crossing private parcels; route new main trunk pipe along East Main Street. CB-86 and CB-87 will be converted into side drainages that will intersect with the trunk line along East Main Street. Abandon CB-88. Install two new catch basins at the intersections of 5<sup>th</sup> and 6<sup>th</sup> Streets with East Main Street for the new main trunk pipe. Two (2) sections of existing pipe to be replaced with perforated HDPE and set in #57 stone, totaling 80-linear feet, and ten (10) dry wells to be installed at inlet structures. These system retrofits will act as a water quality measures, allowing additional stormwater infiltration.

Estimated Cost. \$177,814.93

Priority. High



**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

**McGill Associates**

**CATCHMENT 7**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 3,753.03
2	Demolition (Existing Asphalt Road, Asphalt Driveway)	322	SY	\$ 8.00	\$ 2,576.00
3	18" HDPE	192	LF	\$ 27.00	\$ 5,184.00
4	18" HDPE (Perforated, in #57 stone)	80	LF	\$ 67.00	\$ 5,360.00
5	18" RCP	653	LF	\$ 35.00	\$ 22,855.00
6	Catch Basin with Grate	10	EA	\$ 2,000.00	\$ 20,000.00
7	Existing Pipe Removal	230	LF	\$ 8.00	\$ 1,840.00
8	Existing Structure Removal	8	EA	\$ 500.00	\$ 4,000.00
9	Asphalt Road Repair	322	SY	\$ 125.00	\$ 40,208.33
10	Gravel Driveway Repair	201	SY	\$ 70.00	\$ 14,077.78
11	Dry Well	10	EA	\$ 900.00	\$ 9,000.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	<b>\$ 128,854.14</b>
	Contingency (15 %)				\$ 19,328.12
<b>TOTAL CONSTRUCTION ESTIMATE</b>					<b>\$ 148,182.27</b>

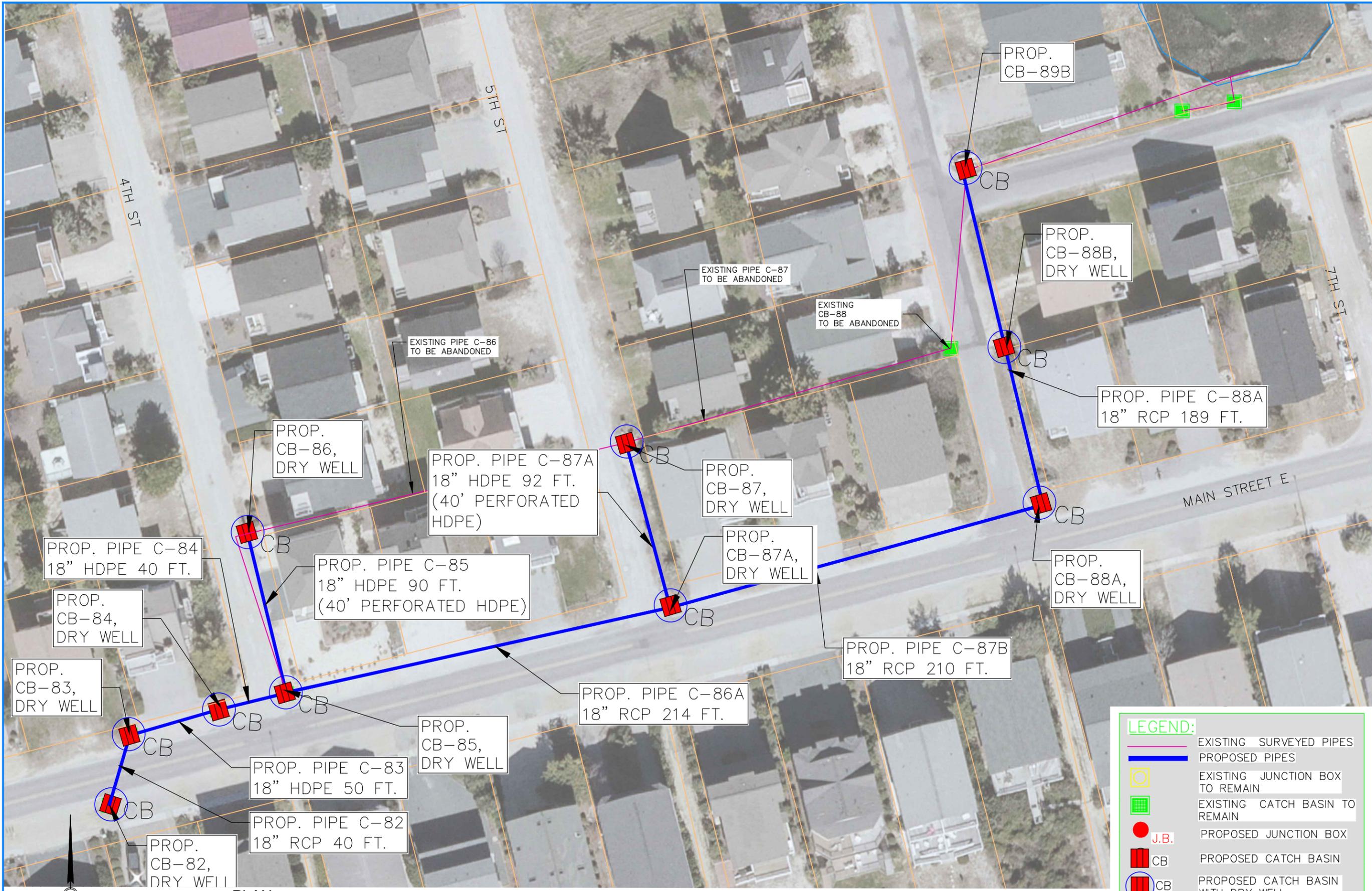
<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
<b>1</b>	Surveying, Geotechnical, Design, Permitting (20%)				\$ 29,636.45

**TOTAL COST ESTIMATE \$ 177,818.72**

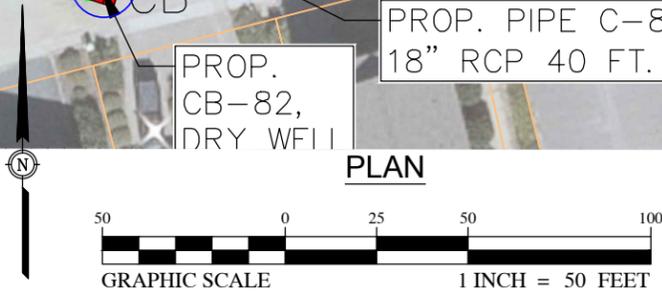
**NOTE:**

- 1) Drainage easement acquisition cost is **not included**.
- 2) The cost of clearing, grading and stabilization is **not included**, but is estimated to be approximately **\$10/sy**.

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PLAN



**LEGEND:**

	EXISTING SURVEYED PIPES
	PROPOSED PIPES
	EXISTING JUNCTION BOX TO REMAIN
	EXISTING CATCH BASIN TO REMAIN
	J.B. PROPOSED JUNCTION BOX
	PROPOSED CATCH BASIN
	PROPOSED CATCH BASIN WITH DRY WELL

NO.	DATE	BY	REVISION DESCRIPTION



STORMWATER DRAINAGE STUDY  
**TOWN OF SUNSET BEACH**  
 BRUNSWICK COUNTY, NORTH CAROLINA

JOB NO.: 15.01917  
 DATE: FEB., 2017  
 DESIGNED BY: XXX  
 CADD BY: ZL  
 DESIGN REVIEW:  
 CONST. REVIEW:  
 Recommended  
 Actions\_ Revised  
 2-24-17.dwg

RECOMMENDED ACTION  
 LAYOUT PLAN  
 CATCHMENT 7

SHEET  
**C-106**

## Catchment 8 – CIP Project

Location. Marlin Street

Description of Problem. Pipe C-96 is too short and has separated from the adjoining bulkhead; stormwater is flowing behind the bulkhead and causing erosion. Pipe material is substandard.

Recommended Actions. Replace pipe and catch basin. Replace CPP with HDPE. A dry well to be installed at inlet structure CB-96 to act as a water quality measure, allowing additional stormwater infiltration.

Estimated Cost. \$6,325.23

Priority. Medium

Photo of outlet end on C-96. Note pipe outlet is not seated in bulkhead.  
Stormwater is piling up at bulkhead and causing erosion around pipe.



**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

**McGill Associates**

**CATCHMENT 8**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 133.50
2	18" HDPE	30	LF	\$ 27.00	\$ 810.00
3	Catch Basin with Grate	1	EA	\$ 2,000.00	\$ 2,000.00
4	Existing Pipe Removal	30	LF	\$ 8.00	\$ 240.00
5	Existing Structure Removal	1	EA	\$ 500.00	\$ 500.00
6	Dry Well	1	EA	\$ 900.00	\$ 900.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	<b>\$ 4,583.50</b>
	Contingency (15 %)				\$ 687.53
<b>TOTAL CONSTRUCTION ESTIMATE</b>					<b>\$ 5,271.03</b>

<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
<b>1</b>	Surveying, Geotechnical, Design, Permitting (20%)				\$ 1,054.21

**TOTAL COST ESTIMATE** \$ 6,325.23

**NOTE:**

- 1) Drainage easement acquisition cost is **not included**.
- 2) The cost of clearing, grading and stabilization is **not included**, but is estimated to be approximately **\$10/sy**.

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PROP. PIPE C-96  
18" HDPE 30 FT.

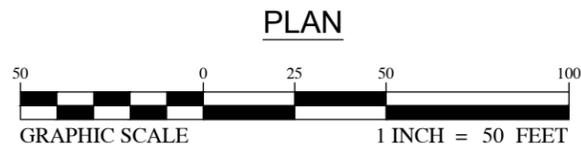
PROP.  
CB-96,  
DRY WELL

CB



STORMWATER DRAINAGE STUDY  
**TOWN OF SUNSET BEACH**  
BRUNSWICK COUNTY, NORTH CAROLINA

JOB NO.: 15.01917  
DATE: FEB., 2017  
DESIGNED BY: XXX  
CADD BY: ZL  
DESIGN REVIEW:  
CONST. REVIEW:  
Recommended  
Actions\_ Revised  
2-24-17.dwg



**LEGEND:**

	EXISTING SURVEYED PIPES
	PROPOSED PIPES
	EXISTING JUNCTION BOX TO REMAIN
	EXISTING CATCH BASIN TO REMAIN
	J.B. PROPOSED JUNCTION BOX
	CB PROPOSED CATCH BASIN
	CB PROPOSED CATCH BASIN WITH DRY WELL

RECOMMENDED ACTION  
LAYOUT PLAN  
CATCHMENT 8

SHEET  
**C-107**

NO.	DATE	BY	REVISION DESCRIPTION

## **Catchment 15 – CIP Project**

Location. Main Street East and Canal Drive

Description of Problem. Flooding noted at CB-128 and CB-129. Undersized infiltration pipes on CB-128. Problems with clogged Infiltration pipes and maintenance on CB-129; not an effective and long-term solution for alleviating flooding.

Recommended Actions. Upsize CB-128 infiltration pipes to 15” perforated HDPE. Connect CB-129 to Catchment 15 outfall with the installation of three (3) new HDPE pipe sections and two (2) new catch basin inlets. Two (2) sections of replacement pipe to use perforated HDPE and set in #57 stone, totaling 100-linear feet. One (1) dry well to be installed at inlet structure CB-110.

Estimated Cost. \$59,057.27

Priority. Medium

**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

McGill Associates

**CATCHMENT 15**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 1,246.54
2	Demolition (Existing Asphalt Road, Asphalt Driveway)	105	SY	\$ 8.00	\$ 840.00
3	18" HDPE	199	LF	\$ 27.00	\$ 5,373.00
4	15" HDPE (Perforated, in #57 stone)	36	LF	\$ 62.00	\$ 2,232.00
5	18" HDPE (Perforated, in #57 stone)	100	LF	\$ 67.00	\$ 6,700.00
6	18" RCP	36	LF	\$ 35.00	\$ 1,260.00
7	Catch Basin with Grate	5	EA	\$ 2,000.00	\$ 10,000.00
8	Existing Pipe Removal	36	LF	\$ 8.00	\$ 288.00
9	Existing Structure Removal	3	EA	\$ 500.00	\$ 1,500.00
10	Asphalt Road Repair	91	SY	\$ 125.00	\$ 11,347.22
11	Asphalt Driveway Repair	14	SY	\$ 80.00	\$ 1,111.11
12	Dry Well	1	EA	\$ 900.00	\$ 900.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	<b>\$ 42,797.87</b>
	Contingency (15 %)				\$ 6,419.68
<b>TOTAL CONSTRUCTION ESTIMATE</b>					<b>\$ 49,217.55</b>

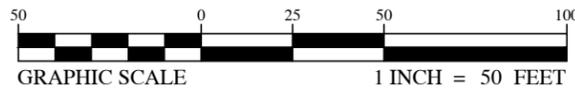
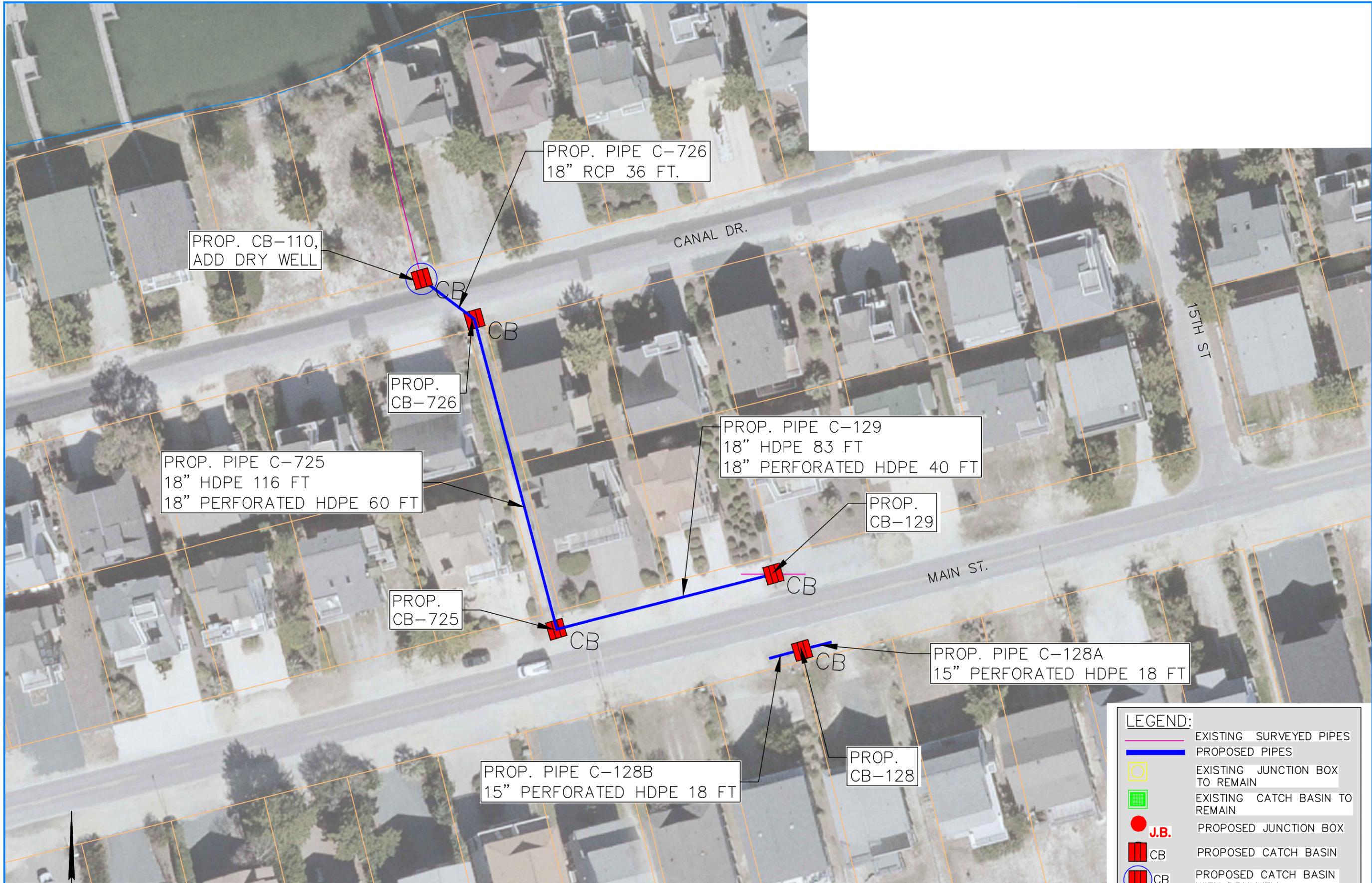
<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
<b>1</b>	Surveying, Geotechnical, Design, Permitting (20%)				\$ 9,843.51

<b>TOTAL COST ESTIMATE</b>					<b>\$ 59,061.07</b>
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NOTE:

- 1) Drainage easement acquisition cost is **not included**.
- 2) The cost of clearing, grading and stabilization is **not included**, but is estimated to be approximately **\$10/sy**.

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**LEGEND:**

	EXISTING SURVEYED PIPES
	PROPOSED PIPES
	EXISTING JUNCTION BOX TO REMAIN
	EXISTING CATCH BASIN TO REMAIN
	J.B. PROPOSED JUNCTION BOX
	CB PROPOSED CATCH BASIN
	CB PROPOSED CATCH BASIN WITH DRY WELL

NO.	DATE	BY	REVISION DESCRIPTION



JOB NO.: 15.01917  
DATE: MARCH, 2017  
DESIGNED BY: XXX  
CADD BY: ZL  
DESIGN REVIEW: J.R.  
CONST. REVIEW: J.R.  
Recommended  
Actions\_Catchment  
15.dwg

## **Catchment 16 – CIP Project**

Location. Canal Drive

Description of Problem. Unknown junction or sharp bend in the pipe. Substandard pipe material.

Recommended Actions. Replace C-112 to follow Canal Drive east and connect with new catch basin CB-113; run new pipe north from CB-113 to outfall. Replace CB-112 with new catch basin. Replace CPP with HDPE. A 40-linear foot section of replacement pipe to be perforated HDPE set in #57 stone, and two (2) dry wells to be installed at inlet structures. These system retrofits will act as a water quality measures, allowing additional stormwater infiltration.

Estimated Cost. \$23,721.59

Priority. Low

**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

**McGill Associates**

**CATCHMENT 16**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 500.77
2	Demolition (Existing Asphalt Road, Asphalt Driveway)	6	SY	\$ 8.00	\$ 48.00
3	18" HDPE	140	LF	\$ 27.00	\$ 3,780.00
4	18" HDPE (Perforated, in #57 stone)	40	LF	\$ 67.00	\$ 2,680.00
5	Catch Basin with Grate	2	EA	\$ 2,000.00	\$ 4,000.00
6	Existing Pipe Removal	180	LF	\$ 8.00	\$ 1,440.00
7	Existing Structure Removal	1	EA	\$ 500.00	\$ 500.00
8	Asphalt Road Repair	6	SY	\$ 125.00	\$ 694.44
9	Gravel Driveway Repair	25	SY	\$ 70.00	\$ 1,750.00
10	Dry Well	2	EA	\$ 900.00	\$ 1,800.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	<b>\$ 17,193.22</b>
	Contingency (15 %)				\$ 2,578.98
<b>TOTAL CONSTRUCTION ESTIMATE</b>					<b>\$ 19,772.20</b>

<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
<b>1</b>	Surveying, Geotechnical, Design, Permitting (20%)				\$ 3,954.44

<b>TOTAL COST ESTIMATE</b>					<b>\$ 23,726.64</b>
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NOTE:

- 1) Drainage easement acquisition cost is **not included**.
- 2) The cost of clearing, grading and stabilization is **not included**, but is estimated to be approximately **\$10/sy**.

