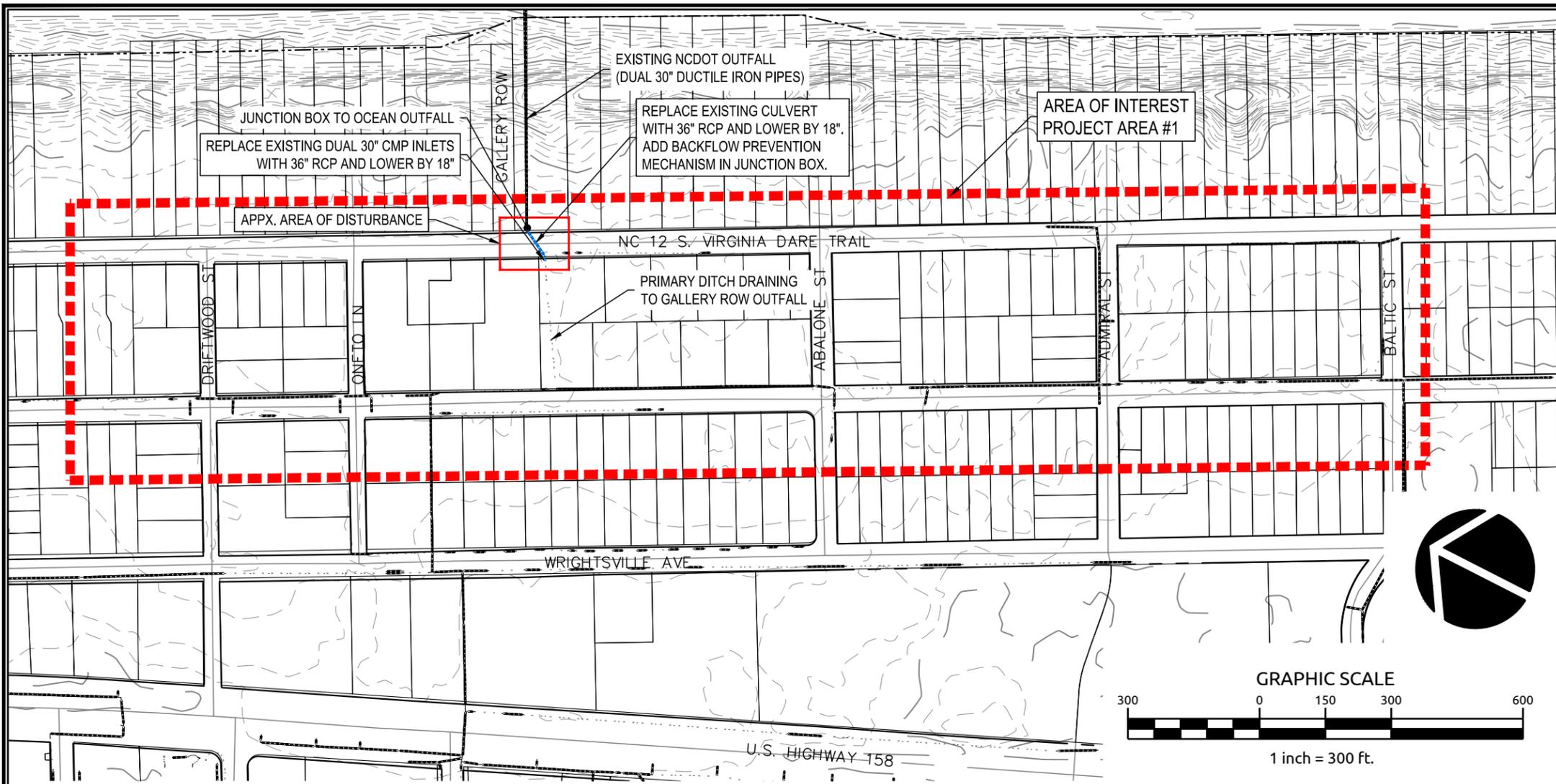


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PROBLEM STATEMENT

FLOODING AT THE GALLERY ROW OUTFALL IS DUE TO A COMBINATION OF AN INSUFFICIENT OUTFALL PIPE CAPACITY, LOW-LYING PROPERTIES, AND ELEVATED GROUNDWATER. ADDITIONALLY, THE CROSS-PIPE DRAINING A PRIMARY DITCH IS APPX. 18" HIGHER THAN THE DOWNSTREAM OCEAN OUTFALL

