



TOWN OF NAGS HEAD STORMWATER MANAGEMENT STANDARD OPERATING PROCEDURES

Town of Nags Head
Nags Head, NC

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Town of Nags Head Stormwater Management Standard Operating Procedures

General Information

The Town has recently created a new Capital Investment Fund (CIF) to strategically plan for long-term capital expenditures and leverage existing financial resources. The CIF is designed to allow the Town to pay cash for capital items such as stormwater and water infrastructure along with street resurfacing projects. An initial CIF fund balance of \$6,000,000 has been dedicated, with a minimum annual amount of \$3,000,000 to be added in future years. The CIF incorporates a holistic view via an integrated infrastructure approach for stormwater, water, and street infrastructure under a single project scope of work.

Drainage projects performed by contracted services are competitively bid and may be approved by the Board of Commissioners, depending on the total contract amount, prior to contract execution. Drainage maintenance work occurs throughout the year by the Facilities Maintenance Division of the Department of Public Services. Work may consist of remedial drainage maintenance project work, routine maintenance, and emergency repairs that may arise throughout the Town.

Historical

The Town of Nags Head Surface Water Drainage Plan completed in June 1980 represents the first comprehensive look at drainage issues within the Town. This was preceded in 2006 with a complete update of the Town's Stormwater Management Plan. The revised plan was submitted by the Town's consultant in December 2006 and included two volumes – A Capital Improvement Plan, and a Technical Manual with stormwater volume (carrying capacity) calculations. The C.I.P. included the identification, preliminary engineering and project cost estimate for nineteen (19) flood control projects, and seven (7) water quality improvement projects. The initial cost estimate for all twenty-six (26) projects was \$5.37 million. Stormwater project prioritization has evolved over time from the initial C.I.P. list to account for spatial, environmental, budgetary, and regulatory constraints and has been reprioritized annually. In addition to annual prioritization, the following measures have/are being addressed as per the recommendations from the 2006 Technical Manual;

- a. Complete GIS inventory of stormwater structures. *(completed)*
- b. *The installation of grass swales and channels where appropriate. (ongoing)*
- c. *Implementation of Low Impact Development Practices in the Town Code of Ordinances and development of a Town specific Best Management Practices Manual. (ongoing)*

- d. *Coordinated effort with NCDOT and other state and federal agencies on infrastructure improvements. (ongoing)*
- e. *Public Education via workshops, videos, and dissemination of reference material with reference to specific and general stormwater management approaches. (ongoing)*
- f. Preservation of native vegetation for natural buffers and enhanced evapotranspiration through Town Code Ordinance amendments. *(completed)*
- g. Implementation of stormwater management ordinance regulations for single family residential development. *(completed)*

In 2019, The Town updated the stormwater Capital Improvement Plan (CIP) to include infrastructure improvements throughout the town to reduce flooding impacts. Plan development was assisted by WithersRavenel, an outside engineering team, to prioritize stormwater maintenance and capital projects based upon a select set of criteria (i.e. frequency of flooding, system condition, water quality, etc.). The CIP program deliverable is serves as a "living document" so that the Town can update the document as projects are completed and new ones are added.

Due to the number, scale, and complexity of the identified flood-prone areas, the plan is being implemented via a phased approach. The initial phase consisted of Town staff compiling data related to existing drainage problem areas via field observations from stakeholders, resulting in 18 individual problem areas which were synthesized into 13 potential CIP projects. The project listing is ranked, utilizing a consistent set of criteria in relation to other projects to determine their relative importance.

The second phase of the project framework includes the development of a problem statement that identifies existing drainage deficiencies, existing constraints and design considerations, and a minimum of two conceptual design alternatives for each project area. Hydraulic and hydrologic models are created, to closely simulate field observations and evaluate project performance as measured by rainfall amount, depth of flooding, and flood frequency.

Construction of five of the identified projects has been completed, construction is tentatively scheduled for three more, two projects addressed with corrective maintenance, and one is in the process of applying for grant assistance. A planning grant was recently awarded to the Town to update the Stormwater Master Plan.

It is anticipated that the information presented in the Stormwater Master Plan will evolve over time as the Town's plans for future development unfolds, as new stormwater management technologies and techniques are created, and with the adoption of new stormwater regulations at all levels of government. The Master Plan should be revisited a minimum of every ten years to respond to the Town's development and to maximize

the use of emerging state-of-the-art design methodologies for sustainable stormwater management.