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PROP. PIPE C-112  
18" HDPE 55 FT.

PROP. CB-112,  
DRY WELL

PROP. PIPE C-113  
18" HDPE 125 FT.  
(40' PERFORATED HDPE)

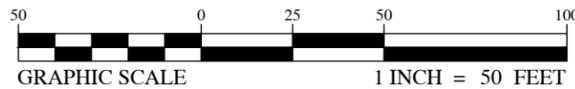
PROP. CB-113,  
DRY WELL

PROP. PIPE C-114  
18" HDPE 105 FT.  
(40' PERFORATED HDPE)

PROP. CB-114,  
DRY WELL



PLAN



**LEGEND:**

	EXISTING SURVEYED PIPES
	PROPOSED PIPES
	EXISTING JUNCTION BOX TO REMAIN
	EXISTING CATCH BASIN TO REMAIN
	J.B. PROPOSED JUNCTION BOX
	CB PROPOSED CATCH BASIN
	CB PROPOSED CATCH BASIN WITH DRY WELL

NO.	DATE	BY	REVISION DESCRIPTION



STORMWATER DRAINAGE STUDY  
**TOWN OF SUNSET BEACH**  
 BRUNSWICK COUNTY, NORTH CAROLINA

JOB NO.: 15.01917  
 DATE: FEB., 2017  
 DESIGNED BY: XXX  
 CADD BY: ZL  
 DESIGN REVIEW: —  
 CONST. REVIEW: —  
 Recommended Actions\_ Revised 2-24-17.dwg

RECOMMENDED ACTION  
 LAYOUT PLAN  
 CATCHMENT 16

SHEET  
**C-108**

## Catchment 17 – CIP Project

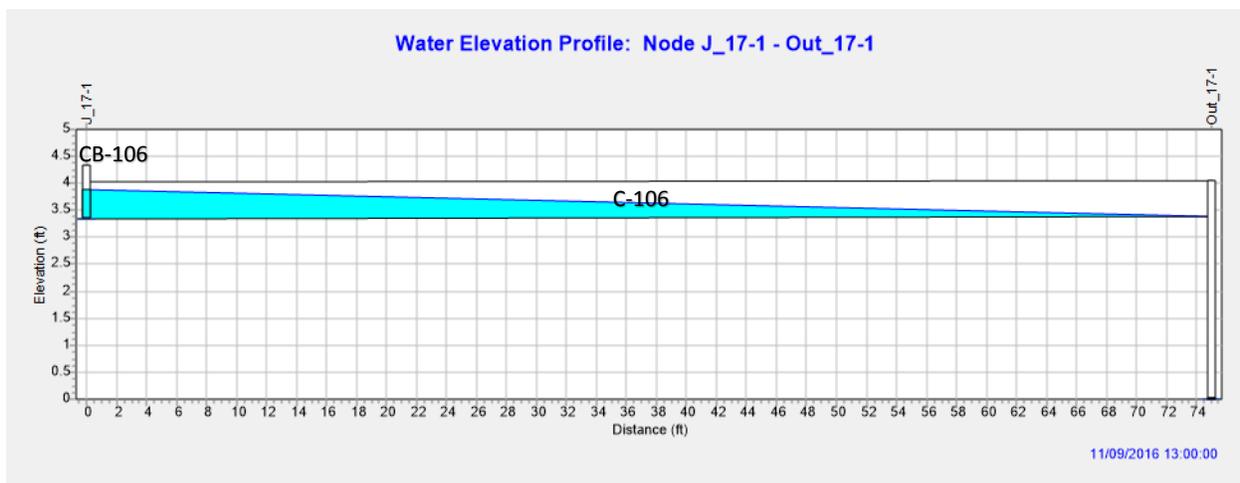
Location. 18<sup>th</sup> Street

Description of Problem. Poor slope on existing pipe. Substandard pipe size. Catch basin located on private property.

Recommended Actions. Replace pipe and catch basin. Install new catch basin in road ROW. Upsize C-106 to a 15" pipe. A 40-linear foot section of replacement pipe to be perforated HDPE set in #57 stone, and one (1) dry well to be installed at inlet structure CB-106. These system retrofits will act as a water quality measures, allowing additional stormwater infiltration.

Estimated Cost. \$17,658.62

Priority. Low



**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

**McGill Associates**

**CATCHMENT 17**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 366.90
2	Demolition (Existing Asphalt Road, Asphalt Driveway)	38	SY	\$ 8.00	\$ 304.00
3	15" HDPE	30	LF	\$ 25.00	\$ 750.00
4	15" HDPE (Perforated, in #57 stone)	40	LF	\$ 62.00	\$ 2,480.00
5	Catch Basin with Grate	1	EA	\$ 2,000.00	\$ 2,000.00
6	Existing Pipe Removal	70	LF	\$ 8.00	\$ 560.00
7	Existing Structure Removal	1	EA	\$ 500.00	\$ 500.00
8	Asphalt Road Repair	38	SY	\$ 125.00	\$ 4,736.11
9	Dry Well	1	EA	\$ 900.00	\$ 900.00
10	Miscellaneous Private Property Repair	1	LOT	\$ 200.00	\$ 200.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	<b>\$ 12,797.01</b>
	Contingency (15 %)				\$ 1,919.55
<b>TOTAL CONSTRUCTION ESTIMATE</b>					<b>\$ 14,716.57</b>

<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
<b>1</b>	Surveying, Geotechnical, Design, Permitting (20%)				\$ 2,943.31
<b>TOTAL COST ESTIMATE</b>					<b>\$ 17,659.88</b>

NOTE:

- 1) Drainage easement acquisition cost is **not included**.
- 2) The cost of clearing, grading and stabilization is **not included**, but is estimated to be approximately **\$10/sv**.

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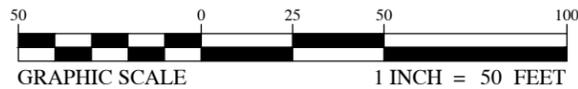


PROP. CB-106  
 NOTE:  
 RELOCATE CATCH BASIN  
 INTO ROW.

PROP. PIPE C-106  
 15" HDPE 70 FT  
 (40' PERFORATED HDPE).

**LEGEND:**

	EXISTING SURVEYED PIPES
	PROPOSED PIPES
	EXISTING JUNCTION BOX TO REMAIN
	EXISTING CATCH BASIN TO REMAIN
	J.B. PROPOSED JUNCTION BOX
	CB PROPOSED CATCH BASIN
	CB PROPOSED CATCH BASIN WITH DRY WELL



PLAN



STORMWATER DRAINAGE STUDY  
**TOWN OF SUNSET BEACH**  
 BRUNSWICK COUNTY, NORTH CAROLINA

JOB NO.: 15.01917  
 DATE: MARCH, 2017  
 DESIGNED BY: XXX  
 CADD BY: ZL  
 DESIGN REVIEW:  
 CONST. REVIEW:  
 Recommended  
 Actions\_ Revised  
 2-24-17.dwg

RECOMMENDED ACTION  
 LAYOUT PLAN  
 CATCHMENT 17

SHEET  
**C-109**

NO.	DATE	BY	REVISION DESCRIPTION

## **Catchment 18 – CIP Project**

Location. Canal Drive

Description of Problem. Unknown junction box between CB-116 and CB-114. Excessive sediment accumulation in pipes and catch basins. Substandard pipe material.

Recommended Actions. Replace C-114 and C-116 with HDPE pipe and upsize. Install new catch basin CB-115 to connect C-114 and C-116 with outfall pipe C-115. Replace CB-114 and CB-116 with new catch basins. Two (2) sections of existing pipe to be replaced with perforated HDPE and set in #57 stone, totaling 80-linear feet, and two (2) dry wells to be installed at inlet structures. These system retrofits will act as a water quality measures, allowing additional stormwater infiltration.

Estimated Cost. \$47,229.96

Priority. Low

**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

**McGill Associates**

**CATCHMENT 18**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 996.81
2	Demolition (Existing Asphalt Road, Asphalt Driveway)	36	SY	\$ 8.00	\$ 288.00
3	18" HDPE	175	LF	\$ 27.00	\$ 4,725.00
4	18" HDPE (Perforated, in #57 stone)	80	LF	\$ 67.00	\$ 5,360.00
5	Catch Basin with Grate	3	EA	\$ 2,000.00	\$ 6,000.00
6	Existing Pipe Removal	255	LF	\$ 8.00	\$ 2,040.00
7	Existing Structure Removal	3	EA	\$ 500.00	\$ 1,500.00
8	Asphalt Road Repair	36	SY	\$ 125.00	\$ 4,513.89
9	Gravel Driveway Repair	100	SY	\$ 70.00	\$ 7,000.00
10	Dry Well	2	EA	\$ 900.00	\$ 1,800.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	\$ <b>34,223.70</b>
	Contingency (15 %)				\$ 5,133.55
<b>TOTAL CONSTRUCTION ESTIMATE</b>					\$ <b>39,357.25</b>

<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
<b>1</b>	Surveying, Geotechnical, Design, Permitting (20%)				\$ 7,871.45
<b>TOTAL COST ESTIMATE</b>					\$ <b>47,228.70</b>

NOTE:

- 1) Drainage easement acquisition cost is **not included**.
- 2) The cost of clearing, grading and stabilization is **not included**, but is estimated to be approximately **\$10/sy**.

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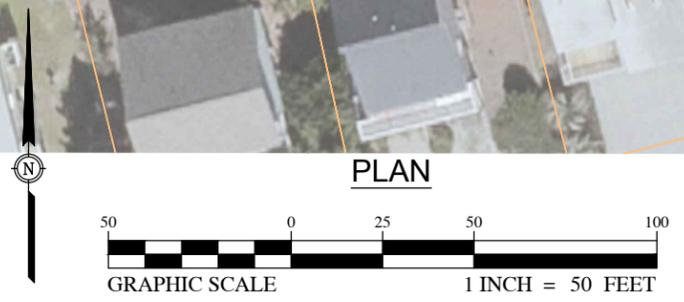
STORMWATER DRAINAGE STUDY  
**TOWN OF SUNSET BEACH**  
 BRUNSWICK COUNTY, NORTH CAROLINA

JOB NO.: 15.01917  
 DATE: FEB., 2017  
 DESIGNED BY: XXX  
 CADD BY: ZL  
 DESIGN REVIEW: —  
 CONST. REVIEW: —  
 Recommended  
 Actions\_ Revised  
 2-24-17.dwg

RECOMMENDED ACTION  
 LAYOUT PLAN  
 CATCHMENT 18

**LEGEND:**

	EXISTING SURVEYED PIPES
	PROPOSED PIPES
	EXISTING JUNCTION BOX TO REMAIN
	EXISTING CATCH BASIN TO REMAIN
	J.B. PROPOSED JUNCTION BOX
	CB PROPOSED CATCH BASIN
	CB PROPOSED CATCH BASIN WITH DRY WELL



NO.	DATE	BY	REVISION DESCRIPTION

## Catchment 22 – CIP Project

Location. Ocean Harbour Golf Club Rd.

Description of Problem. C-262 is severely deteriorated with holes observed along the bottom of the pipe. Pipe material is substandard.

Recommended Actions. Replace C-262 with RCP.

Estimated Cost. \$12,018.82

Priority. Medium



Photo of pipe inlet with signs of severe deterioration.



Photo of pipe outlet with signs of severe deterioration.

**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

**McGill Associates**

**CATCHMENT 22**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 247.90
2	Demolition (Existing Asphalt Road, Asphalt Driveway)	22	SY	\$ 8.00	\$ 176.00
3	18" RCP	55	LF	\$ 35.00	\$ 1,925.00
4	FES with Riprap apron	1	EA	\$ 3,000.00	\$ 3,000.00
5	Existing Pipe Removal	55	LF	\$ 8.00	\$ 440.00
6	Asphalt Road Repair	22	SY	\$ 125.00	\$ 2,722.22
7	Miscellaneous Private Property Repair	1	LOT	\$ 200.00	\$ 200.00
<b>Subtotal Construction Cost Estimate</b>				<b>\$ -</b>	<b>\$ 8,711.12</b>
	Contingency (15 %)				\$ 1,306.67
<b>TOTAL CONSTRUCTION ESTIMATE</b>				<b>\$ -</b>	<b>\$ 10,017.79</b>

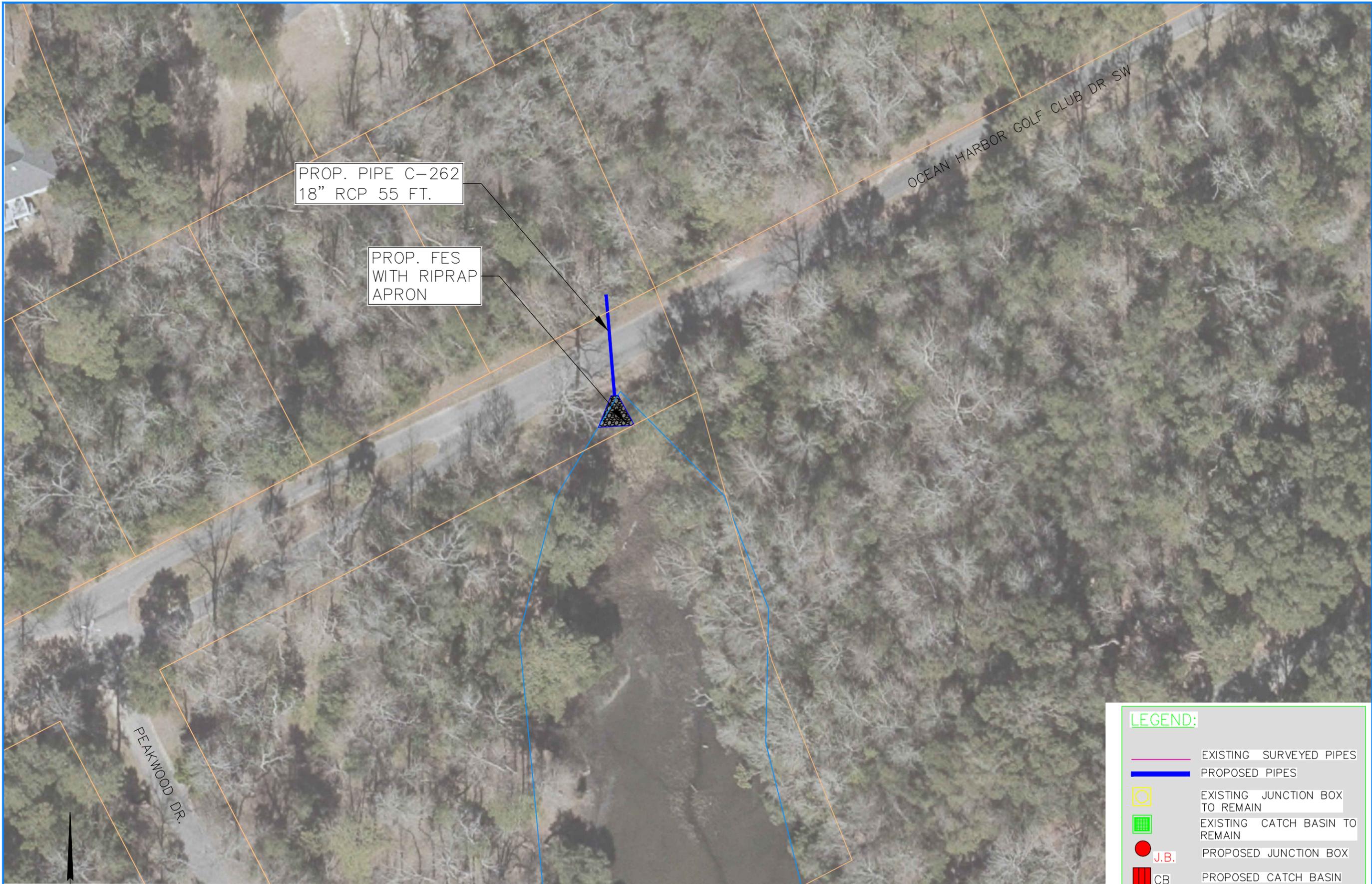
<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
<b>1</b>	Surveying, Geotechnical, Design, Permitting (20%)				\$ 2,003.56

<b>TOTAL COST ESTIMATE</b>				<b>\$</b>	<b>12,021.34</b>
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NOTE:

- 1) Drainage easement acquisition cost is **not included**.
- 2) The cost of clearing, grading and stabilization is **not included**, but is estimated to be approximately **\$10/sy**.

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PROP. PIPE C-262  
18" RCP 55 FT.

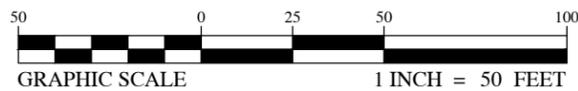
PROP. FES  
WITH RIPRAP  
APRON

OCEAN HARBOR GOLF CLUB DR SW

PEAKWOOD DR.



PLAN



**LEGEND:**

	EXISTING SURVEYED PIPES
	PROPOSED PIPES
	EXISTING JUNCTION BOX TO REMAIN
	EXISTING CATCH BASIN TO REMAIN
	J.B. PROPOSED JUNCTION BOX
	CB PROPOSED CATCH BASIN

NO.	DATE	BY	REVISION DESCRIPTION



STORMWATER DRAINAGE STUDY  
**TOWN OF SUNSET BEACH**  
BRUNSWICK COUNTY, NORTH CAROLINA

JOB NO.: 15.01917  
DATE: FEB., 2017  
DESIGNED BY: XXX  
CADD BY: ZL  
DESIGN REVIEW:  
CONST. REVIEW:  
Project Maps\_Recommended Actions.dwg

RECOMMENDED ACTION  
LAYOUT PLAN  
CATCHMENT 22

SHEET  
**C-111**

## Catchment 23 – CIP Project

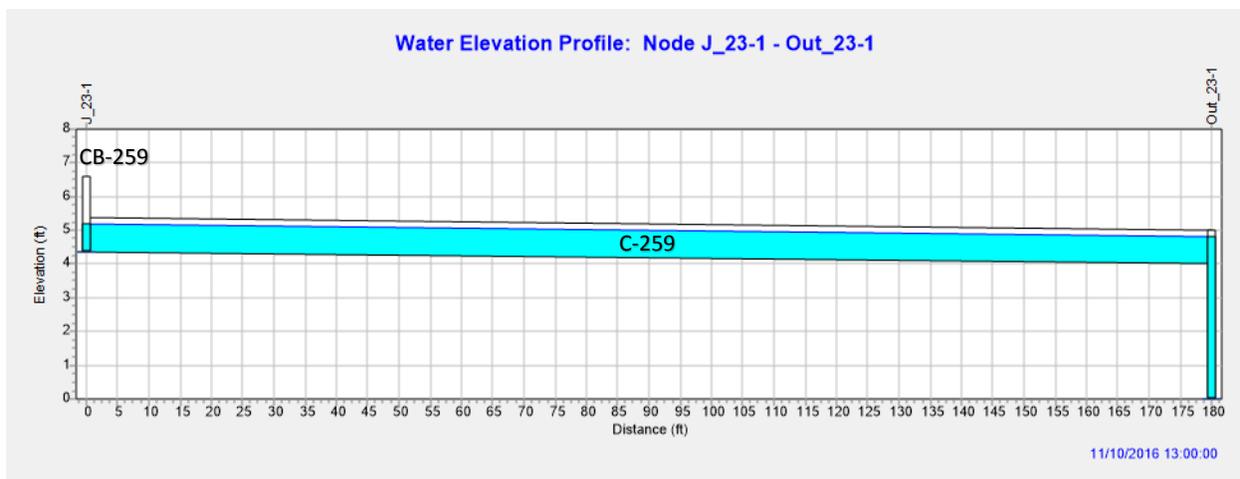
Location. Twin Lakes Ct.