CONSTRAINTS AND CONSIDERATIONS

- OUTFALL PIPE CANNOT BE UPGRADED DUE TO EXISTING NCDOT REGULATIONS
- REPLACING CROSS-PIPE WILL REQUIRE NCDOT COORDINATION

PROJECT AREA #1 - GALLERY ROW

DESIGN GOAL

CREATE ADDITIONAL SOIL STORAGE BY LOWERING UPSTREAM CROSS-PIPE INVERT TO MORE CLOSELY MATCH PIPE INVERTS IN JUNCTION BOX THAT LEADS TO OCEAN OUTFALL

ASSUMPTIONS

- HIGH GROUNDWATER SIMULATED BY MODELING SOILS AS HSG D SOILS
- CONSTANT TAILWATER ELEVATION OF 0.00 (SEA LEVEL) APPLIED

PROPOSED DESIGN

REPLACE EXISTING 30" CMP WITH 75 LF OF 36" RCP AND LOWER UPSTREAM INVERT BY 18". ADD FLASHBOARD RISER TO ACCOUNT FOR TAILWATER CONDITIONS.

ENGINEER'S COST OPINION*

- 36" RCP: \$15,000
- 36" HEADWALLS: \$10,500
- 36" RCP INSTALLATION: \$12,500
- EXCAVATION AND PAVEMENT REMOVAL: \$7,500
- MOBILIZATION: \$5,000
- RE-PAVING: \$7,000

TOTAL ESTIMATE: \$50,000 - \$100,000

PRELIMINARY RESULTS: REDUCED ROADWAY FLOODING IN THE 25-YEAR STORM TO LESS THAN 3" AND REDUCED TIME FOR FLOODWATERS TO RECEDE TO LESS THAN 6 HRS. NUMBER OF FLOODING EVENTS OVER AN AVERAGE 5-YEAR PERIOD DECREASED BY 80%

*THIS ESTIMATE OF PROBABLE COST IS APPROXIMATE. ACTUAL CONSTRUCTION BIDS MAY VARY SIGNIFICANTLY FROM THIS STATEMENT OF PROBABLE COSTS.