SECTION 1.0 - DRAINAGE MAINTENANCE PROGRAM

1.1. Overview

Stormwater management facilities perform the function of the removal of water from the street, highway sections, parking areas, and other drainage areas and the protection of the facilities from the effects of water. The stormwater management facilities include drop inlets, storm drains, culverts, underdrains, ditches, slope protection, detention facilities and erosion control devices. In order for these facilities to function as designed and constructed, they must properly be maintained. Maintaining catch basins, stormwater inlets, and other stormwater conveyance structures on a regular basis will remove pollutants, prevent clogging of the downstream conveyance system, restore sediment trapping capacity, and ensure the system functions properly to avoid flooding.

Maintenance generally falls into three categories – routine, remedial, and capital improvements:

- **Routine maintenance** includes those activities that happen on a periodic basis, which may be driven by the passage of time, not the specific deterioration of the system.
- **Remedial maintenance** corrects specific deficiencies in the existing system without upgrading its capacity.
- **Capital Improvement Projects (CIP)** replace deficient systems with larger or improved designs. They become, in effect, new systems.

Routine maintenance of stormwater management structures and facilities include the following:

- Keeping water courses free from accumulations of debris and vegetation, and storm drains free of silt, sand, and debris.
- Anticipating problems and making minor modifications.
- Inspection of facilities periodically to ensure continued operation and function.

Remedial maintenance of stormwater management structures and facilities include the following:

- Correcting malfunctioning parts of the system (i.e. settlement or breaks).
- Replacing or repairing pump apparatus.
- Repairing eroded banks and establishing with a permanent means of stabilization.

Capital Improvement Projects for stormwater management structures and facilities include the following:

- Replacing and upsizing deteriorating pipes and structures.
- Re-establishing stormwater control systems (i.e. grassed swales)
- Installing new stormwater control systems, (i.e. groundwater lowering systems, new storm conveyance systems, new retention areas, etc).

There are four basic approaches to stormwater maintenance. They are reactive, predictive, periodic and proactive:

Reactive maintenance is essentially complaint-driven. It is episodic in nature, wherein the maintenance staff attempts to meet normal to overwhelming demands for stormwater services on a priority basis. In order for a problem to be addressed, it must be severe enough to make it to the top of the list.

Predictive maintenance is driven by inspections and inspection standards. Inspection of stormwater facilities serve as a method for scheduling and controlling work crews and for responding or anticipating specific problems within the system. Stormwater system visual inspections should be made annually and after each major storm to confirm that satisfactory conditions exist, or to evaluate the need for cleanup or repair.

Periodic maintenance is calendar driven and is performed when maintenance needs are known without inspection. For example, it might be known through experience that channels need to be mowed three times in a growing season.

Proactive maintenance gets at the root cause of problems. For example, the watershed leading to an outfall may exceed design capacity and through policy, increased on-site stormwater management is required, mitigating the impacts of downstream flooding. Substitution of different material types on structures and pipes can save long-term replacement costs.

1.2. Goals

The established goals related to the maintenance of the stormwater system are as follows:

- Provide, operate, and maintain a system of stormwater management facilities, controls, criteria, and standards that will mitigate the damaging effects of uncontrolled and unplanned stormwater runoff, to improve public health, safety and welfare, protect property and lives, and maintain and enhance the environment.
- Establish consistent levels of protection against flooding for existing and future land development conditions, and to correct existing physical drainage problems with available resources and the authority to conduct work.

1.3. Objective

The **Drainage Maintenance Program** procedure specifies responsibilities and procedures for inspecting and cleaning of canals, channels, ditches, swales, culverts, pump systems and discrete collection systems within the jurisdiction of the Town of Nags Head, North Carolina.

1.4. Responsibilities

- a. The *Facilities Maintenance Superintendent*, herein referred to as *Superintendent*, is responsible for the administration of the Drainage Maintenance Program. The *Superintendent*, or his/her designee, shall conduct visual inspections of public canals, channels, ditches, swales, culverts, Stormwater Control Measures (SCM's) and discrete collection systems and insure they are cleaned in accordance with the **Drainage Maintenance Program**.
- b. The *Superintendent*, or his/her designee, is responsible for maintenance activities of all drainage facilities located on public properties and within the Town public rights-of-ways.
- c. Drainage conveyances located within the S. Croatan Hwy. (US Hwy 158), S. Virginia Dare Trail (NC 12), and S. Old Oregon Inlet Rd. (NCSR 1243) rights-of-way are maintained by the *North Carolina Department of Transportation, (NCDOT)* in addition to the following point source ocean outfall discharges;
 - i. Red Drum Ocean Outfall
 - ii. Curlew St. Ocean Outfall
 - iii. Conch St. Ocean Outfall
 - iv. Soundside Rd. Ocean Outfall
 - v. Park Service Outfall

It should be noted that coordinated efforts may be required to conduct maintenance activities at the above referenced locations.