Description of Problem. Substandard pipe material. Model shows C-259 is undersized and unable to support new development in the surrounding area; functions at full capacity during a 50-year storm. No drainage easement on pipe and outfall.

Recommended Actions. Obtain a drainage easement. Replace C-259 with HDPE and install catch basin. A 40-linear foot section of replacement pipe to be perforated HDPE set in #57 stone, and one (1) dry well to be installed at inlet structure CB-259. These system retrofits will act as a water quality measures, allowing additional stormwater infiltration.

Estimated Cost. \$18,848.33

Priority. Low



**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

**McGill Associates**

**CATCHMENT 23**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 392.01
2	Demolition (Existing Asphalt Road, Asphalt Driveway)	17	SY	\$ 8.00	\$ 136.00
3	15" HDPE	140	LF	\$ 25.00	\$ 3,500.00
4	15" HDPE (Perforated, in #57 stone)	40	LF	\$ 62.00	\$ 2,480.00
5	Catch Basin with Grate	1	EA	\$ 2,000.00	\$ 2,000.00
6	Existing Pipe Removal	180	LF	\$ 8.00	\$ 1,440.00
7	Existing Structure Removal	1	EA	\$ 500.00	\$ 500.00
8	Asphalt Road Repair	17	SY	\$ 125.00	\$ 2,111.11
9	Dry Well	1	LF	\$ 900.00	\$ 900.00
10	Miscellaneous Private Property Repair	1	LOT	\$ 200.00	\$ 200.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	\$ <b>13,659.12</b>
	Contingency (15 %)				\$ 2,048.87
<b>TOTAL CONSTRUCTION ESTIMATE</b>					\$ <b>15,707.99</b>

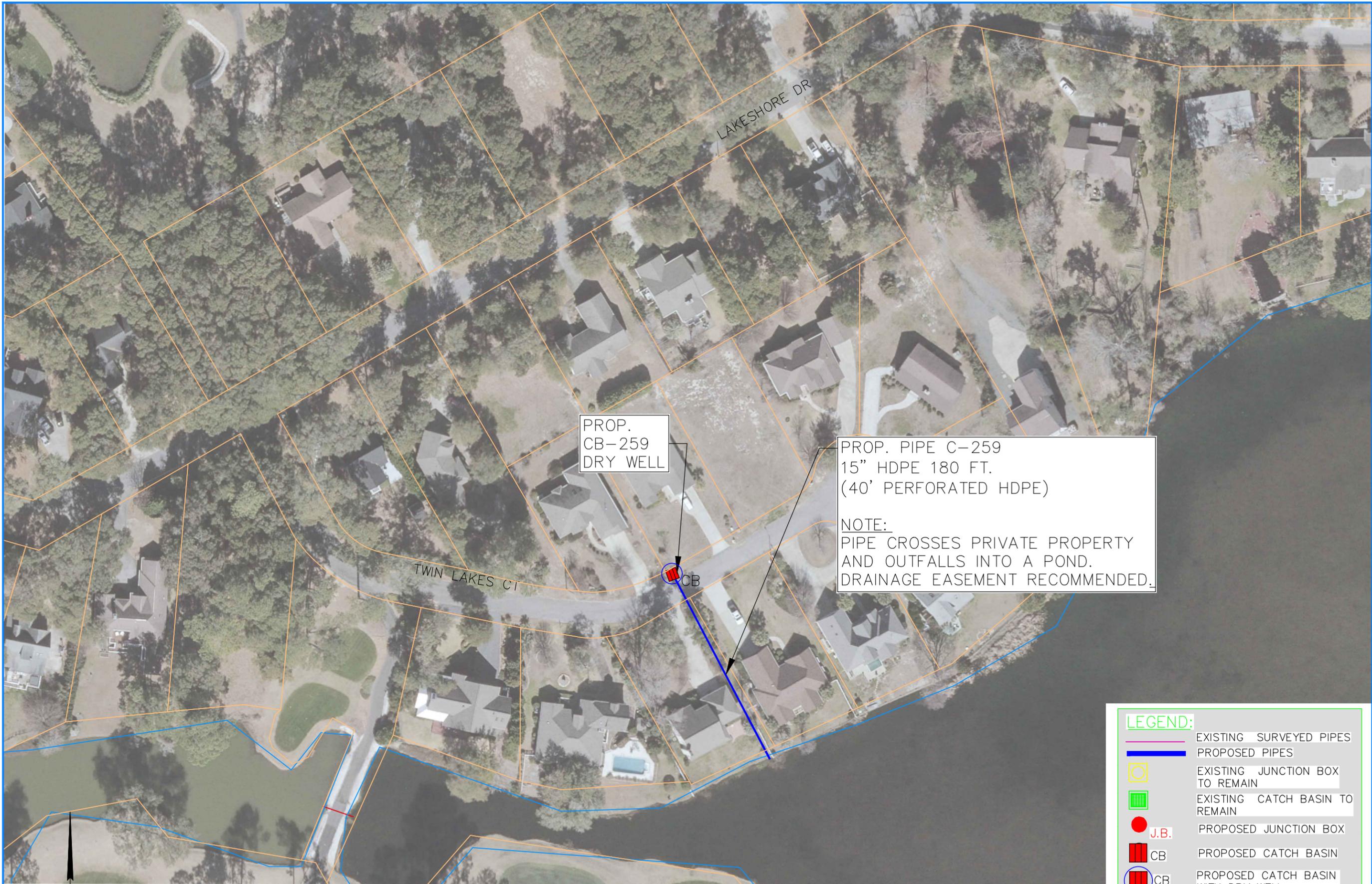
<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
<b>1</b>	Surveying, Geotechnical, Design, Permitting (20%)				\$ 3,141.60

<b>TOTAL COST ESTIMATE</b>					\$ <b>18,849.59</b>
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NOTE:

- 1) Drainage easement acquisition cost is **not included**.
- 2) The cost of clearing, grading and stabilization is **not included**, but is estimated to be approximately **\$10/sy**.

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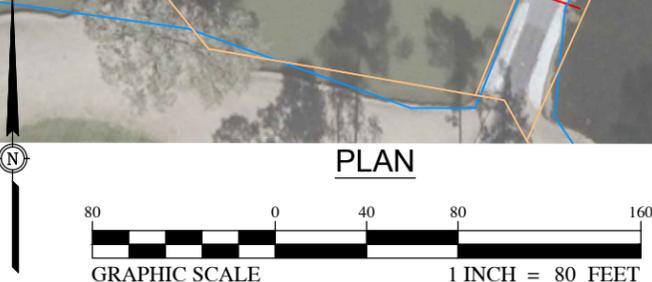
PROP.  
CB-259  
DRY WELL

PROP. PIPE C-259  
15" HDPE 180 FT.  
(40' PERFORATED HDPE)

NOTE:  
PIPE CROSSES PRIVATE PROPERTY  
AND OUTFALLS INTO A POND.  
DRAINAGE EASEMENT RECOMMENDED.

**LEGEND:**

	EXISTING SURVEYED PIPES
	PROPOSED PIPES
	EXISTING JUNCTION BOX TO REMAIN
	EXISTING CATCH BASIN TO REMAIN
	J.B. PROPOSED JUNCTION BOX
	CB PROPOSED CATCH BASIN
	CB PROPOSED CATCH BASIN WITH DRY WELL



PLAN



STORMWATER DRAINAGE STUDY  
**TOWN OF SUNSET BEACH**  
BRUNSWICK COUNTY, NORTH CAROLINA

JOB NO.: 15.01917  
DATE: FEB., 2017  
DESIGNED BY: XXX  
CADD BY: ZL  
DESIGN REVIEW:  
CONST. REVIEW:  
Recommended  
Actions\_ Revised  
2-24-17.dwg

RECOMMENDED ACTION  
LAYOUT PLAN  
CATCHMENT 23

SHEET  
**C-112**

NO.	DATE	BY	REVISION DESCRIPTION

## **Catchment 26 – CIP Project**

Location. Clubhouse Road from northern intersection with Sea Trail Dr., south approximately 1600 feet.

Description of Problem. Periodic flooding in road.

- CB-250 – located south of the flooding area, this existing drop inlet does not capture water ponding in road, it is uncertain where this inlet drains to because the 24" RCP extends onto private property and an outlet or connecting structure could be located.
- CB-253 – located on the north end of the flooding area, this drop inlet does not collect sufficient stormwater to mitigate road flooding. The 12" CPP exiting the box extends into private property and an outlet or connection could be located.

Recommended Actions. Install a new drainage system to capture all stormwater that collects along Clubhouse Road from north of Sea Trail Road and south approximately 1600 feet to where an outfall to an existing ditch is possible. This system would add additional inlets in the areas most impacted by periodic flooding. This system will include infiltration pipes in the areas where soils and depth to water table are suitable.

Estimated Cost. \$175,536.00

Priority. Medium

**PRELIMINARY PROJECT COST ESTIMATE**

June 8, 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

McGill Associates

**CATCHMENT 26 - CLUBHOUSE ROAD**

No.	DESCRIPTION	QTY.	UNIT	UNIT PRICE	EXTENSION
1	Mobilization (3%)	1	LS	\$ -	\$ 3,500.00
2	Demolition (Existing Asphalt Road, Asphalt Driveway)	110	SY	\$ 8.00	\$ 880.00
3	18" HDPE	700	LF	\$ 27.00	\$ 18,900.00
4	15" HDPE (Perforated, in #57 stone)	800	LF	\$ 62.00	\$ 49,600.00
5	15" RCP	100	LF	\$ 32.00	\$ 3,200.00
6	Catch Basin with Grate	4	EA	\$ 2,000.00	\$ 8,000.00
7	FES with Riprap apron	1	EA	\$ 3,000.00	\$ 3,000.00
8	Asphalt Road Repair	100	SY	\$ 125.00	\$ 12,500.00
9	Inlet with Dry Well	8	EA	\$ 2,900.00	\$ 23,200.00
10	Miscellaneous Private Property Repair	1	LS	\$ 4,500.00	\$ 4,500.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	<b>\$ 127,280.00</b>
	Contingency (15 %)				\$ 19,000.00
<b>TOTAL CONSTRUCTION ESTIMATE</b>					<b>\$ 146,280.00</b>

No.	DESCRIPTION				EXTENSION
1	Surveying, Geotechnical, Design, Permitting (20%)				\$ 29,256.00

<b>TOTAL COST ESTIMATE</b>					<b>\$ 175,536.00</b>
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NOTE:

- 1) Drainage easement acquisition cost is **not included**.
- 2) The cost of clearing, grading and stabilization is **not included**, but is estimated to be approximately **\$10/sy**.

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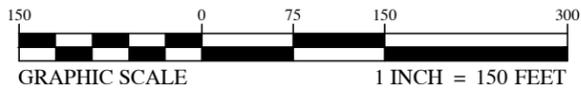


PROP. PIPE  
 15" RCP 100 FT. UNDER ROAD  
 15" PERFORATED HDPE 800 FT.  
 18" HDPE 700 FT.

PROP. FES WITH RIPRAP APRON



PLAN



**LEGEND:**

	EXISTING SURVEYED PIPES
	PROPOSED PIPES
	EXISTING JUNCTION BOX TO REMAIN
	EXISTING CATCH BASIN TO REMAIN
	PROPOSED JUNCTION BOX
	PROPOSED CATCH BASIN
	PROPOSED CATCH BASIN WITH DRY WELL

NO.	DATE	BY	REVISION DESCRIPTION



STORMWATER DRAINAGE STUDY  
**TOWN OF SUNSET BEACH**  
 BRUNSWICK COUNTY, NORTH CAROLINA

JOB NO.: 15.01917  
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 CADD BY: ZL  
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 CONST. REVIEW:  
 Recommended  
 Actions\_ Revised  
 2-24-17.dwg

RECOMMENDED ACTION  
 LAYOUT PLAN  
 CLUBHOUSE ROAD  
 CATCHMENT 26

SHEET  
**C-119**

## Catchment 29 – CIP Project

Location. Shoreline Drive East and Magnolia Drive

Description of Problem. Severe pipe deterioration.

- C-182 – 15” CMP: Partially crushed pipe at inlet; flooding reported at pipe; excessive sediment accumulation. Substandard pipe material. Pipe is beneath Magnolia Drive.
- C-166 – 20” CMP: Severely deteriorated pipe with holes along the bottom of pipe. Substandard pipe material. Pipe conveys jurisdictional flow beneath Shoreline Drive East.

Recommended Actions. Replace both pipes with RCP. Upsize C-166 to 24” and add flared end section with rip-rap apron on downstream end.

Estimated Cost. \$19,267.71

Priority. High



Photo of C-166 inlet showing severe deterioration.



Photo of C-182 inlet showing blockage and damage.

**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

McGill Associates

**CATCHMENT 29**

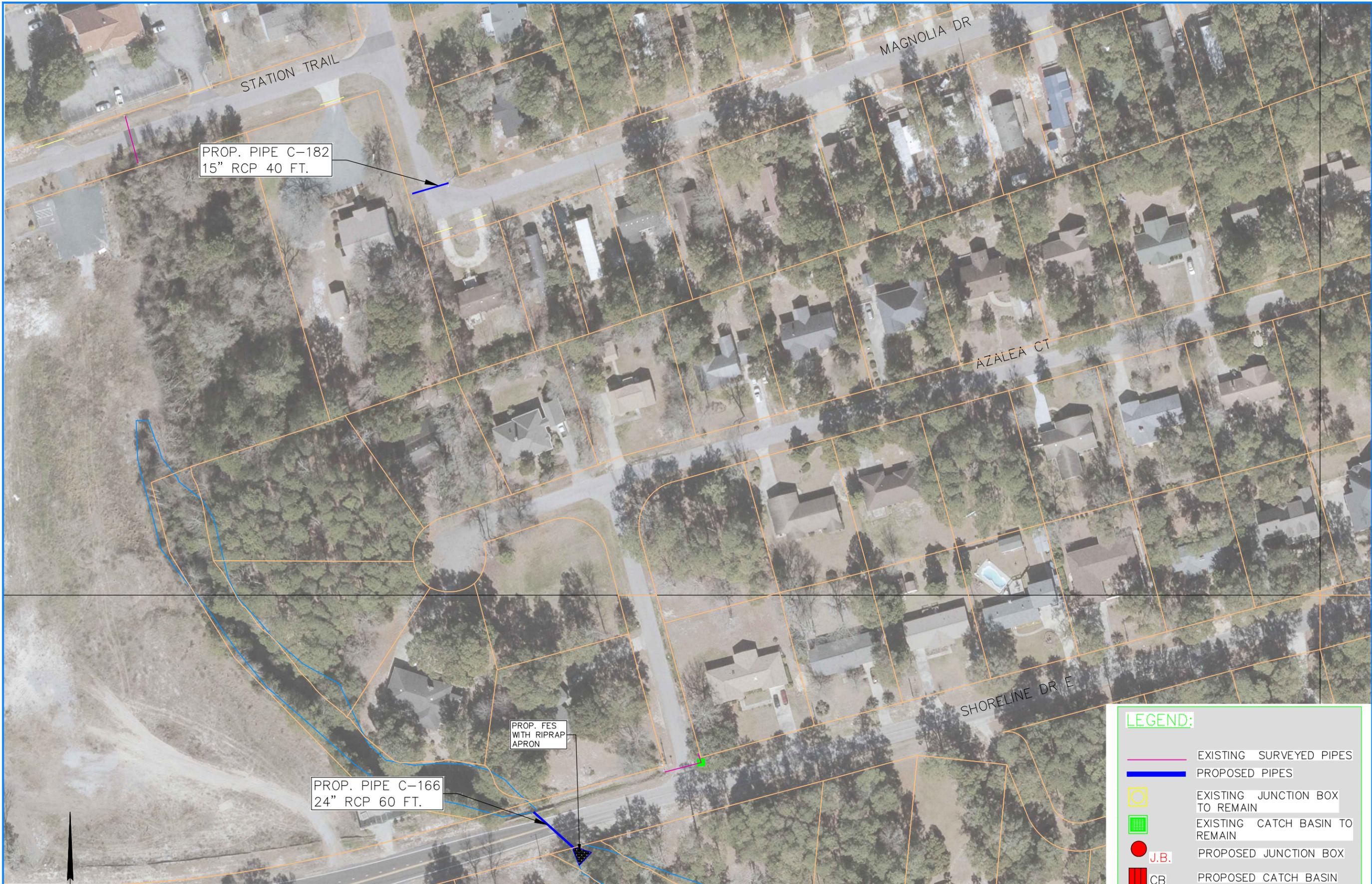
<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 406.72
2	Demolition (Existing Asphalt Road, Asphalt Driveway)	45	SY	\$ 8.00	\$ 360.00
3	15" RCP	40	LF	\$ 32.00	\$ 1,280.00
4	24" RCP	60	LF	\$ 42.00	\$ 2,520.00
5	FES with Riprap apron	1	EA	\$ 3,000.00	\$ 3,000.00
6	Existing Pipe Removal	100	LF	\$ 8.00	\$ 800.00
7	Asphalt Road Repair	45	SY	\$ 125.00	\$ 5,597.22
<b>Subtotal Construction Cost Estimate</b>				\$ -	<b>\$ 13,963.94</b>
	Contingency (15 %)				\$ 2,094.59
<b>TOTAL CONSTRUCTION ESTIMATE</b>					<b>\$ 16,058.53</b>

<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
<b>1</b>	Surveying, Geotechnical, Design, Permitting (20%)				\$ 3,211.71
<b>TOTAL COST ESTIMATE</b>					<b>\$ 19,270.24</b>

NOTE:

- 1) Drainage easement acquisition cost is **not included**.
- 2) The cost of clearing, grading and stabilization is **not included**, but is estimated to be approximately **\$10/sy**.

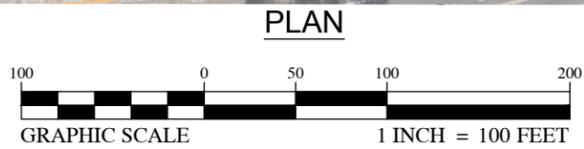
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PROP. PIPE C-182  
15" RCP 40 FT.

PROP. FES  
WITH RIPRAP  
APRON

PROP. PIPE C-166  
24" RCP 60 FT.



**LEGEND:**

	EXISTING SURVEYED PIPES
	PROPOSED PIPES
	EXISTING JUNCTION BOX TO REMAIN
	EXISTING CATCH BASIN TO REMAIN
	J.B. PROPOSED JUNCTION BOX
	CB PROPOSED CATCH BASIN

NO.	DATE	BY	REVISION DESCRIPTION



STORMWATER DRAINAGE STUDY  
**TOWN OF SUNSET BEACH**  
 BRUNSWICK COUNTY, NORTH CAROLINA

JOB NO.: 15.01917  
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 CONST. REVIEW:  
 Project Maps\_Recommended Actions.dwg

RECOMMENDED ACTION  
 LAYOUT PLAN  
 CATCHMENT 29

SHEET  
**C-113**

## Catchment 32 – CIP Project

Location. Kings Trail

Description of Problem. Likely pipe separation, cracked pipe sections or unknown junction; surface subsidence problems around C-232. Substandard pipe material.

Recommended Actions. Replace C-232 with HDPE; replace two catch basins, CB -232 and CB-234. Two (2) dry wells to be installed at inlet structures CB-232 and CB-233 to act as a water quality measures, allowing additional stormwater infiltration.