Sheet No. **1**

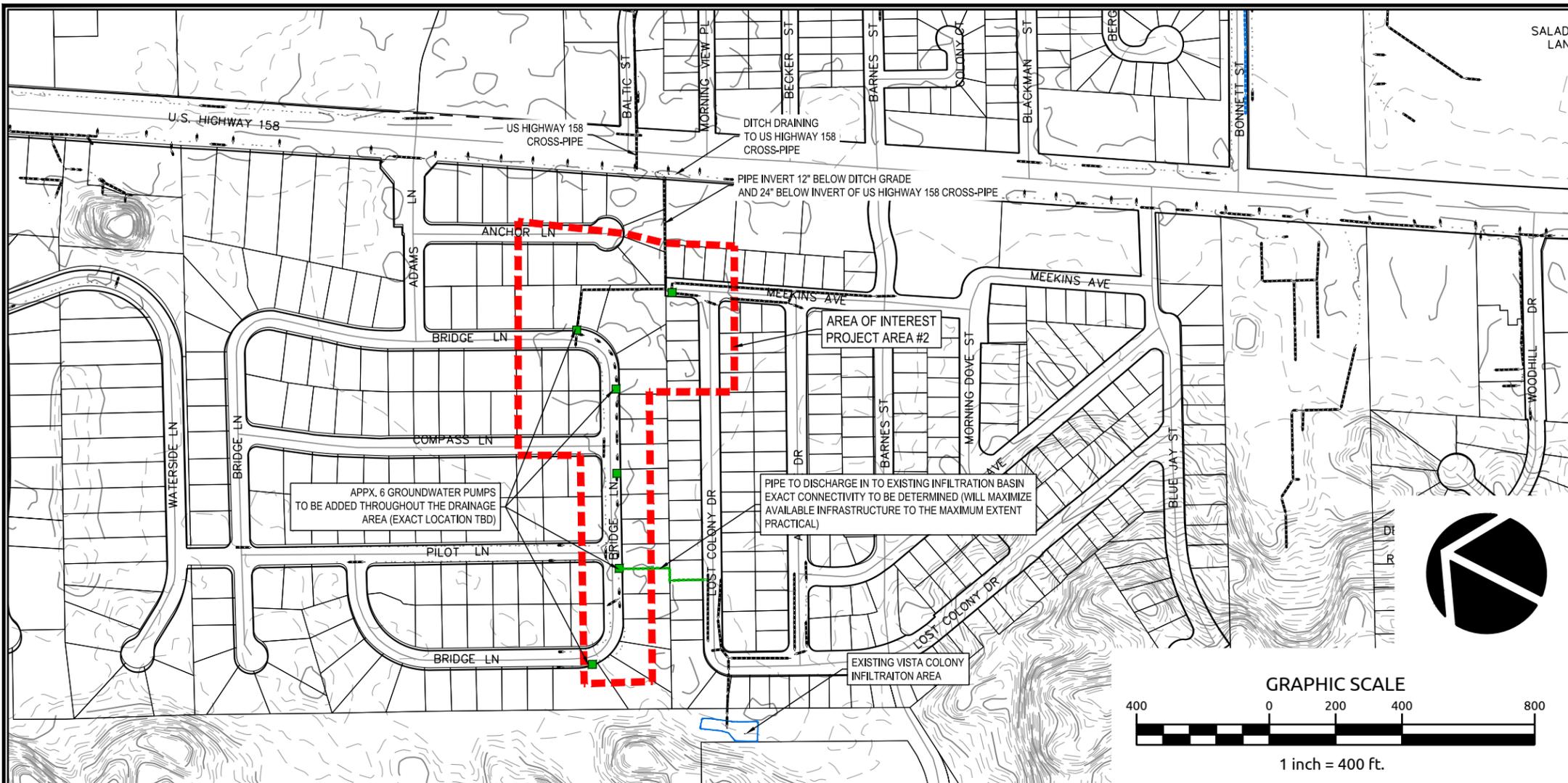
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PROJECT AREA #1

NAGS HEAD PHASE 2

No.	Revision	Date	By	Scale	AS NOTED
1	Nags Head Comments	6/7/18		WR	4/10/18
	Designer				
	Drawn By				
	Checked By				
	Job No.				
	WR	02160539-10			

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PROBLEM STATEMENT

INADEQUATE DRAINAGE INFRASTRUCTURE, HIGH GROUNDWATER, AND LACK OF A GRAVITY-FED OUTFALL IS CAUSING FLOODING IN BOTH SUBDIVISIONS. THE PIPE DRAINING BRIDGE LANE IS 12" LOWER THAN THE DITCH ADJACENT TO US HIGHWAY 158. ADDITIONALLY, THE PRIMARY OUTLET CROSSING US HIGHWAY 158 TO DRAIN THE DITCH IS OVER 12" HIGHER THAN THE GRATE, SO THERE IS CONSTANT STANDING WATER IN THE DITCH.

CONSTRAINTS AND CONSIDERATIONS

- DUE TO A HIGHER CROSS-PIPE ELEVATION THAN THE DITCH INVERT, US HIGHWAY 158 ACTS AS A DAM
- UPSTREAM CONTROLS VIA PUMPING OF THE DITCH OR GROUNDWATER LOWERING MOST LIKELY REQUIRED

PROJECT AREA #2 -NAGS HEAD ACRES & VISTA COLONY

DESIGN GOAL

PUMP WATER WEST TO DISCHARGE POINT OF EXISTING GROUNDWATER LOWERING PROJECT. GRADUAL GROUNDWATER LOWERING (LOW-FLOW OPTION) AND EMERGENCY PUMPING (HIGH-FLOW OPTION) TO BE ASSESSED

ASSUMPTIONS

- LOWERED GROUNDWATER SIMULATED BY MODELING SOILS AS HSG A SOILS
- CONSTANT PUMPING RATE OF 5 CFS USED FOR EMERGENCY PUMPING DURING 25-YEAR STORM
- WATER PUMPED FROM THE DRAINAGE AREA WAS ASSUMED TO DEPOSIT IN AN UPSTREAM INFILTRATION AREA AND NOT INTERFERE WITH DOWNSTREAM NODE