- d. All related drainage work conducted on Federal, State and Town properties and rights-of-way shall be coordinated through the appropriate agencies.
- e. Private Property owners are responsible for maintaining canals, ditches, swales, and stormwater control measures (SCM) sited on their property. Town personnel shall not enter onto private property unless a drainage easement or written permission has been granted, in written form, or the problem is deemed an emergency with guidance given by the Town Attorney.
- f. The *Town Code Compliance Officer*, or their designee, is responsible for enforcing Town Code Section 34-13, an ordinance maintaining un-obstructed flow paths for drainage infrastructure along Town rights-of-way.

- g. **Reactive maintenance** activities will be managed and administered by the *Facilities Maintenance Superintendent* or his/her designee.
- h. **Predictive maintenance** activities will be coordinated and administered by the *Facilities Maintenance Superintendent* or his/her designee.
- i. **Periodic Maintenance** will be conducted by the Public Services Department and *Facilities Maintenance Superintendent* or his/her designee.
- j. **Proactive Maintenance** will be managed by the *Town's Stormwater Administrator*, and coordinated with the Public Services Department and the Town Manager.

1.5. Jurisdiction

- 1) The Drainage Maintenance Program encompasses public canals, channels, ditches, swales, culverts, Stormwater Control Measures (SCM's) and discrete collection systems as described in Town of Nags Head Drainage Infrastructure Inventory Maps and overlaid with recent maintenance work in the Town of Nags Head Drainage Infrastructure Maintenance Maps. The maps are living documents and are continually updated. Maps are located at www.nagsheadnc.gov/264/Drainage-and-Elevation-Maps

1.6. Authority

- a. The *Superintendent*, or his/her designee, has the responsibility to visually inspect and maintain all public canals, channels, ditches, swales, culverts, stormwater control measures (SCM's) and discrete collection systems and those properties where an approved drainage easement has been granted.
- b. The Town reserves the right to inspect and maintain all channels and canal banks of all navigable within the corporate limits and in accordance with approval from the appropriate permitting agency.

1.7. Identification of Problems

- a. The *Facilities Maintenance Superintendent*, or his/her designee, shall inspect the main drainageways listed below, at a minimum, biannually, and in accordance with the *Public Services Department Storm Preparedness Check Sheet- Town of Nags Head Emergency Operations Plan, current version*, as applicable.
- b. Within 24 hours, or to maximum extent practicable, of a major rainfall event, the *Superintendent*, or his/her designee, shall inspect the main drainageways at each of the ocean and sound outfalls, to include, but not be limited to;
 - i. Red Drum Ocean Outfall
 - ii. Curlew St. Ocean Outfall

- iii. Conch St. Ocean Outfall
- iv. Soundside Rd. Ocean and Sound Outfall
- v. Whalebone Junction Sound Outfall
- vi. S. Memorial Avenue ditch
- vii. S. Old Oregon Inlet Rd. ditch
- viii. S. Croatan Hwy. west side ditch
- ix. Station 21 Sound Outfall
- x. Park Service Ocean Outfall
- xi. Whalebone Junction Sound Outfall

- c. The *Facilities Maintenance Superintendent*, or his/her designee, shall inspect complaints submitted by residents, businesses and public agencies. Such complaints shall be entered into the Towns asset management software system. The *Superintendent* shall ensure that a review of the subject property(s) is conducted within five working days. Copies of the completed form shall be maintained by the Department of Public Services and shared with *Town's Stormwater Administrator*.

1.8. Maintenance Activities

- a. There are four types of drainage obstructions:
 - 1) Trash: artificial or man-made objects such as garbage, tires, lumber, solid waste containers, beach recreational items, (i.e. boogie boards) and similar items. Animal carcasses are included in this category as well.
 - 2) Minor obstructions or repairs: vegetative growth, tree limbs, minor amounts of accumulated sediment and other naturally occurring debris which reduces water flow by no greater than 33%.
 - 3) Major obstructions: fallen trees, significant amounts of sediment accumulation, compromised culverts which impedes the flow of water greater than 33% of its capacity.
 - 4) Structural Deficiencies: outfall repair/replacement, culvert or drainage pipe replacement, bank stabilization or other project related work which may require permitting from a Federal or State agency.