Estimated Cost. \$18,726.95

Priority. Medium



Photo of Facility 232, C-232 upper portion of photo.



Photo of Facility 232 with C-232 on left, note angle of inlet; poor inlet efficiency.

**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

**McGill Associates**

**CATCHMENT 32**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 395.25
2	15" HDPE	255	LF	\$ 25.00	\$ 6,375.00
3	Catch Basin with Grate	2	EA	\$ 2,000.00	\$ 4,000.00
4	Existing Structure Removal	2	EA	\$ 500.00	\$ 1,000.00
5	Dry Well	2	EA	\$ 900.00	\$ 1,800.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	<b>\$ 13,570.25</b>
	Contingency (15 %)				\$ 2,035.54
<b>TOTAL CONSTRUCTION ESTIMATE</b>					<b>\$ 15,605.79</b>

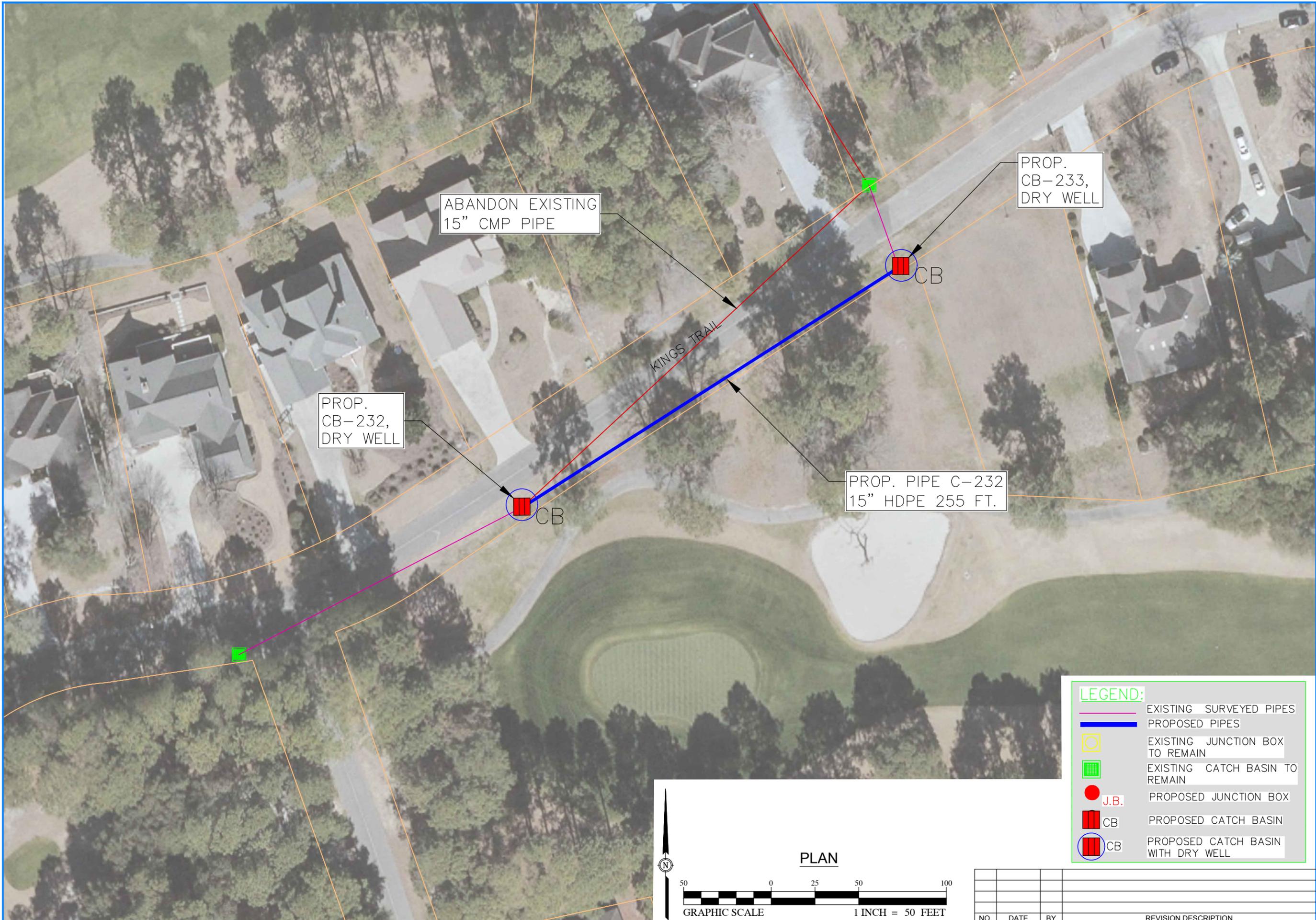
<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
<b>1</b>	Surveying, Geotechnical, Design, Permitting (20%)				\$ 3,121.16

**TOTAL COST ESTIMATE** \$ 18,726.95

**NOTE:**

- 1) Drainage easement acquisition cost is **not included**.
- 2) The cost of clearing, grading and stabilization is **not included**, but is estimated to be approximately **\$10/sy**.

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STORMWATER DRAINAGE STUDY  
**TOWN OF SUNSET BEACH**  
 BRUNSWICK COUNTY, NORTH CAROLINA

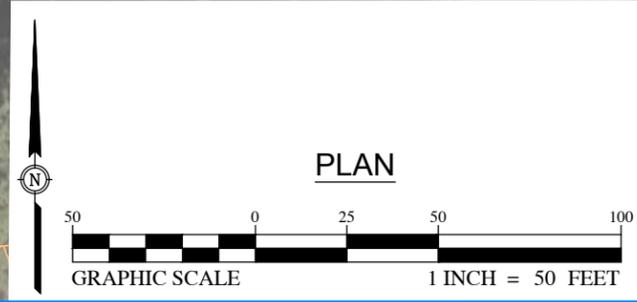
JOB NO.: 15.01917  
 DATE: FEB., 2017  
 DESIGNED BY: XXX  
 CADD BY: ZL  
 DESIGN REVIEW: ZL  
 CONST. REVIEW: Recommended  
 Actions\_ Revised 2-24-17.dwg

RECOMMENDED ACTION  
 LAYOUT PLAN  
 CATCHMENT 32

SHEET  
**C-114**

**LEGEND:**

	EXISTING SURVEYED PIPES
	PROPOSED PIPES
	EXISTING JUNCTION BOX TO REMAIN
	EXISTING CATCH BASIN TO REMAIN
	J.B. PROPOSED JUNCTION BOX
	CB PROPOSED CATCH BASIN
	CB PROPOSED CATCH BASIN WITH DRY WELL



NO.	DATE	BY	REVISION DESCRIPTION

## **Catchment 32-1 – CIP Project**

Location. Vicinity of intersection of Fairway Drive East and Longleaf Drive.

Description of Problem. Periodic flooding in road. This area has no existing stormwater drainage pipes or ditches and is located in an area of relatively high elevation near the top the Catchment 32. The area is very flat but a low area near this intersection produces standing water during higher intensity storm events.

Recommended Actions. There is no existing storm drainage system in the immediate vicinity of the problem area to extend and the area is too flat for effective ditches. The soils in this area appear to be well suited for infiltration so the proposed project will involve installation in several new inlets in the area of flooding, the inlets will connect to a series of infiltration pipes extending several hundred feet along Longleaf Road. Cleanout access will be provided to facilitate maintenance of the infiltration system.

Estimated Cost. \$44,352.00

Priority. Medium

**PRELIMINARY PROJECT COST ESTIMATE**

June 8, 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

McGill Associates

**CATCHMENT 32-1 LONGLEAF DRIVE**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 900.00
2	Demolition (Existing Asphalt Road, Asphalt Driveway)	40	SY	\$ 8.00	\$ 320.00
3	15" HDPE	180	LF	\$ 25.00	\$ 4,500.00
4	15" HDPE (Perforated, in #57 stone)	180	LF	\$ 62.00	\$ 11,160.00
5	15" RCP	40	LF	\$ 32.00	\$ 1,280.00
6	Catch Basin with Grate	4	EA	\$ 2,000.00	\$ 8,000.00
7	Asphalt Road Repair	40	SY	\$ 125.00	\$ 5,000.00
8	Miscellaneous Private Property Repair	1	LS	\$ 1,000.00	\$ 1,000.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	<b>\$ 32,160.00</b>
	Contingency (15 %)				\$ 4,800.00
<b>TOTAL CONSTRUCTION ESTIMATE</b>					<b>\$ 36,960.00</b>

<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
1	Surveying, Geotechnical, Design, Permitting (20%)				\$ 7,392.00

<b>TOTAL COST ESTIMATE</b>					<b>\$ 44,352.00</b>
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NOTE:

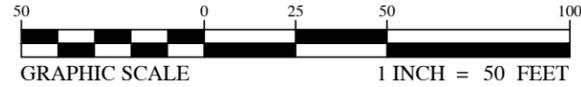
- 1) Drainage easement acquisition cost is **not included**.
- 2) The cost of clearing, grading and stabilization is **not included**, but is estimated to be approximately **\$10/sy**.

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PROPOSED PIPE  
 15" RCP 40 FT. UNDER ROAD  
 15" PERFORATED HDPE 180 FT.  
 15" HDPE 180 FT.

PROPOSED CATCH BASIN  
 FOR SYSTEM OVERFLOW



PLAN

**LEGEND:**

	EXISTING SURVEYED PIPES
	PROPOSED PIPES
	EXISTING JUNCTION BOX TO REMAIN
	EXISTING CATCH BASIN TO REMAIN
	PROPOSED JUNCTION BOX
	PROPOSED CATCH BASIN
	PROPOSED CATCH BASIN WITH DRY WELL

NO.	DATE	BY	REVISION DESCRIPTION



STORMWATER DRAINAGE STUDY  
**TOWN OF SUNSET BEACH**  
 BRUNSWICK COUNTY, NORTH CAROLINA

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 CADD BY: ZL  
 DESIGN REVIEW: —  
 CONST. REVIEW: —  
 Recommended  
 Actions\_ Revised  
 2-24-17.dwg

RECOMMENDED ACTION  
 LAYOUT PLAN  
 FAIRWAY DRIVE EAST  
 CATCHMENT 32-1

SHEET  
**C-120**

## Catchment 35 – CIP Project

Location. Shoreline Drive East and Magnolia Drive

Description of Problem. Pipe deterioration.

- C-199 – 15" HDPE: Pipe is crushed by 4-6 inches.
- C-161 – 18" RCP: Reported surface subsidence around pipe; appears to be separating at pipe sections. Model shows pipe is at full capacity during a 50-year storm.

Recommended Actions. Replace C-199 with new HDPE and replace CB-199. Replace C-161 with new RCP; upsize C-161 to 24" pipe.

Estimated Cost. \$12,368.17

Priority. Medium

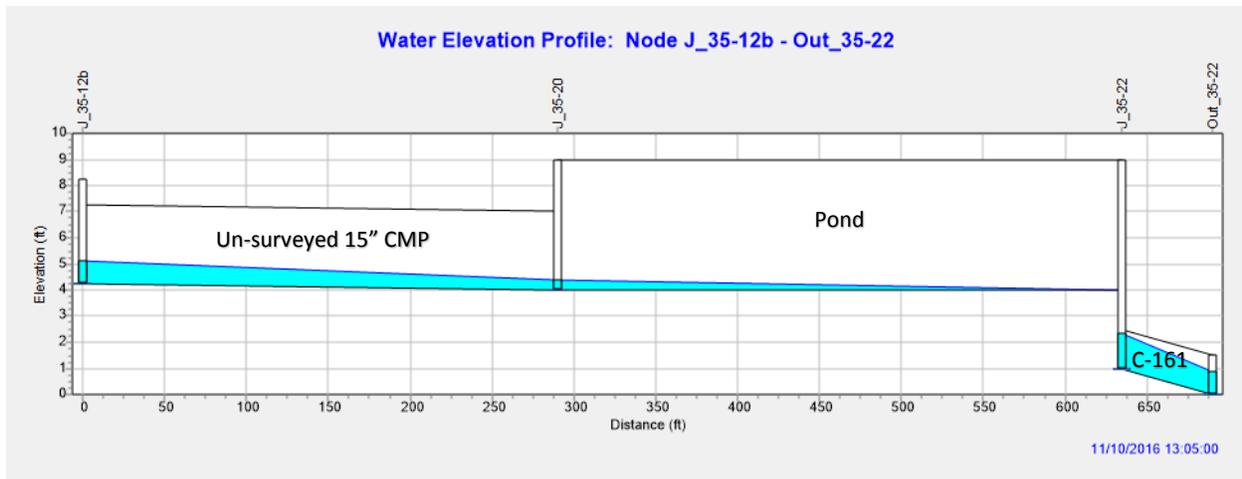


Photo of area above C-161 showing surface subsidence. Photo looking upstream from pipe outlet, note pipe separation.



Photo of C-199 pipe inlet showing damage and blockage.

**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

**McGill Associates**

**CATCHMENT 35**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 255.24
2	Demolition (Existing Asphalt Road, Asphalt Driveway)	19	SY	\$ 8.00	\$ 152.00
3	15" HDPE	15	LF	\$ 25.00	\$ 375.00
4	24" RCP	60	LF	\$ 42.00	\$ 2,520.00
5	Catch Basin with Grate	1	EA	\$ 2,000.00	\$ 2,000.00
6	Existing Pipe Removal	75	LF	\$ 8.00	\$ 600.00
7	Existing Structure Removal	1	EA	\$ 500.00	\$ 500.00
8	Asphalt Road Repair	19	SY	\$ 125.00	\$ 2,361.11
9	Miscellaneous Private Property Repair	1	LOT	\$ 200.00	\$ 200.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	\$ <b>8,963.35</b>
	Contingency (15 %)				\$ 1,344.50
<b>TOTAL CONSTRUCTION ESTIMATE</b>					\$ <b>10,307.86</b>

<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
<b>1</b>	Surveying, Geotechnical, Design, Permitting (20%)				\$ 2,061.57

<b>TOTAL COST ESTIMATE</b>					\$ 12,369.43
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NOTE:

- 1) Drainage easement acquisition cost is **not included**.
- 2) The cost of clearing, grading and stabilization is **not included**, but is estimated to be approximately **\$10/sy**.

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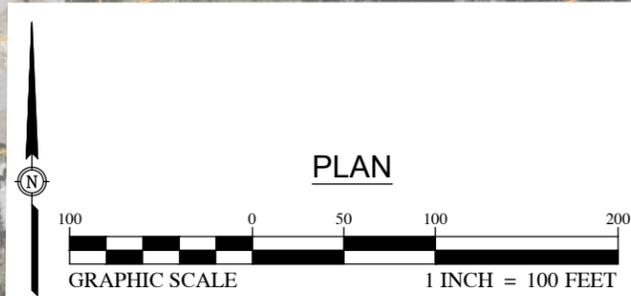
PROP. PIPE C-161  
24" RCP 60 FT.

PROP.  
CB-199

PROP. PIPE C-199  
15" HDPE 15 FT.

**LEGEND:**

-  EXISTING SURVEYED PIPES
-  PROPOSED PIPES
-  EXISTING JUNCTION BOX TO REMAIN
-  EXISTING CATCH BASIN TO REMAIN
-  J.B. PROPOSED JUNCTION BOX
-  CB PROPOSED CATCH BASIN



**PLAN**

NO.	DATE	BY	REVISION DESCRIPTION



STORMWATER DRAINAGE STUDY  
**TOWN OF SUNSET BEACH**  
 BRUNSWICK COUNTY, NORTH CAROLINA

JOB NO.: 15.01917  
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 CADD BY: ZL  
 DESIGN REVIEW:  
 CONST. REVIEW:  
 Project Maps\_Recommended Actions.dwg

RECOMMENDED ACTION  
 LAYOUT PLAN  
 CATCHMENT 35

SHEET  
**C-115**

## Catchment 36 – CIP Project

Location. Shoreline Drive East

Description of Problem. Surface cavitation observed around CB-162; catch basin grate is failing. Area of surface subsidence noted approximately 100-linear feet south of CB-162. Likely pipe separation and safety concerns.

Recommended Actions. Replace C-162 (18" CMP) with new HDPE and replace CB-162. Replace C-162 with perforated HDPE set in #57 stone until soils become saturated (approximately 100-linear feet).

Estimated Cost. \$22,571.83

Priority. Medium



*Photo of CB-162, note deteriorated condition of grate as well as surface cavitation surrounding catch basin.*



*Photo of surface subsidence above pipe C-162 approximately 100-linear feet south of CB-162.*

**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

McGill Associates

**CATCHMENT 36**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 476.40
2	18" HDPE	168	LF	\$ 27.00	\$ 4,536.00
3	18" HDPE (Perforated, in #57 stone)	100	LF	\$ 67.00	\$ 6,700.00
4	Catch Basin with Grate	1	EA	\$ 2,000.00	\$ 2,000.00
5	Existing Pipe Removal	268	LF	\$ 8.00	\$ 2,144.00
6	Existing Structure Removal	1	EA	\$ 500.00	\$ 500.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	\$ <b>16,356.40</b>
	Contingency (15 %)				\$ 2,453.46
<b>TOTAL CONSTRUCTION ESTIMATE</b>					\$ <b>18,809.86</b>

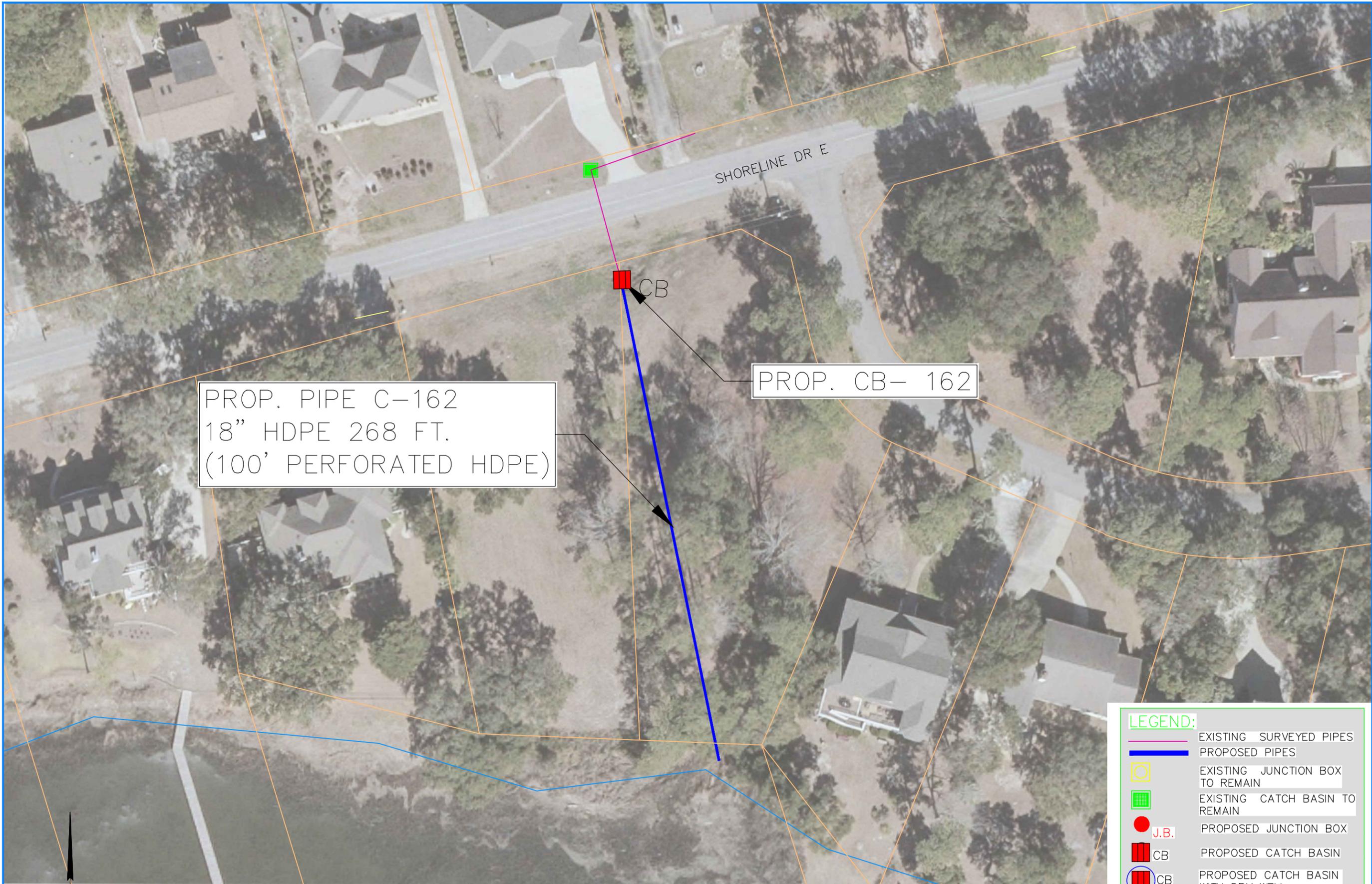
<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
<b>1</b>	Surveying, Geotechnical, Design, Permitting (20%)				\$ 3,761.97

<b>TOTAL COST ESTIMATE</b>					\$ 22,571.83
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NOTE:

- 1) Drainage easement acquisition cost is **not included**.
- 2) The cost of clearing, grading and stabilization is **not included**, but is estimated to be approximately **\$10/sy**.