PROPOSED DESIGN

APPX. 6 GROUNDWATER PUMPS AND 1 EMERGENCY PUMP TO BE UTILIZED TO LOWER GROUNDWATER THROUGHOUT 75-ACRE DRAINAGE AREA. EXISTING INFILTRATION AREA AT VISTA COLONY TO BE USED AS DISCHARGE POINT

ENGINEER'S COST OPINION*

- GROUNDWATER PUMPS: \$30,000
- PUMP INSTALLATION: \$30,000
- ADD'L INFRASTRUCTURE: \$10,000
- MOBILIZATION: \$5,000
- EXCAVATION : \$3,500
- EMERGENCY PUMPS (OPTIONAL): \$75,000

TOTAL ESTIMATE: \$75,000 - \$175,000

PRELIMINARY RESULTS: REDUCED DEPTH OF FLOODING IN 1-YR STORM; REDUCES TIME FOR FLOODWATERS TO RECEDE BY 4 TO 13 HOURS. NUMBER OF FLOODING EVENTS OVER AN AVERAGE 5-YEAR PERIOD DECREASED BY OVER 65%

*THIS ESTIMATE OF PROBABLE COST IS APPROXIMATE. ACTUAL CONSTRUCTION BIDS MAY VARY SIGNIFICANTLY FROM THIS STATEMENT OF PROBABLE COSTS.

Sheet No. **2**

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PROJECT AREA #2

NAGS HEAD PHASE 2

No.	Revision	Date	By	Checked By	Scale	Date
1	Nags Head Comments	6/5/18	WR	WR	AS NOTED	4/10/18
2	Nags Head 2nd Comments	6/5/18	WR	WR		

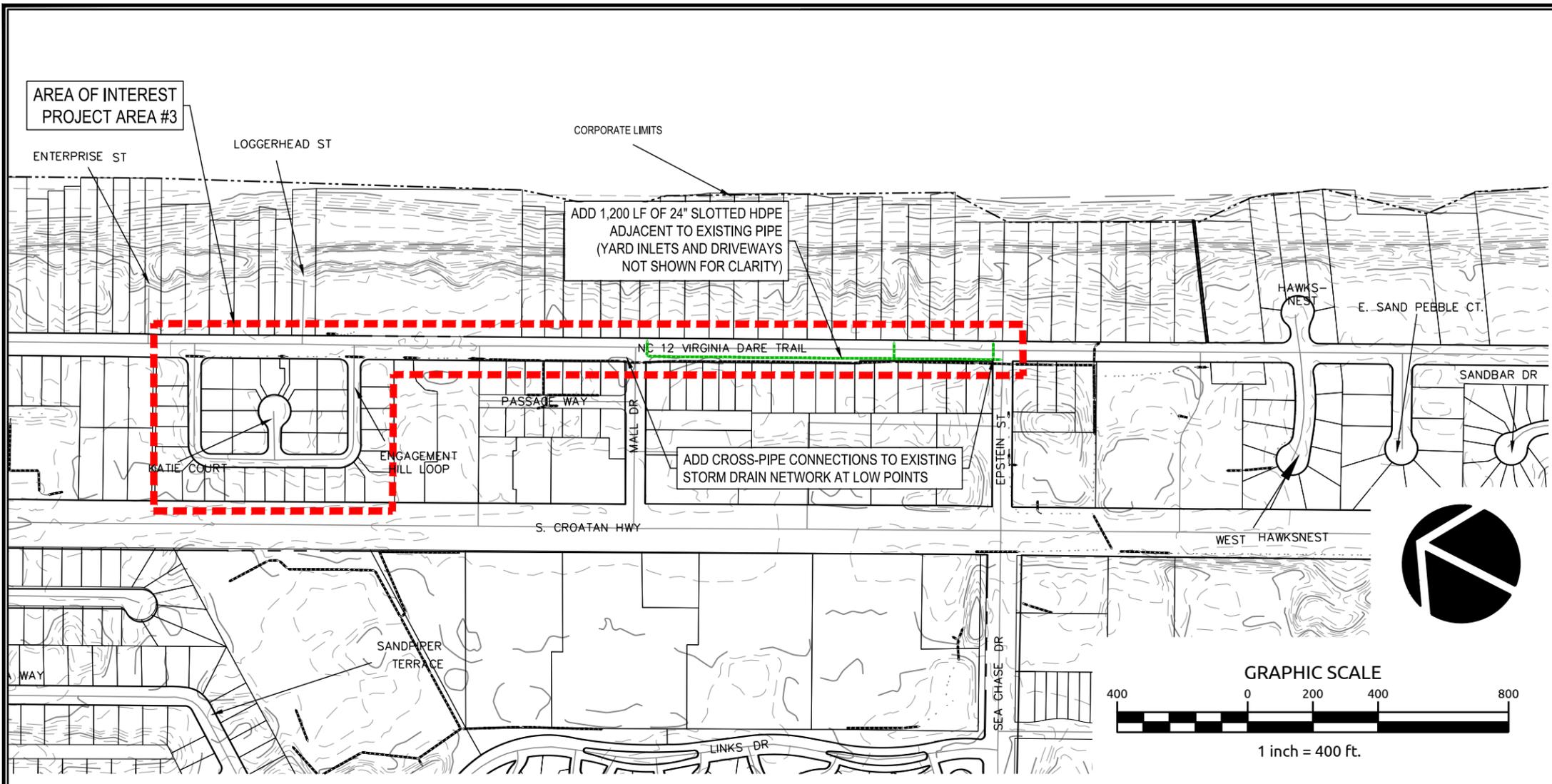
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 NC