1.9. Maintenance by Location and Response Time

- a. Maintenance by location:
 - 1) **Public property:** *Facilities Maintenance Superintendent*, or his/her designee, shall schedule maintenance personnel to remove trash and minor obstructions. This work shall be conducted within **5 working days** of being reported.
 - 2) **Private property** with drainage maintenance easements: trash, minor problems and obstructions shall be reported to the property owner within **3 working days** of its identification. If the property owner does not remove the issue **within 7 calendar days**, the *Superintendent* shall coordinate with the *Town Code Compliance Officer* in resolving this matter.
 - 3) **NCDOT Rights-of-Way:** Reactive maintenance work type, report to the Division One Maintenance Office for corrective action. Periodic Maintenance work type: depending on the scale, work conducted within the NCDOT right-of-way may require permitting at the state level, and in certain cases, Federal permitting (i.e. US Army Corps of Engineers). A written right-of-way encroachment agreement through NCDOT is typically required in advance for scheduled Capital Project Improvement work being conducted within the NCDOT right-of-way corridor.
 - 4) **Other Permitting Requirements:** If the maintenance work includes large-scale removal of earthen material from main drainageways, an NC Division of Coastal Management CAMA Permit or US Army Corps of Engineer Permit may be required.
 - 5) Upon completion of a maintenance project, record of the corrective actions shall be documented in the Towns asset management software and retained by the Department of Public Services.

1.10. Drainage Routine Maintenance Protocols

Town staff should conduct routine inspection of facilities to ensure the following:

Catch Basins/Inlet Structures

- Remove sand, silt, vegetation or debris from inlets
- Immediate repair of structure deterioration threatening structural integrity.
- Cleaning before the sump is 33% full of sand, silt or debris. System elements should be cleaned as frequently as needed to meet this standard.
- Clean catch basins, storm drain inlets and other conveyance structures before the summer season to remove accumulated sand, silt and debris.
- Catch basin/storm drain inlet cleaning may require jetting operations for sand, silt and debris removal. Conduct jetting operations from upstream to downstream.
- Conduct inspections more frequently during the wet season for problem areas where sediment or trash accumulates more often. Clean and repair as needed.
- Conduct video inspection, as required, post cleaning to evaluate structural integrity of catch basin/inlet. Conduct remedial measures as necessary.
- Sand, silt and debris removed from cleaning activities shall be transported to an approved off-site facility
- Keep accurate logs on system elements inspected, cleaned and repaired.

Storm Drain Conveyance /Culverts

- Remove sand, silt, vegetation or debris from pipe inlets.
- Vegetation should be controlled to prevent restriction of flow
- Immediate repair of structure deterioration threatening structural integrity.
- Cleaning before the pipe is 33% full of sand, silt or debris. System elements should be cleaned as frequently as needed to meet this standard.
- Conduct pipe jetting operations, as necessary, to purge pipes of sand, silt and debris. Flushing should be conducted from upstream to downstream.
- Conduct inspections more frequently during the wet season for problem areas where sediment or trash accumulates more often. Clean and repair as needed.
- Sand, silt and debris removed from cleaning activities shall be transported to an approved off-site facility.
- Conduct video inspection, as required, post cleaning to evaluate structural integrity of catch basin/inlet. Conduct remedial measures as necessary.
- Conveyance inlets/outlets banks should be permanently stabilized to prevent future erosion and for energy dissipation to prevent scouring.
- Keep accurate logs on system elements inspected, cleaned and repaired.

Canals/Channel/Ditches

Ditches, canals and channels are used to collect and disperse surface water in a controlled manner without causing erosion or ponding. Ditches have steeper bank slopes, are deeper in depth and have greater flow capacity and are primarily designed for conveyance of runoff.

- Remove sand, silt or debris from ditch flow line.
- Remove vegetation to prevent restriction of flow.
- Invasive and noxious aquatic plant species removal (i.e. alligator weed) should be incorporated into a bi-annual aquatic weed maintenance program.
- Maintain ditch flow line with continuous grades established between ditch beginning and end points.
- Immediate repair of ditch bank erosion threatening roadway integrity.
- Stabilize disturbed areas after maintenance activities with permanent seeding, erosion control matting and rip-rap stabilization as necessary.
- Maintain a permanent vegetative cover along ditch banks to stabilize and mitigate erosion. Conduct mowing operations monthly during the growing season.
- Repair ditch banks compromised from animal burrowing with supplemental fill, compact and revegetate.
- Clean before the ditch is 33% full of vegetation, sand, silt or debris. System elements should be cleaned as frequently as needed to meet this standard.
- Conduct inspections more frequently during the wet season for problem areas where sediment or trash accumulate more often. Clean and repair as needed.