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PROP. PIPE C-162  
18" HDPE 268 FT.  
(100' PERFORATED HDPE)

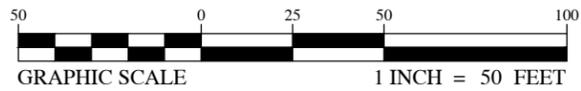
PROP. CB- 162

CB

SHORELINE DR E



PLAN



**LEGEND:**

	EXISTING SURVEYED PIPES
	PROPOSED PIPES
	EXISTING JUNCTION BOX TO REMAIN
	EXISTING CATCH BASIN TO REMAIN
	J.B. PROPOSED JUNCTION BOX
	CB PROPOSED CATCH BASIN
	CB PROPOSED CATCH BASIN WITH DRY WELL

NO.	DATE	BY	REVISION DESCRIPTION



STORMWATER DRAINAGE STUDY  
**TOWN OF SUNSET BEACH**  
BRUNSWICK COUNTY, NORTH CAROLINA

JOB NO.: 15.01917  
DATE: FEB., 2017  
DESIGNED BY: XXX  
CADD BY: ZL  
DESIGN REVIEW: ZL  
CONST. REVIEW: ZL  
Recommended Actions Revised 2-24-17.dwg

RECOMMENDED ACTION  
LAYOUT PLAN  
CATCHMENT 36

SHEET  
**C-118**

## Catchment 37 – CIP Project

Location. Cross Creek Drive, Great Oak Circle and Shoreline Drive East.

Description of Problem. Reported flooding, pipe deterioration and modeled problems.

- C-141 – 18" RCP: Reported surface subsidence around pipe; appears to be separating at pipe sections. Model shows pipe is surcharged during a 50-year storm.
- C-145 – 15" CMP: Model shows surcharge on pipe. Substandard pipe material.
- C-181 – 8" CPP: Flooding reported in the area. Substandard pipe size and material. No drainage easement.

Recommended Actions. Obtain drainage easement for C-181. Replace pipe C-141 and upsize to 24" RCP. Replace pipe C-145 and upsize to 18" RCP. Replace CB-181; replace C-181 with 18" HDPE. Install a new catch basin and 15" RCP to alleviate flooding along Great Oak Circle; new pipe will tie into CB-181. A 60-linear foot section of replacement pipe C-181 to be perforated HDPE set in #57 stone. Two (2) dry wells to be installed at inlet structures CB-181 and CB-181A to act as a water quality measures.

Estimated Cost. \$46,147.74

Priority. Medium

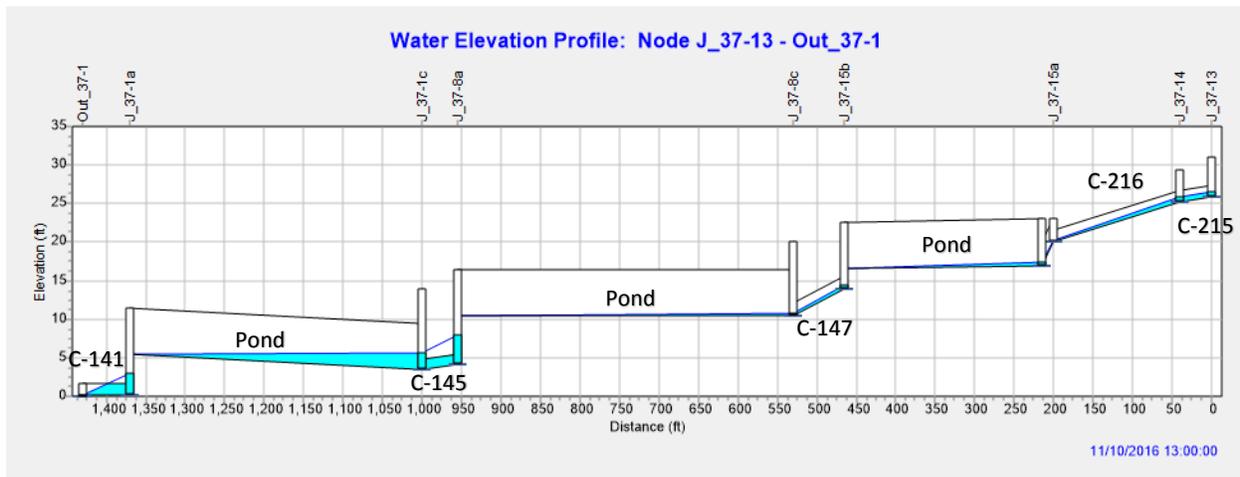




Photo of yard inlet at Facility 181, area is prone to flooding off Great Oak Circle.

**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

McGill Associates

**CATCHMENT 37**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 968.19
2	Demolition (Existing Asphalt Road, Asphalt Driveway)	69	SY	\$ 8.00	\$ 552.00
3	18" HDPE	165	LF	\$ 27.00	\$ 4,455.00
4	18" HDPE (Perforated, in #57 stone)	60	LF	\$ 67.00	\$ 4,020.00
5	15" RCP	40	LF	\$ 32.00	\$ 1,280.00
6	18" RCP	45	LF	\$ 35.00	\$ 1,575.00
7	24" RCP	60	LF	\$ 42.00	\$ 2,520.00
8	Catch Basin with Grate	2	EA	\$ 2,000.00	\$ 4,000.00
9	Existing Pipe Removal	370	LF	\$ 8.00	\$ 2,960.00
10	Existing Structure Removal	1	EA	\$ 500.00	\$ 500.00
11	Asphalt Road Repair	69	SY	\$ 125.00	\$ 8,611.11
12	Dry Well	2	EA	\$ 900.00	\$ 1,800.00
13	Miscellaneous Private Property Repair	1	LOT	\$ 200.00	\$ 200.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	\$ <b>33,441.30</b>
	Contingency (15 %)				\$ 5,016.20
<b>TOTAL CONSTRUCTION ESTIMATE</b>					\$ <b>38,457.50</b>

<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
<b>1</b>	Surveying, Geotechnical, Design, Permitting (20%)				\$ 7,691.50

<b>TOTAL COST ESTIMATE</b>				\$	<b>46,149.00</b>
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NOTE:

- 1) Drainage easement acquisition cost is **not included**.
- 2) The cost of clearing, grading and stabilization is **not included**, but is estimated to be approximately **\$10/sy**.

PROP. PIPE C-181  
18" HDPE 225 FT.  
(60' PERFORATED HDPE)

NOTE:  
PIPE IS ON PRIVATE PROPERTY.  
EXISTING PIPE MAY BE PERFORATED  
OR MAY OUTFALL TO POND TO THE NORTH  
(UNKNOWN).

PROP. CB- 181,  
DRY WELL

PROP. PIPE C-181A  
15" RCP 40 FT.

PROP. CB- 181A,  
DRY WELL

PROP. PIPE C-145  
18" RCP 45 FT.

PROP. PIPE C-141  
24" RCP 60 FT.

MILLSLOUGH LN

MILLSLOUGH LN SW

CROSS CREEK

SHORELINE DR E



STORMWATER DRAINAGE STUDY  
**TOWN OF SUNSET BEACH**  
BRUNSWICK COUNTY, NORTH CAROLINA

JOB NO.: 15.01917  
DATE: FEB., 2017  
DESIGNED BY: XXX  
CADD BY: ZL  
DESIGN REVIEW: ZL  
CONST. REVIEW: Recommended  
Actions Revised  
2-24-17.dwg

RECOMMENDED ACTION  
LAYOUT PLAN  
CATCHMENT 37

SHEET  
**C-116**

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**LEGEND:**

	EXISTING SURVEYED PIPES
	PROPOSED PIPES
	EXISTING JUNCTION BOX TO REMAIN
	EXISTING CATCH BASIN TO REMAIN
	J.B. PROPOSED JUNCTION BOX
	CB PROPOSED CATCH BASIN
	CB PROPOSED CATCH BASIN WITH DRY WELL



NO.	DATE	BY	REVISION DESCRIPTION

## Catchment 39 – CIP Project

Location. Dogwood Dr., Magnolia Dr., and Kirkwood Place.

Description of Problem. Pipe deterioration.

- C-130 – dual 15" CMP and 12" Steel: 12" Steel appears rusted and deteriorated; substandard pipe size and material.
- C-131 – dual 15" CMP's: Pipes appear to have moderate deterioration; surface subsidence around pipes. Substandard pipe material.
- C-712 – 12" Steel: Severe pipe deterioration; substandard size and material.
- C-702 – 12" CMP: Pipe appears corroded and deteriorated. Substandard pipe size and material.

Recommended Actions. Replace CMP pipes with HDPE and RCP under roads; upsize pipes where substandard pipe sizes exist. A 40-linear foot section of replacement pipe C-702 to be perforated HDPE set in #57 stone.

Estimated Cost. \$53,625.34

Priority. Low



Dual pipes C-130.



Pipe C-712.



Pipe C-702.

**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

**McGill Associates**

**CATCHMENT 39**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 1,120.14
2	Demolition (Existing Asphalt Road, Asphalt Driveway)	118	SY	\$ 8.00	\$ 944.00
3	15" HDPE	150	LF	\$ 25.00	\$ 3,750.00
4	15" HDPE (Perforated, in #57 stone)	40	LF	\$ 62.00	\$ 2,480.00
5	15" RCP	280	LF	\$ 32.00	\$ 8,960.00
6	FES with Riprap apron	1	EA	\$ 3,000.00	\$ 3,000.00
7	Existing Pipe Removal	430	LF	\$ 8.00	\$ 3,440.00
8	Asphalt Road Repair	118	SY	\$ 125.00	\$ 14,763.89
9	Miscellaneous Private Property Repair	2	LOT	\$ 200.00	\$ 400.00
	<b>Subtotal Construction Cost Estimate</b>			\$ -	\$ <b>38,858.03</b>
	Contingency (15 %)				\$ 5,828.70
<b>TOTAL CONSTRUCTION ESTIMATE</b>					<b>\$ 44,686.73</b>

<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
<b>1</b>	Surveying, Geotechnical, Design, Permitting (20%)				\$ 8,937.35

<b>TOTAL COST ESTIMATE</b>					<b>\$ 53,624.08</b>
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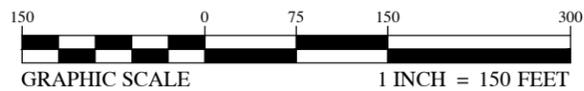
NOTE:

- 1) Drainage easement acquisition cost is **not included**.
- 2) The cost of clearing, grading and stabilization is **not included**, but is estimated to be approximately **\$10/sy**.

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PLAN



LEGEND:	
	EXISTING SURVEYED PIPES
	PROPOSED PIPES
	EXISTING JUNCTION BOX TO REMAIN
	EXISTING CATCH BASIN TO REMAIN
	J.B. PROPOSED JUNCTION BOX
	CB PROPOSED CATCH BASIN
	CB PROPOSED CATCH BASIN WITH DRY WELL

NO.	DATE	BY	REVISION DESCRIPTION



JOB NO.: 15.01917  
 DATE: FEB., 2017  
 DESIGNED BY: XXX  
 CADD BY: ZL  
 DESIGN REVIEW: ZL  
 CONST. REVIEW: —  
 Recommended Actions Revised 2-24-17.dwg

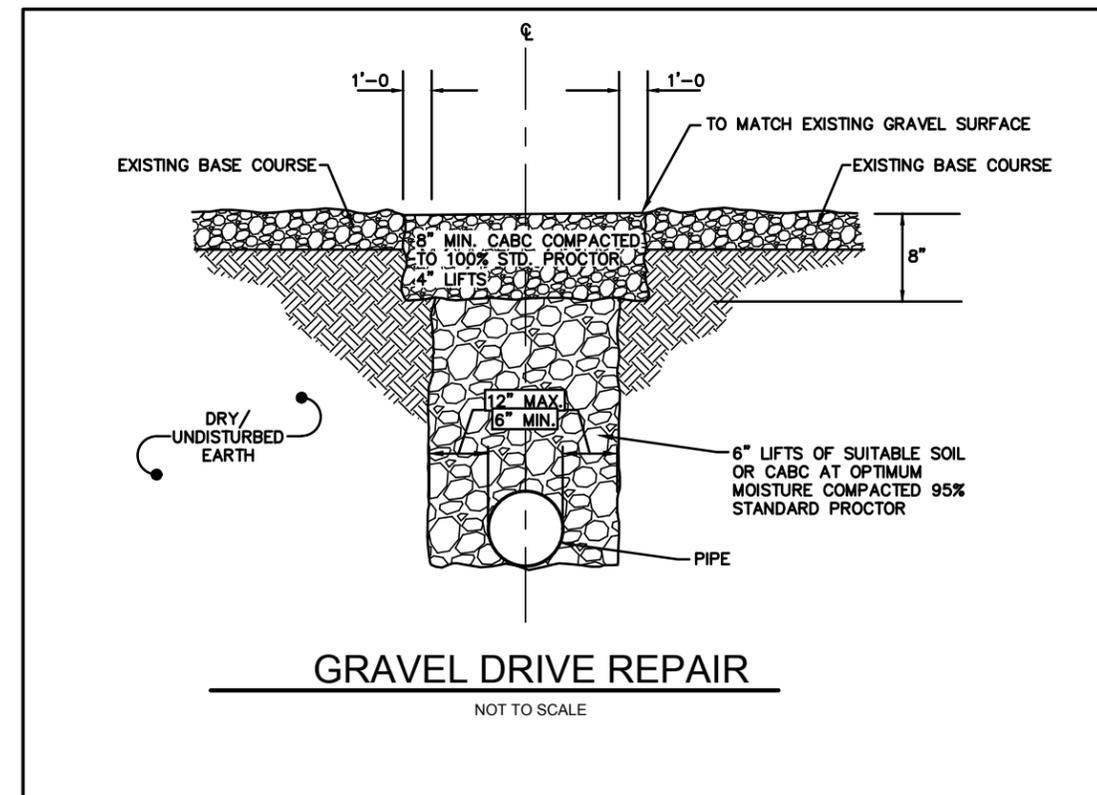
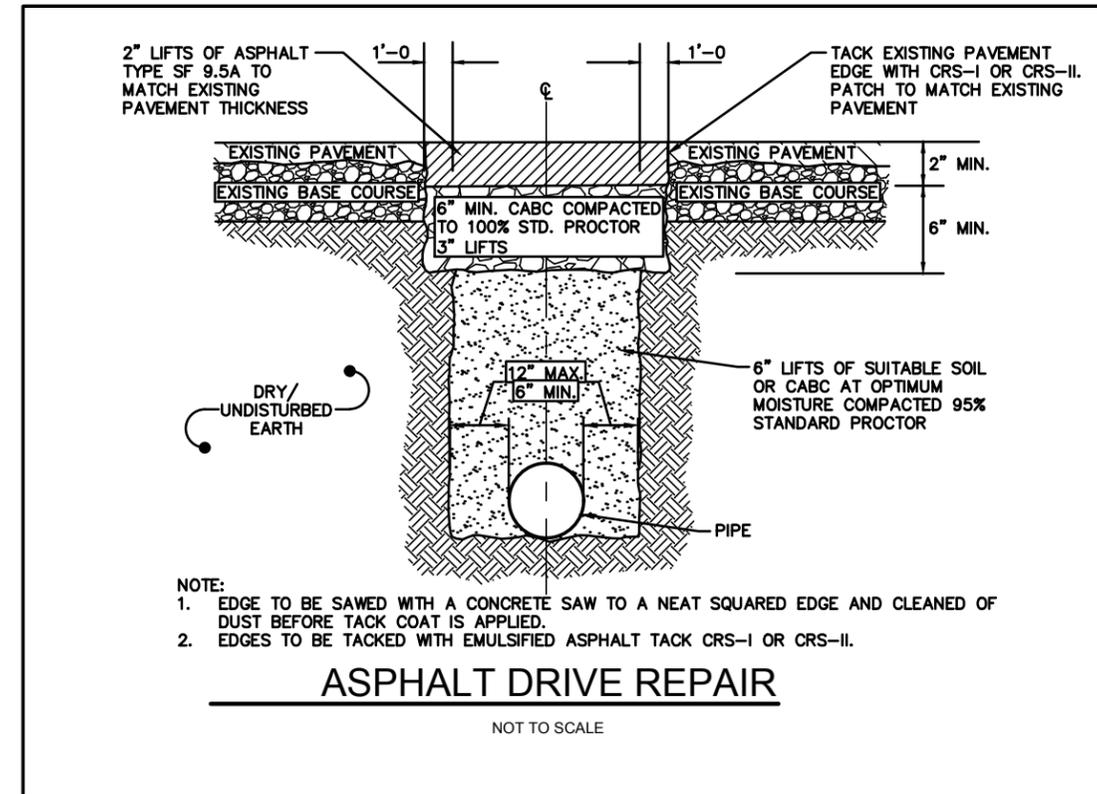
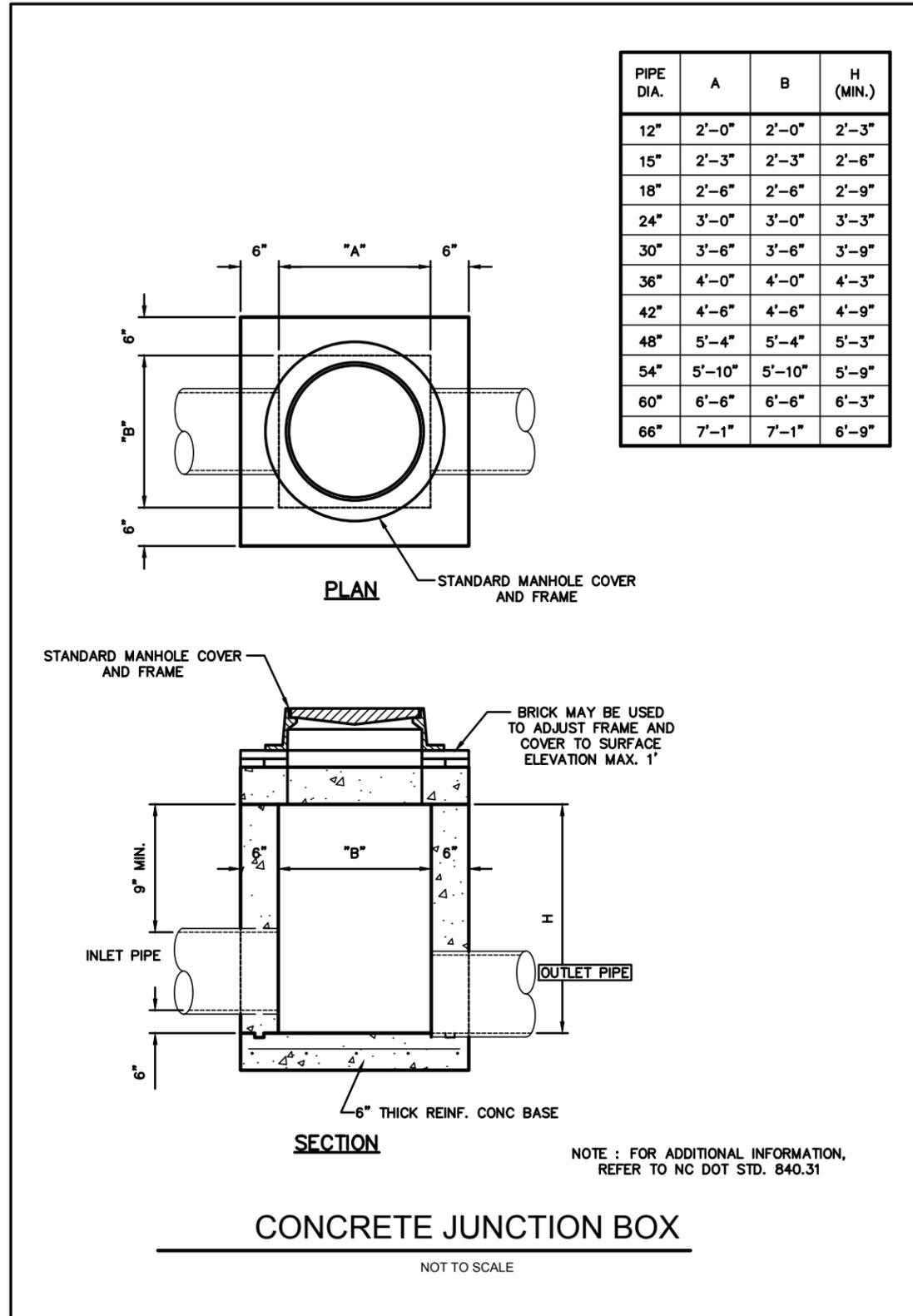
RECOMMENDED ACTION  
 LAYOUT PLAN  
 CATCHMENT 39