PROBLEM STATEMENT

HIGH GROUNDWATER, INSUFFICIENT DRAINAGE INFRASTRUCTURE AND VARIATIONS FROM ORIGINALLY PLANNED DRAINAGE INFRASTRUCTURE HAS CAUSED ROADWAY FLOODING THROUGHOUT THE PROJECT AREA

CONSTRAINTS AND CONSIDERATIONS

- MISMATCHED INFRASTRUCTURE (I.E., DUAL 24" RCPS REDUCE TO A SINGLE 30" RCP)
- NEGATIVE PIPE GRADIENTS AND UNDERSIZED CROSS-PIPES



PROJECT AREA #3 - VILLAGE AT NAGS HEAD: OPTION A

DESIGN GOAL

ADD ADDITIONAL PIPE INFRASTRUCTURE ALONG VIRGINIA DARE TRAIL (BEACH ROAD) TO IMPROVE CONVEYANCE AND INFILTRATION CAPACITY

ASSUMPTIONS

- PIPE STORAGE ADDED WAS CONSIDERED ADDITIONAL STORAGE WITHIN EACH RESPECTIVE DRAINAGE AREA
- TO MODEL INFILTRATION RATE FROM PERFORATED PIPE, AN INFILTRATION RATE OF 8 IN/HR WAS APPLIED TO THE FOOTPRINT OF THE PIPE
- STORAGE AREAS MODELED AS INTERCONNECTED PONDS
- CONSTANT TAILWATER OF 0.00 (SEA LEVEL) APPLIED

PROPOSED DESIGN

INSTALL 1,200 LF OF 24" SLOTTED HDPE AT 0% SLOPE. ADD CROSS PIPE CONNECTIONS TO EXISTING INFRASTRUCTURE AT LOW POINTS.

ENGINEER'S COST OPINION*

- SLOTTED 24" HDPE: \$90,000
- 24" HDPE CROSS-PIPE: \$20,000
- YARD INLETS: \$42,000
- DRIVEWAY REPLACEMENT: \$51,000
- EXCAVATION + GRADING: \$12,500
- HAULING: \$12,500

TOTAL ESTIMATE: \$225,000 - \$275,000

PRELIMINARY RESULTS: REDUCES TIME FOR FLOODWATERS TO RECEDE BY 2 HOURS. NUMBER OF FLOODING EVENTS OVER AN AVERAGE 5-YEAR PERIOD DECREASED BY NEARLY 70%

*THIS ESTIMATE OF PROBABLE COST IS APPROXIMATE. ACTUAL CONSTRUCTION BIDS MAY VARY SIGNIFICANTLY FROM THIS STATEMENT OF PROBABLE COSTS.