Grassed Swales

Swales are used to collect and disperse surface water through infiltration. Swales are typically broad and shallow with a continuous vegetative cover. Swales are utilized to intercept runoff from impervious surfaces, filter pollutants and reduce runoff peak velocities.

- Remove trash, debris or sediment from swale flow line.
- Repair swale surface area if bare and/or erosive gullies have formed. Regrade, install excelsior matting, as required, and re-establish vegetation as necessary.
- Report any developer/contractor/homeowner related swale disturbance or modification to Town Code Compliance officer for corrective action.
- Keep accurate logs on system elements inspected, cleaned and repaired.

Pump Apparatus

Pump stations may consist of surface water lift station or pumped groundwater lowering systems. Maintenance activities will be system specific but in general shall consist of the following:

- Pumps are manually operated and shall be triggered by the water surface levels in the adjoining ditch or basin. When the water surface levels exceed the midpoint of the ditch or basin depth, the system shall be activated. Severe storm events shall also prompt system activation. A severe storm may consist of a Nor'easter, Tropical Storm, Hurricane, thunderstorm or a prolonged rainfall event which generates rainfall in excess of two inches. It is recommended that the system be operated a minimum of 24-hours in advance of a severe weather event to create excess storage capacity. The above referenced information provides guidance on the operation of the pumping system. Judgement and discretion may be necessary for operation of the system in addition to continual monitoring of conditions.
- Vista Colony pump system- Well pumps are designated #1-#6. Well pump #1 being the southernmost pump and well pump #6 being the northernmost pump. Pumps are spaced at fifty-foot intervals. Well pumps are self-priming above-grade submersible pumps enclosed within a green weatherproof enclosure.
- Nags Head Acres pump system-Well pumps are designated A1-A7. Well Pump A1 is located at the north end of Meekins Ave., well pump A2 is located on the adjacent to the southeast corner of 2620 Bridge Lane, well pump A3 is located adjacent to the common property line of 2620 Bridge Lane/2621 S. Compass Lane, well pump A4 is located near the southwest corner of 2621 S. Compass Lane, well pump A5 is located adjacent to the common property line of 2620 S. Compass Lane and 2611 S. Pilot Lane, well pump A6 is located near the southeast property corner of 404 W. Bridge Lane and well pump A7 is located near the southwest property corner of 414 W. Bridge Lane. Well pumps are typically offset 10'+/- from the north edge of pavement. Well pumps are submersible type.
- When possible, alternate operation of multi-pump system to increase pump longevity. For consistency, the pumps can alternate between odd and even numbered pumps (e.g. 1,3,5 on and 2,4,6 off) Generally, continuous pump operation should be limited to a maximum of a 24-hr period.
- In advance or during of wet weather conditions, both groundwater lowering systems shall be operated with 50% of the pumps on and the remaining pumps off. Pumps shall run for a maximum time period of up to 24hrs at which time the pumps will be alternated with the remaining pumps turned on as required.

- During the time of pumping operation, the water level shall be monitored at the discharge basin. A staff gauge level will be placed indicating 25%, 50%, 75% and 90% capacity levels. The water surface level will ultimately dictate the number and duration of pumps in operation.
 - 0-50%- All pumps can be turned on and operate when the discharge water surface level is at or lower than this elevation.
 - 50%-75%- Only half of the pumps can operate for a single system or for both systems. The discharge water surface levels should be monitored closely during this period.
 - 75%- 90%- Only half of the pumps of a single system should operate. The discharge water surface levels should be monitored closely during this period.
 - >90%- All pumps off. A minimum of 18-24 hour recovery period for the discharge basin should be employed prior to activating any further pump operation.
- Conduct routine inspections during pump operation, noting any changes in audible motor noise that may indicate mechanical issues. Document inspections and note any deficiencies.
- Conduct routine inspections during pump operation documenting system flow at inline flow meter and at discharge point. Water levels in the outfall reservoir shall be monitored during prolonged operation of the pumps system(s).
- At a minimum, conduct monthly visual observations of pump operation. This shall include the removal of housing and insulation to observe any apparent excessive vibration or material defect at the well head.
- Conduct annual system purging of wells and discharge line to maintain system efficiency. This may consist of chlorinating the system for removal of any accumulated silt, iron and bacteria buildup. Bi-annual assessment of the individual pump operation shall be assessed and evaluated to determine efficient pump operation and assist with scheduling for replacement. This scope of work may be conducted via contracted services.
- Pumps shall be exercised when temperatures fall below freezing.
- Above grade pumps shall be outfitted with insulation to protect against freezing.
- Monitor and maintain documentation of water quality sampling and system flows in accordance with NCDEQ permitting. Groundwater samples will be analyzed