**TOWN OF SUNSET BEACH, NC  
STORMWATER DRAINAGE CAPITAL IMPROVEMENTS PLAN  
JUNE 2017**

**Miscellaneous Details**

**Sheets C-501, C-502, C-503, C-504**

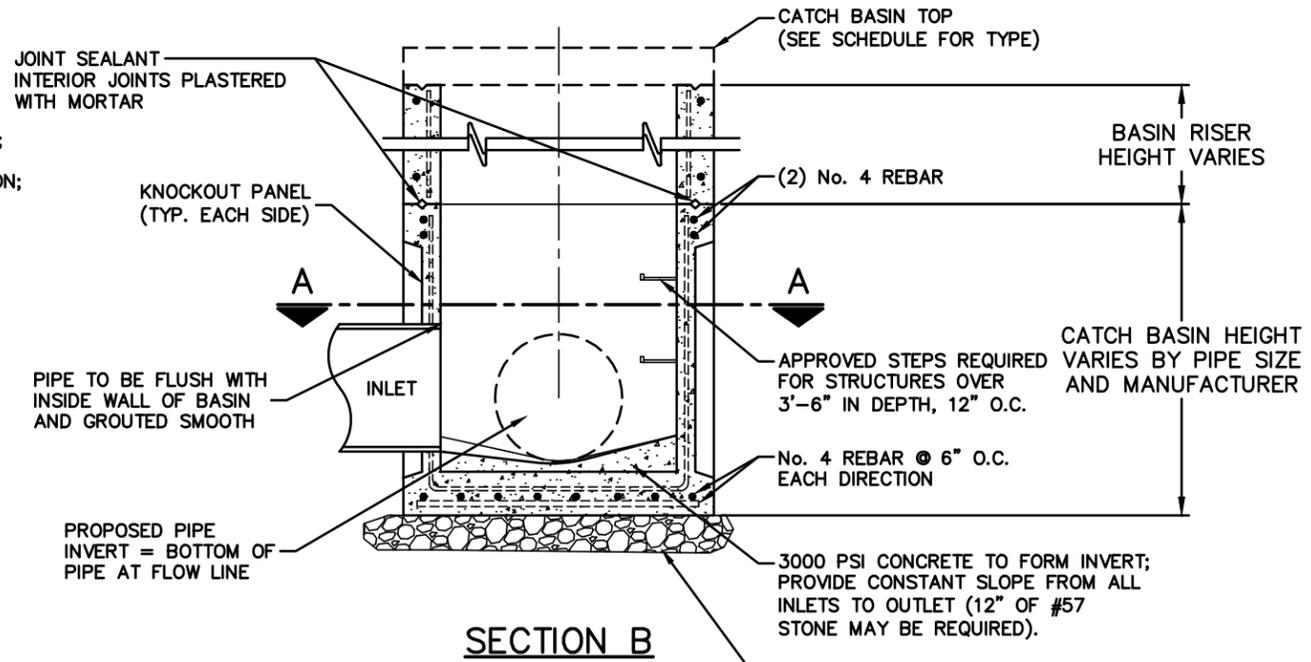
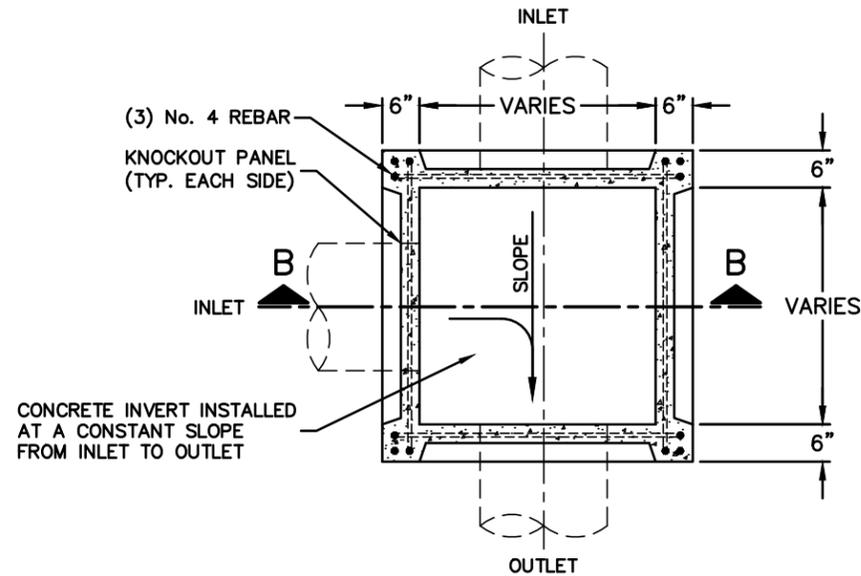
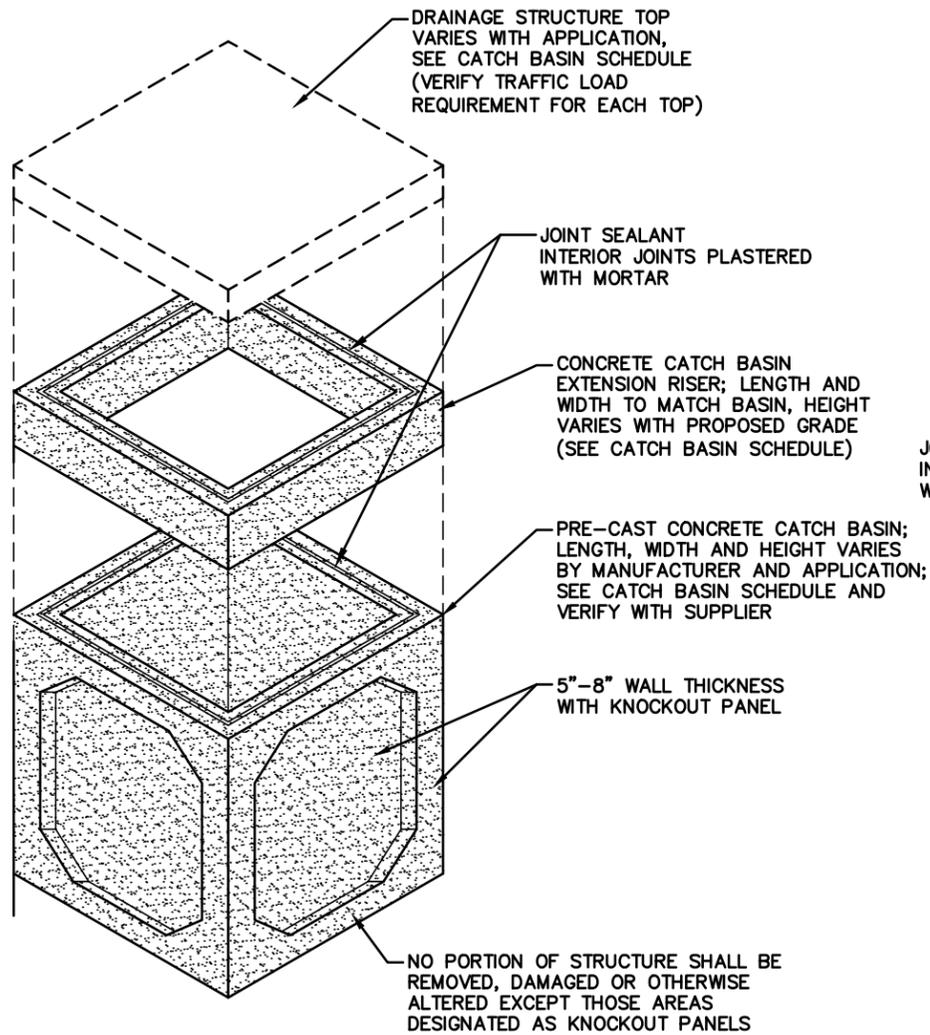
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NO.	DATE	BY	REVISION DESCRIPTION

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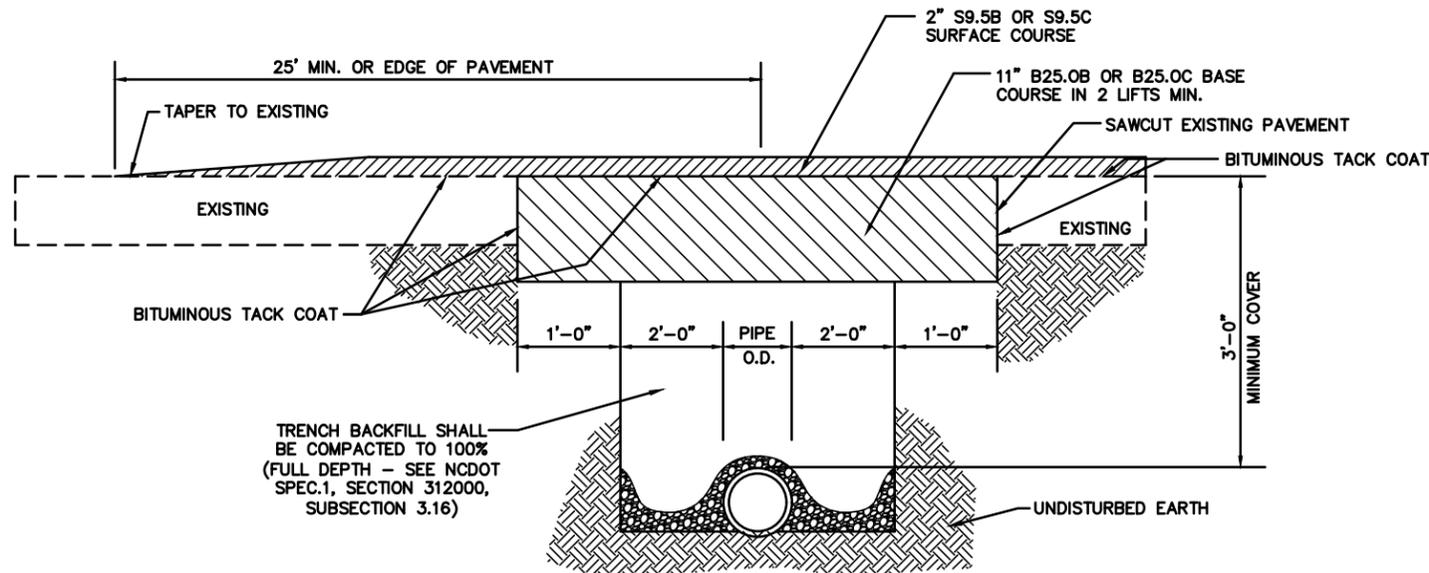
**NOTE:**  
MIN. 3000 PSI CONCRETE  
REQUIRED THROUGHOUT.



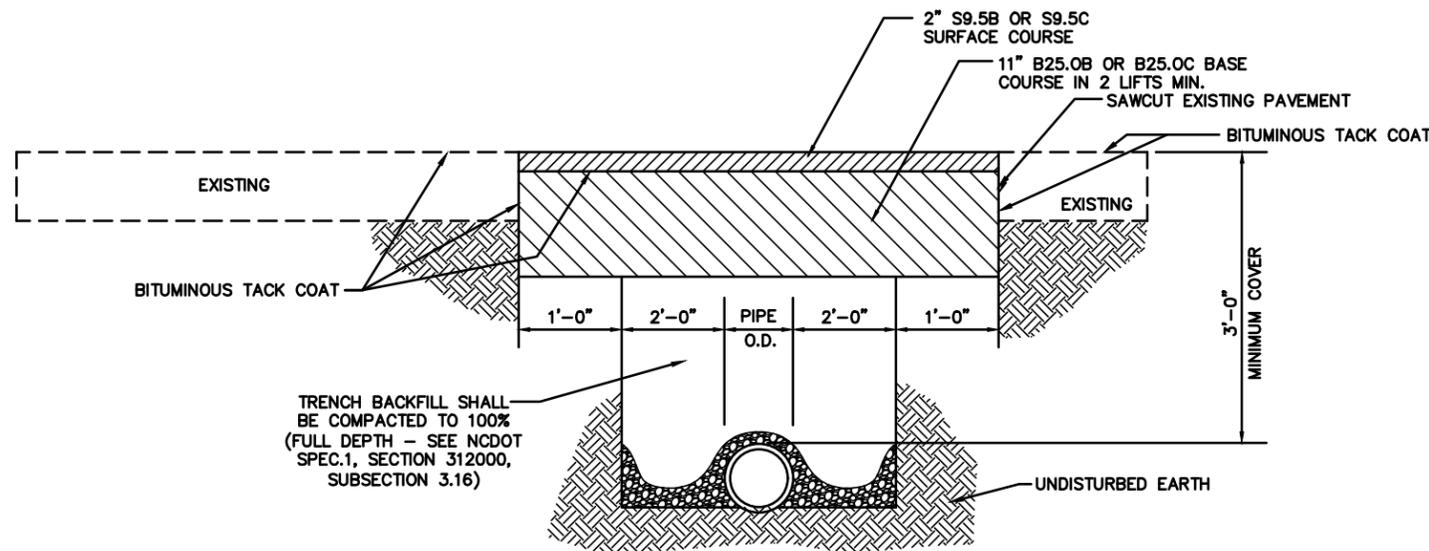
**PRE-CAST CATCH BASIN**

NOT TO SCALE

NO.	DATE	BY	REVISION DESCRIPTION



PAVEMENT REPAIRS ON ROADS TO BE RESURFACED



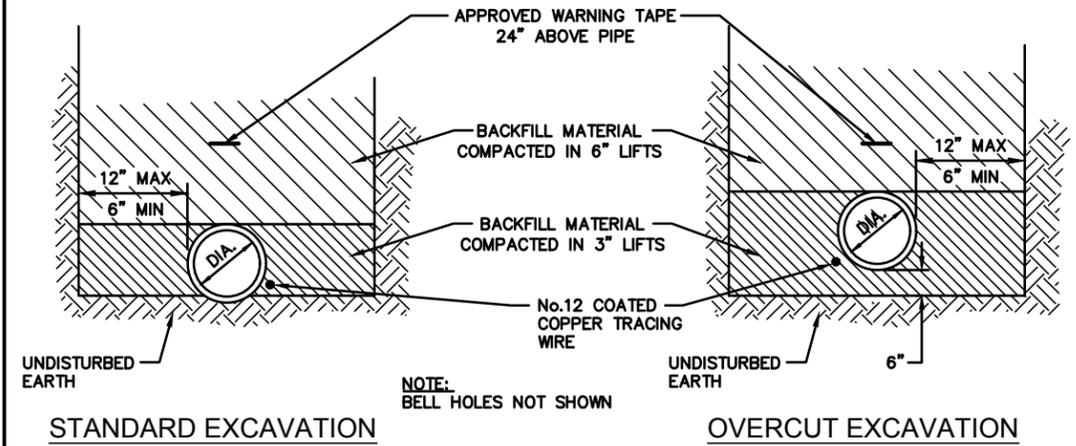
PAVEMENT REPAIRS ON ROADS NOT TO BE RESURFACED

**NOTES:**

1. EDGE TO BE SAWED WITH A CONCRETE SAW TO A NEAT SQUARED EDGE AND CLEANED OF DUST BEFORE TACK COAT IS APPLIED.
2. EDGES TO BE TACKED WITH CRS-I OR CRS-II.
3. THICKNESS OF B25.0B OR B25.0C BASE COURSE AND S9.5B OR S9.5C SURFACE COURSE SHALL MATCH EXISTING CONDITIONS IF GREATER THAN SHOWN ON DETAILS.
4. CONTRACTOR RESPONSIBLE FOR REPLACEMENT OF ANY PAVEMENT MARKINGS DISTURBED OR COVERED BY OVERLAY.

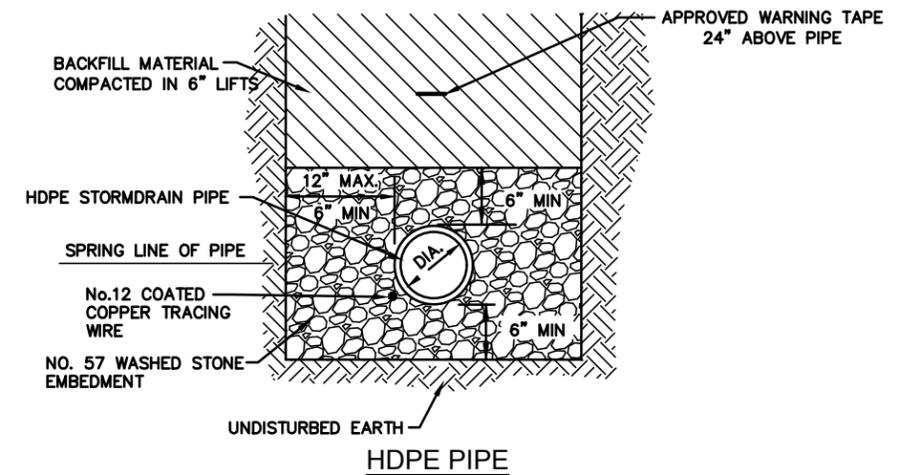
**TYPICAL PAVEMENT REPAIRS - NCDOT ROADS**

NOT TO SCALE



STANDARD EXCAVATION

OVERCUT EXCAVATION



**NOTES:**

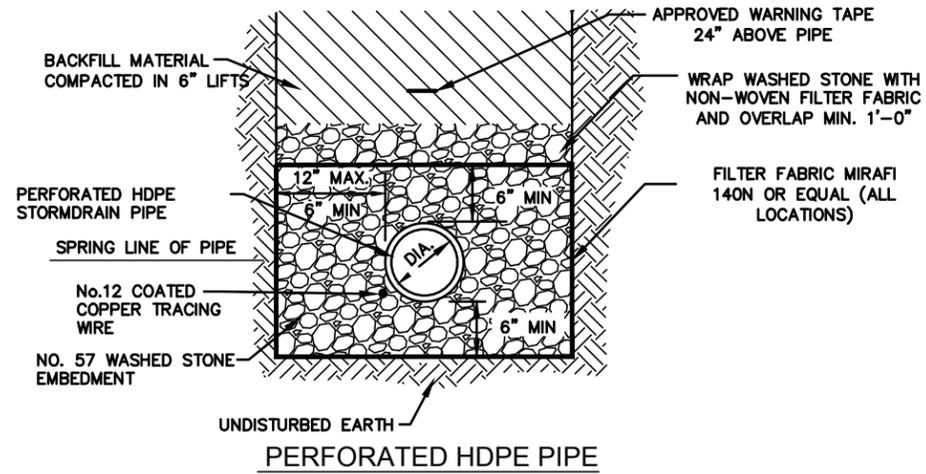
1. CONSTRUCTION OF TRENCHES SHALL COMPLY WITH ALL FEDERAL, STATE AND LOCAL SAFETY AND HEALTH REGULATIONS WHICH HAVE JURISDICTION AT THE PROJECT SITE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO BE FAMILIAR WITH THE APPLICABLE REGULATIONS AND FOLLOW THEM ACCORDINGLY.
2. PAYMENT FOR ROCK EXCAVATION AND SELECT BACKFILL IN TRENCH SHALL BE FOR ACTUAL QUANTITIES AND SHALL NOT EXCEED THE WIDTH OF TRENCH SHOWN ON THIS DETAIL.

**STORM DRAIN TRENCH DETAIL**

NOT TO SCALE

NO.	DATE	BY	REVISION DESCRIPTION

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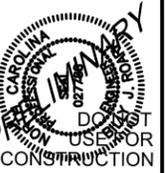


**NOTES:**

1. CONSTRUCTION OF TRENCHES SHALL COMPLY WITH ALL FEDERAL, STATE AND LOCAL SAFETY AND HEALTH REGULATIONS WHICH HAVE JURISDICTION AT THE PROJECT SITE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO BE FAMILIAR WITH THE APPLICABLE REGULATIONS AND FOLLOW THEM ACCORDINGLY.
2. PAYMENT FOR ROCK EXCAVATION AND SELECT BACKFILL IN TRENCH SHALL BE FOR ACTUAL QUANTITIES AND SHALL NOT EXCEED THE WIDTH OF TRENCH SHOWN ON THIS DETAIL.

**PERFORATED HDPE / INFILTRATION TRENCH DETAIL**

NOT TO SCALE



STORMWATER DRAINAGE STUDY  
**TOWN OF SUNSET BEACH**  
 BRUNSWICK COUNTY, NORTH CAROLINA

JOB NO.: 15.01917  
 DATE: FEB., 2017  
 DESIGNED BY: XXX  
 CADD BY: ZL  
 DESIGN REVIEW:  
 CONST. REVIEW:  
 Project Maps\_Recommended Actions.dwg

MISCELLANEOUS  
 DETAILS

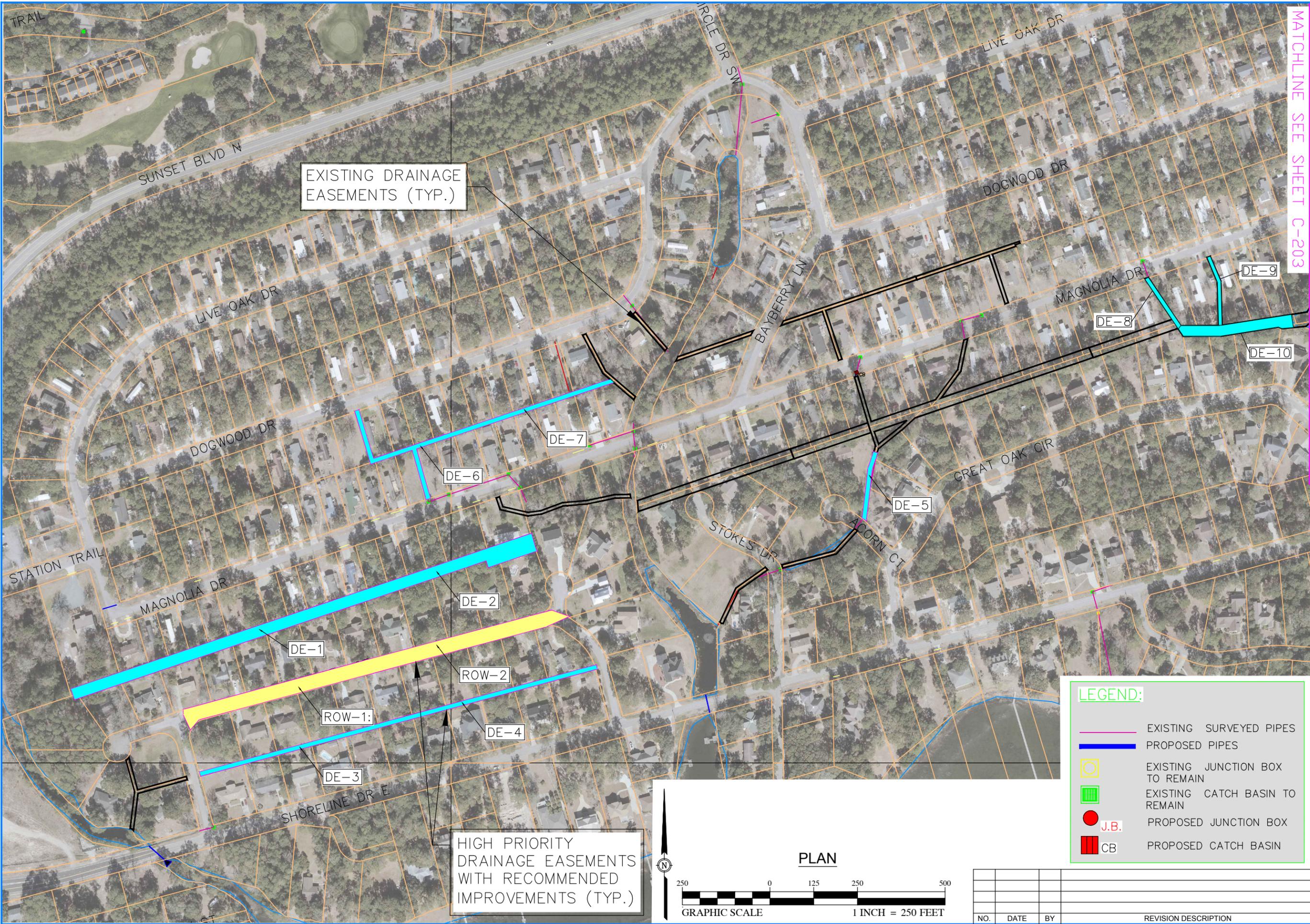
SHEET  
**C-504**

NO.	DATE	BY	REVISION DESCRIPTION

**APPENDIX B**

**CIP DRAINAGE EASEMENT PROJECTS**

P:\2015\15.01917 - Sunset Beach Stormwater\dwg\Easements\_C-202 to C-203.dwg 3/17/2017 4:57 PM ZUZANA LUJAN



MATCHLINE SEE SHEET C-203



STORMWATER DRAINAGE STUDY  
**TOWN OF SUNSET BEACH**  
BRUNSWICK COUNTY, NORTH CAROLINA

JOB NO.: 15.01917  
DATE: MARCH, 2017  
DESIGNED BY: XXX  
CADD BY: ZL  
DESIGN REVIEW:  
CONST. REVIEW:  
Easements\_C-202 to C-203.dwg

EXISTING DRAINAGE EASEMENTS

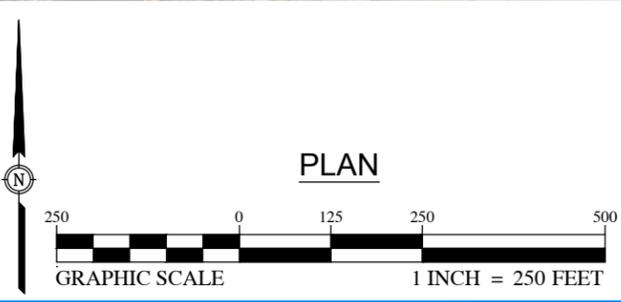
SHEET  
**C-202**

HIGH PRIORITY DRAINAGE EASEMENTS WITH RECOMMENDED IMPROVEMENTS (TYP.)

EXISTING DRAINAGE EASEMENTS (TYP.)

**LEGEND:**

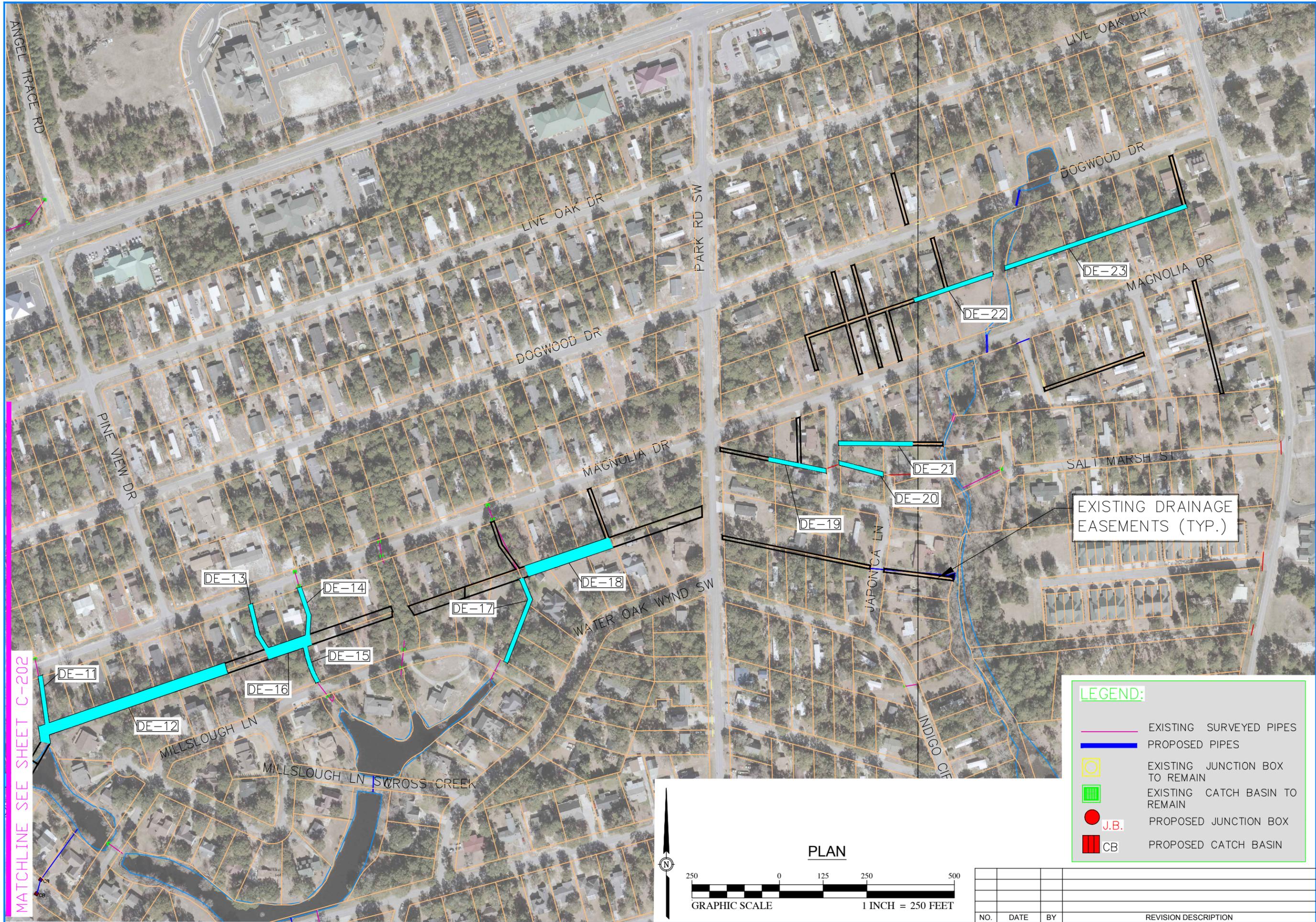
	EXISTING SURVEYED PIPES
	PROPOSED PIPES
	EXISTING JUNCTION BOX TO REMAIN
	EXISTING CATCH BASIN TO REMAIN
	J.B. PROPOSED JUNCTION BOX
	CB PROPOSED CATCH BASIN



NO.	DATE	BY	REVISION DESCRIPTION

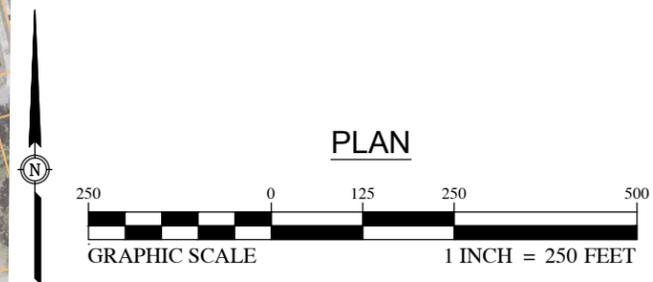
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MATCHLINE SEE SHEET C-202



**LEGEND:**

- EXISTING SURVEYED PIPES
- PROPOSED PIPES
- EXISTING JUNCTION BOX TO REMAIN
- EXISTING CATCH BASIN TO REMAIN
- J.B. PROPOSED JUNCTION BOX
- CB PROPOSED CATCH BASIN



NO.	DATE	BY	REVISION DESCRIPTION



STORMWATER DRAINAGE STUDY  
**TOWN OF SUNSET BEACH**  
 BRUNSWICK COUNTY, NORTH CAROLINA

JOB NO.: 15.01917  
 DATE: MARCH, 2017  
 DESIGNED BY: XXX  
 CADD BY: ZL  
 DESIGN REVIEW:  
 CONST. REVIEW:  
 Easements\_C-202 to C-203.dwg

EXISTING DRAINAGE EASEMENTS

SHEET  
**C-203**

**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

**McGill Associates**

**EASEMENT - ROW-1**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 585.75
2	Demolition (Existing Asphalt Road, Asphalt Driveway)	25	SY	\$ 8.00	\$ 200.00
3	Underdrain Piping	540	LF	\$ 30.00	\$ 16,200.00
4	Asphalt Driveway Repair	25	SY	\$ 80.00	\$ 2,000.00
5	Swale Grading	75	LF	\$ 15.00	\$ 1,125.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	<b>\$ 20,110.75</b>
	Contingency (15 %)				\$ 3,016.61
<b>TOTAL CONSTRUCTION ESTIMATE</b>					<b>\$ 23,127.36</b>

<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
<b>1</b>	Surveying and Design (10%)				\$ 2,312.74

<b>TOTAL COST ESTIMATE</b>					<b>\$ 25,440.10</b>
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NOTE:

- 1) Drainage easement acquisition cost is **not included**.

**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

**McGill Associates**

**EASEMENT - ROW-2**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 1,047.24
2	Demolition (Existing Asphalt Road, Asphalt Driveway)	56	SY	\$ 8.00	\$ 448.00
3	Underdrain Piping	560	LF	\$ 30.00	\$ 16,800.00
4	Asphalt Driveway Repair	42	SY	\$ 80.00	\$ 3,360.00
5	Swale Grading	250	LF	\$ 15.00	\$ 3,750.00
6	15" RCP	275	LF	\$ 32.00	\$ 8,800.00
7	Asphalt Road Repair	14	SY	\$ 125.00	\$ 1,750.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	<b>\$ 35,955.24</b>
	Contingency (15 %)				\$ 5,393.29
<b>TOTAL CONSTRUCTION ESTIMATE</b>					<b>\$ 41,348.53</b>

<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
<b>1</b>	Surveying and Design (10%)				\$ 4,134.85

**TOTAL COST ESTIMATE \$ 45,483.38**

NOTE:

- 1) Drainage easement acquisition cost is **not included**.

**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

**McGill Associates**

**EASEMENT - DE-1**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 67.50
2	Swale Grading	150	LF	\$ 15.00	\$ 2,250.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	\$ 2,317.50
	Contingency (15 %)				\$ 347.63
<b>TOTAL CONSTRUCTION ESTIMATE</b>					<b>\$ 2,665.13</b>

<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
1	Surveying and Design (10%)				\$ 266.51

**TOTAL COST ESTIMATE** \$ 2,931.64

NOTE:

- 1) Drainage easement acquisition cost is **not included**.

**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

**McGill Associates**

**EASEMENT - DE-2**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 505.50
2	Underdrain Piping	260	LF	\$ 30.00	\$ 7,800.00
3	Swale Grading	270	LF	\$ 15.00	\$ 4,050.00
4	Clearing and Tree/Vegetation Removal	500	SY	\$ 10.00	\$ 5,000.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	<b>\$ 17,355.50</b>
	Contingency (15 %)				\$ 2,603.33
<b>TOTAL CONSTRUCTION ESTIMATE</b>					<b>\$ 19,958.83</b>

<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
<b>1</b>	Surveying and Design (10%)				\$ 1,995.88

**TOTAL COST ESTIMATE** \$ 21,954.71

NOTE:

- 1) Drainage easement acquisition cost is **not included**.

**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

**McGill Associates**

**EASEMENT - DE-3**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 535.50
2	Underdrain Piping	550	LF	\$ 30.00	\$ 16,500.00
3	Swale Grading	90	LF	\$ 15.00	\$ 1,350.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	<b>\$ 18,385.50</b>
	Contingency (15 %)				\$ 2,757.83
<b>TOTAL CONSTRUCTION ESTIMATE</b>					<b>\$ 21,143.33</b>

<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
<b>1</b>	Surveying and Design (10%)				\$ 2,114.33

**TOTAL COST ESTIMATE \$ 23,257.66**

NOTE:

- 1) Drainage easement acquisition cost is **not included**.

**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

**McGill Associates**

**EASEMENT - DE-4**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 82.20
2	Swale Grading	160	LF	\$ 15.00	\$ 2,400.00
3	Clearing and Tree/Vegetation Removal	34.00	SY	\$ 10.00	\$ 340.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	\$ <b>2,822.20</b>
	Contingency (15 %)				\$ 423.33
<b>TOTAL CONSTRUCTION ESTIMATE</b>					\$ <b>3,245.53</b>

<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
<b>1</b>	Surveying and Design (10%)				\$ 324.55

**TOTAL COST ESTIMATE** \$ **3,570.08**

NOTE:

- 1) Drainage easement acquisition cost is **not included**.

**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

**McGill Associates**

**EASEMENT - DE-5**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 108.00
2	Swale Grading	180	LF	\$ 15.00	\$ 2,700.00
3	CPP Removal	180	LF	\$ 5.00	\$ 900.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	<b>\$ 3,708.00</b>
	Contingency (15 %)				\$ 556.20
<b>TOTAL CONSTRUCTION ESTIMATE</b>					<b>\$ 4,264.20</b>

<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
<b>1</b>	Surveying and Design (10%)				\$ 426.42

**TOTAL COST ESTIMATE \$ 4,690.62**

NOTE:

- 1) Drainage easement acquisition cost is **not included**.

**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

**McGill Associates**

**EASEMENT - DE-6**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 45.00
2	Clearing and Tree/Vegetation Removal	150	SY	\$ 10.00	\$ 1,500.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	<b>\$ 1,545.00</b>
	Contingency (15 %)				\$ 231.75
<b>TOTAL CONSTRUCTION ESTIMATE</b>					<b>\$ 1,776.75</b>

<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
<b>1</b>	Surveying and Design (10%)				\$ 177.68

**TOTAL COST ESTIMATE** \$ 1,954.43

NOTE:

- 1) Drainage easement acquisition cost is **not included**.

**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

**McGill Associates**

**EASEMENT - DE-7**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 61.80
2	Clearing and Tree/Vegetation Removal	206	SY	\$ 10.00	\$ 2,060.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	\$ <b>2,121.80</b>
	Contingency (15 %)				\$ 318.27
<b>TOTAL CONSTRUCTION ESTIMATE</b>					\$ <b>2,440.07</b>

<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
<b>1</b>	Surveying and Design (10%)				\$ 244.01

**TOTAL COST ESTIMATE** \$ 2,684.08

NOTE:

- 1) Drainage easement acquisition cost is **not included**.

**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

**McGill Associates**

**EASEMENT - DE-8**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 56.70
2	Clearing and Tree/Vegetation Removal	189	SY	\$ 10.00	\$ 1,890.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	<b>\$ 1,946.70</b>
	Contingency (15 %)				\$ 292.01
<b>TOTAL CONSTRUCTION ESTIMATE</b>					<b>\$ 2,238.71</b>

<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
1	Surveying and Design (10%)				\$ 223.87

**TOTAL COST ESTIMATE** \$ 2,462.58

NOTE:

- 1) Drainage easement acquisition cost is **not included**.

**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

**McGill Associates**

**EASEMENT - DE-9**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 66.90
2	Clearing and Tree/Vegetation Removal	223	SY	\$ 10.00	\$ 2,230.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	\$ 2,296.90
	Contingency (15 %)				\$ 344.54
<b>TOTAL CONSTRUCTION ESTIMATE</b>					<b>\$ 2,641.44</b>

<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
1	Surveying and Design (10%)				\$ 264.14

**TOTAL COST ESTIMATE** \$ 2,905.58

NOTE:

- 1) Drainage easement acquisition cost is **not included**.

**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

**McGill Associates**

**EASEMENT - DE-10**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 325.20
2	Clearing and Tree/Vegetation Removal	1,084	SY	\$ 10.00	\$ 10,840.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	<b>\$ 11,165.20</b>
	Contingency (15 %)				\$ 1,674.78
<b>TOTAL CONSTRUCTION ESTIMATE</b>					<b>\$ 12,839.98</b>

<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
<b>1</b>	Surveying and Design (10%)				\$ 1,284.00

**TOTAL COST ESTIMATE** \$ 14,123.98

NOTE:

- 1) Drainage easement acquisition cost is **not included**.

**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

**McGill Associates**

**EASEMENT - DE-11**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 46.80
2	Clearing and Tree/Vegetation Removal	156	SY	\$ 10.00	\$ 1,560.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	<b>\$ 1,606.80</b>
	Contingency (15 %)				\$ 241.02
<b>TOTAL CONSTRUCTION ESTIMATE</b>					<b>\$ 1,847.82</b>

<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
<b>1</b>	Surveying and Design (10%)				\$ 184.78

**TOTAL COST ESTIMATE** \$ 2,032.60

NOTE:

- 1) Drainage easement acquisition cost is **not included**.

**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

**McGill Associates**

**EASEMENT - DE-12**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 580.20
2	Clearing and Tree/Vegetation Removal	1,934	SY	\$ 10.00	\$ 19,340.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	<b>\$ 19,920.20</b>
	Contingency (15 %)				\$ 2,988.03
<b>TOTAL CONSTRUCTION ESTIMATE</b>					<b>\$ 22,908.23</b>

<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
<b>1</b>	Surveying and Design (10%)				\$ 2,290.82

**TOTAL COST ESTIMATE** \$ 25,199.05

NOTE:

- 1) Drainage easement acquisition cost is **not included**.

**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

**McGill Associates**

**EASEMENT - DE-13**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 46.80
2	Clearing and Tree/Vegetation Removal	156	SY	\$ 10.00	\$ 1,560.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	<b>\$ 1,606.80</b>
	Contingency (15 %)				\$ 241.02
<b>TOTAL CONSTRUCTION ESTIMATE</b>					<b>\$ 1,847.82</b>

<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
<b>1</b>	Surveying and Design (10%)				\$ 184.78

**TOTAL COST ESTIMATE** \$ 2,032.60

NOTE:

- 1) Drainage easement acquisition cost is **not included**.

**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

**McGill Associates**

**EASEMENT - DE-14**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 46.80
2	Clearing and Tree/Vegetation Removal	156	SY	\$ 10.00	\$ 1,560.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	<b>\$ 1,606.80</b>
	Contingency (15 %)				\$ 241.02
<b>TOTAL CONSTRUCTION ESTIMATE</b>					<b>\$ 1,847.82</b>

<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
<b>1</b>	Surveying and Design (10%)				\$ 184.78

**TOTAL COST ESTIMATE** \$ 2,032.60

NOTE:

- 1) Drainage easement acquisition cost is **not included**.

**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

**McGill Associates**

**EASEMENT - DE-15**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 30.00
2	Clearing and Tree/Vegetation Removal	100	SY	\$ 10.00	\$ 1,000.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	<b>\$ 1,030.00</b>
	Contingency (15 %)				\$ 154.50
<b>TOTAL CONSTRUCTION ESTIMATE</b>					<b>\$ 1,184.50</b>

<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
1	Surveying and Design (10%)				\$ 118.45

**TOTAL COST ESTIMATE** \$ 1,302.95

NOTE:

- 1) Drainage easement acquisition cost is **not included**.

**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

**McGill Associates**

**EASEMENT - DE-16**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 63.00
2	Swale Grading	140	LF	\$ 15.00	\$ 2,100.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	\$ <b>2,163.00</b>
	Contingency (15 %)				\$ 324.45
<b>TOTAL CONSTRUCTION ESTIMATE</b>					\$ <b>2,487.45</b>

<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
1	Surveying and Design (10%)				\$ 248.75

**TOTAL COST ESTIMATE** \$ 2,736.20

NOTE:

- 1) Drainage easement acquisition cost is **not included**.

**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

**McGill Associates**

**EASEMENT - DE-17**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 86.70
2	Clearing and Tree/Vegetation Removal	289	SY	\$ 10.00	\$ 2,890.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	\$ <b>2,976.70</b>
	Contingency (15 %)				\$ 446.51
<b>TOTAL CONSTRUCTION ESTIMATE</b>					\$ <b>3,423.21</b>

<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
<b>1</b>	Surveying and Design (10%)				\$ 342.32

**TOTAL COST ESTIMATE** \$ 3,765.53

NOTE:

- 1) Drainage easement acquisition cost is **not included**.

**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

**McGill Associates**

**EASEMENT - DE-18**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 340.95
2	Swale Grading	235	LF	\$ 15.00	\$ 3,525.00
3	Clearing and Tree/Vegetation Removal	784	SY	\$ 10.00	\$ 7,840.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	<b>\$ 11,705.95</b>
	Contingency (15 %)				\$ 1,755.89
<b>TOTAL CONSTRUCTION ESTIMATE</b>					<b>\$ 13,461.84</b>

<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
<b>1</b>	Surveying and Design (10%)				\$ 1,346.18

**TOTAL COST ESTIMATE \$ 14,808.03**

NOTE:

- 1) Drainage easement acquisition cost is **not included**.

**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

**McGill Associates**

**EASEMENT - DE-19**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 129.45
2	Swale Grading	165	LF	\$ 15.00	\$ 2,475.00
3	Clearing and Tree/Vegetation Removal	184	SY	\$ 10.00	\$ 1,840.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	<b>\$ 4,444.45</b>
	Contingency (15 %)				\$ 666.67
<b>TOTAL CONSTRUCTION ESTIMATE</b>					<b>\$ 5,111.12</b>

<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
<b>1</b>	Surveying and Design (10%)				\$ 511.11

**TOTAL COST ESTIMATE \$ 5,622.23**

NOTE:

- 1) Drainage easement acquisition cost is **not included**.

**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

**McGill Associates**

**EASEMENT - DE-20**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 19.50
2	Clear Excessive Sediment	130	LF	\$ 5.00	\$ 650.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	<b>\$ 669.50</b>
	Contingency (15 %)				\$ 100.43
<b>TOTAL CONSTRUCTION ESTIMATE</b>					<b>\$ 769.93</b>

<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
<b>1</b>	Surveying and Design (10%)				\$ 76.99

**TOTAL COST ESTIMATE** \$ 846.92

NOTE:

- 1) Drainage easement acquisition cost is **not included**.

**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

**McGill Associates**

**EASEMENT - DE-21**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 70.20
2	Clearing and Tree/Vegetation Removal	234	SY	\$ 10.00	\$ 2,340.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	<b>\$ 2,410.20</b>
	Contingency (15 %)				\$ 361.53
<b>TOTAL CONSTRUCTION ESTIMATE</b>					<b>\$ 2,771.73</b>

<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
<b>1</b>	Surveying and Design (10%)				\$ 277.17

**TOTAL COST ESTIMATE \$ 3,048.90**

NOTE:

- 1) Drainage easement acquisition cost is **not included**.

**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

**McGill Associates**

**EASEMENT - DE-22**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 184.35
2	Swale Grading	235	LF	\$ 15.00	\$ 3,525.00
3	Clearing and Tree/Vegetation Removal	262	SY	\$ 10.00	\$ 2,620.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	<b>\$ 6,329.35</b>
	Contingency (15 %)				\$ 949.40
<b>TOTAL CONSTRUCTION ESTIMATE</b>					<b>\$ 7,278.75</b>

<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
<b>1</b>	Surveying and Design (10%)				\$ 727.88

**TOTAL COST ESTIMATE \$ 8,006.63**

NOTE:

- 1) Drainage easement acquisition cost is **not included**.

**PRELIMINARY PROJECT COST ESTIMATE**

May 2017

**SUNSET BEACH STORMWATER DRAINAGE STUDY  
SUNSET BEACH, NORTH CAROLINA**

**McGill Associates**

**EASEMENT - DE-23**

<b>No.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENSION</b>
1	Mobilization (3%)	1	LS	\$ -	\$ 180.00
2	Clearing and Tree/Vegetation Removal	600	SY	\$ 10.00	\$ 6,000.00
<b>Subtotal Construction Cost Estimate</b>				\$ -	<b>\$ 6,180.00</b>
	Contingency (15 %)				\$ 927.00
<b>TOTAL CONSTRUCTION ESTIMATE</b>					<b>\$ 7,107.00</b>

<b>No.</b>	<b>DESCRIPTION</b>				<b>EXTENSION</b>
<b>1</b>	Surveying and Design (10%)				\$ 710.70

**TOTAL COST ESTIMATE** \$ 7,817.70

NOTE:

- 1) Drainage easement acquisition cost is **not included**.

**APPENDIX C**

**CIP RECOMMENDED STORMWATER MAINTENANCE EQUIPMENT**

## APPENDIX C – RECOMMENDED STORMWATER MAINTENANCE EQUIPMENT

The Town of Sunset Beach has approximately 16,000 linear feet of stormwater drainage pipe within the maintained system, much of this pipe is 20 to 30 years old and in need of repair or maintenance. Town Public Works staff has a long list of projects; this study has clarified and added to that list; and with each major storm event new issues arise. The information compiled in the Geographic Information System (GIS) database during this project provides the Town with a vital component for long term maintenance of their system. Another necessary element of a successful storm drainage system maintenance program is regular inspections and cleanout – as needed – of system components. This maintenance program will allow the Town to be proactive with repairs and reduce the number of emergency projects that must be managed.

Having equipment and trained operators allows the Town to respond quickly to identified problems. In-house capability creates efficiency for the use of equipment on small jobs where only a few inlets require cleaning or a few hundred feet of pipe require inspection. The efficiency comes from avoiding contract and scheduling delays and mobilization charges. In-house capability also facilitates more frequent regular inspection and maintenance activities that would be more difficult to justify using contracted services. Typical costs for contracted services to perform video inspection and cleaning of storm water pipes ranges from \$3 to \$6 per linear foot for larger jobs of at least 3000 linear feet. For example, if the Town of Sunset Beach contracted inspection and cleaning services for its pipe network once a year the annual costs would range from \$48,000 to \$96,000 per year.

### 1. Combination Vacuum Truck and Catch Basin Cleaner

Proper maintenance of stormwater inlets, pipe conveyances and outlet structures is vital to preventing flood related risks during storm events. McGill Associates has coordinated with Town Public Works staff to develop a recommendation for a combination hydro-vacuum truck capable of meeting the maintenance demands of the Town's stormwater drainage system. The Vactor 2100 vacuum truck with hydro-cleaning capabilities is an example of a truck that has the desired capability and specifications. This combination truck has a powerful engine that allows sediment to be vacuumed over long distances. The truck comes with a 1,250-gallon water tank which allows Town personnel to complete extensive cleaning without having to stop work to refill the water tank. The hydro-cleaning capability allows for a powerful jet of water to be directed at clogged pipes or hardened sediment packs and loosen these sediment clogs to be subsequently vacuumed out of the stormwater system. Also the truck is equipped with a 12-cubic yard debris tank, used to store vacuumed sediments and gravel. The truck comes equipped with a telescoping boom which allows Town personnel to reach stormwater structures from the street without having to cross onto yards or grassed areas.

Projected Cost Range for Model Years:

2015/2016: \$330,000 - \$380,000

2013-2015: \$265,000 - \$330,000

2011/2012: \$180,000 - \$265,000



## 2. Street Sweeper – 636 Green Machine Air Sweeper

Cleaning roadways, bike lanes, sidewalks and other paved areas is important preventative maintenance in the upkeep of a functional stormwater system. Stormwater management measures such as pervious pavers require regular maintenance to function as designed and to promote longevity. McGill Associates has coordinated with Town Public Works staff to develop a recommendation for a street sweeper to prevent sediment and debris buildup from accumulating and clogging stormwater structures. The 636 Green Machine Air Sweeper is a good example of a machine that would meet the needs of the Town. The Green Machine 636 series is easy to operate and efficiently sweeps sidewalks and other pedestrian areas without disrupting patrons. Due to its smaller size, the Green Machine 636 can be operated on footpaths and hard to reach areas that larger machines could not reach. The Green Machine 636 can travel up to 20mph and is street legal so it can reach its destination relatively quickly. This machine is also needed to maintain existing pervious pavers in the Town of Sunset Beach Park, bike lanes, and streetscape. It would be an advantage for the Town to utilize this machine on existing features and the planned new features (new pervious concrete sidewalk). A closed circuit television reverse camera allows the operator to see obstacles behind the sweeper and improves safety. A built in pressure washer allows debris and caked on materials to be washed away and swept up. The operator cab is air conditioned.

Projected Cost: \$100,000 - \$115,000.



### 3. Stormwater Mini Camera Inspection Equipment

The ability to evaluate existing stormwater facilities is an important tool for preventative maintenance. McGill Associates has coordinated with Town Public Works staff to develop a recommendation for a mobile camera unit which can be used to inspect and document stormwater system conditions. The Proteus CRP300 would adequately meet the Town's needs for completing pipeline inspections. The Proteus CRP300 is a remote controlled camera crawler that can tackle medium to larger sized pipes. It comes equipped with a 360 degree rotational camera that can be remotely controlled and includes powerful LED lighting. A 200 meter long cable reel, purchased with the crawler, would allow Town personnel to inspect any of the Town's stormwater pipes and facilities. The camera crawler comes with a tether, allowing the operator to manually pull the unit back if it becomes lodged. The crawler control unit is portable, controls the movement of the crawler as well as the camera, works under daylight conditions, captures video footage and still photos, and connects with a desktop computer via USB for the download of captured footage.

Projected Cost: \$50,000 - \$80,000 (waiting on quote).



**APPENDIX D**

**GIS MAINTENANCE AGREEMENT**

## APPENDIX D – GIS MAINTENANCE AGREEMENT

The development of any comprehensive Stormwater Management Plan and associated Capital Improvement Plan (CIP) involves the acquisition and processing of large amounts of data. A major component of this project has been to build a working database for the information collected and integrate this with the Town's Geographic Information System (GIS). The goal was to develop a system for the Town that included accurate base data for the stormwater drainage system and CIP. Going forward, the intended use of the GIS is to serve as data management and an analysis tool the Town can use to track a broad range of stormwater drainage system information and activities including maintenance, repairs, complaints, impervious area, location and specific details about all system components, and various water quality measures. For this system to function as intended for the long term, regular management and maintenance will be required.

### Stormwater Database Management (Collector Data):

The Town has purchased an iPad to collect GPS data and photos in the field. The purpose of the iPad GPS data collection system is to assist Town Public Works personnel in keeping records of stormwater facilities and related activities. Field data can be standardized using field forms created for the iPad and data integrated with the Town's GIS desktop workstation using the Collector App. However, without an ArcGIS Online extension, the collected data is maintained in a public account using cloud based storage. For long term use of this system, the Town should consider an upgrade of their GIS account to include an ArcGIS Online extension which will allow collected data to remain private and will enhance data management significantly. Advantages of the ArcGIS Online extension include enhanced analytics, integration with additional online apps, administrative control, and content sharing. ArcGIS Online integrates field operations efficiently, allowing for better planning, coordination and data capture. The use of this system could be expanded to include other Town maintained utilities. The current annual cost for an ArcGIS Online extension is \$500.

Proposed GIS maintenance would include annual system updates and monthly database maintenance, on-call technical support, and periodic training. Some of these activities can be managed remotely while others will require site visits. Monthly updates should be performed by a GIS technician, working remotely, to ensure proper GPS data storage and maintenance of the GIS database. Monthly or on-call services would include assisting the Town with creating new GPS data collection files used for specific tasks, as well as assistance and troubleshooting of data management or analysis. This service would also include recommendations on new apps that can be used on the iPad to enhance field operations, data collection and work productivity.

Annual updates on the Town's GIS database are needed to ensure the system is running optimally and all aspects of the system are up to date. These updates will generally require an in-person appointment. Annual updates would include performing data backup, duplicate data removal and database structuring. Annual updates will include analysis of the GIS database and field data collection procedures.

#### Update impervious cover and integrate newest aerial imagery:

Impervious cover was evaluated for the Town's stormwater drainage system service area using 2012 aerial imagery. Impervious surfaces were digitized and used to determine the total impervious area for each of the stormwater drainage catchments in the study area for the stormwater modeling process. Data generated from this analysis has been incorporated into the Town's GIS.

New aerial imagery is created and available for download approximately every 5 years from the North Carolina One Map geospatial portal. It is estimated that new aerial imagery covering the Town of Sunset Beach will become available sometime between 2017 or 2018. Periodic maintenance of the impervious cover data layer is recommended on a 5-year cycle to facilitate further analysis and for possible future uses such as a stormwater utility. Updating the impervious cover database can be completed by a GIS technician working remotely.

#### Estimated Cost for GIS System Maintenance:

- Monthly Database Management: \$2,000 per month
- Annual System Update: \$5,000 per year
- On-call services: \$1,000 per month allowance - billed hourly
- Impervious Area Update: \$10,000 per cycle