for Fecal Coliform, Chlorides, and Nutrients (Total Nitrogen, Ammonia, Nitrate, Total Phosphorous.). Water Quality sampling of the Vista Colony system shall occur on a triannual basis, sampling in March, July and November. Water Quality sampling of the Nags Head Acres system shall occur on a monthly basis. The process for water quality sampling is as follows:

- Locate the provided containers labeled according to sample, the data sheet and thermometer.
 - Prepare the data sheet by updating with the current date and time.
 - Activate pumps via main electrical control panel. A minimum of 3 pumps should be activated. Pumps A2, A3 & A4 should be operated for the Nags Head Acres system. Vista Colony panel is located adjacent to Pump #4. Nags Head Acres electrical control panel is located on the south side of 2620 S. Bridge Lane.
 - Proceed to sampling spigot. Vista Colony spigot is located on north side of riser pipe adjacent to pump #6. Sampling spigot for the Nags Head Acres system is located on the forcemain adjacent to the flow meter device, immediately north of the Vista Colony system. Turn on the sampling spigot until water flows. Let water flow a minimum of 5 minutes.
 - Place the thermometer in the flow of water. Record temperature on data sheet.
 - Fill each container $\frac{3}{4}$ of the way full, and return the caps.
 - Turn off valve.
 - Unscrew and open the top to the water flow meter, and record the number displayed.
 - Record any other necessary information on the data sheet. Immediately after sampling, take the samples and data sheet to the Environmental Chemists lab located behind the Manteo Public Services location on Bowsertown Rd. Sign and date the form, and they will send off the samples to be analyzed.
 - The results will be emailed directly to David Ryan and Kate Jones. The data should be entered into the corresponding excel data sheet located here: <K:\Public Services\STORMWATER\2019\SW Program> .
- The lab results, along with the corresponding excel data sheet, a copy of the original data sheet and corresponding letter addressed to David May at the Aquifer Protection Washington Regional Office should be sent via mail on or

before the last day of the following month. Replace pumps and appurtenances as necessary for optimized system operation.

- Keep accurate logs on system elements inspected, cleaned and repaired.

1.11. Maintenance Documentation

- a. Records of all inspections, complaints and work performed on the drainage system shall be prepared and maintained. Inspections and reports shall be recorded in the Towns asset management software program. At a minimum, the collected field documentation shall include:
 - i. Location
 - ii. Nature of the problem
 - iii. Time and date of inspection
 - iv. Corrective action performed
 - v. Associative photographic documentation
 - vi. Follow-up performed by staff, as applicable
- b. System records will be maintained in Town purchased asset management software.
- c. System records will be supported by the Town's GIS system mapping for publishing and reporting to the Town citizens.
- d. Maintenance information will be compiled and utilized in the preparation of annual reports or other related reporting purposes by the *Superintendent* or the *Town's Stormwater Administrator*.

1.12. Maintenance Zone Areas

Maintenance within the Town of Nags Head is divided into (3) separate zone areas, with (3) sub zones further delineating each area. The zones are delineated based upon the concentration of infrastructure contained within each area, equating to approximately 1/3 of the existing infrastructure per zone. The zones encompass the following areas:

Zone 1: East of US Hwy 158, spanning from Eighth St. to Hollowell St

- 1A (E. 8th St to E. Abalone)
- 1B (E. Abalone to E. Bonnet St.)
- 1C (E. Bonnett to E. Hollowell St.)

Zone 2: East of US Hwy 158, spanning from Hollowell St to US Hwy 64, S. Virginia Dare Trail and through to NCSR 1243 to the Town southern corporate limits, (National Park Service boundary).

- 2A (E. Hollowell St to Town Hall)

- 2B (Town Hall to E. Gulfstream)
- 2C (E. Gulfstream to McCall Ct.)

Zone 3: West of US Hwy 158, spanning from Eighth St. to US Hwy 64 S. Virginia Dare Trail through to the Washington Baum Bridge.

- 3A (W. 8th St. to W. Villa Dunes Dr.)
- 3B (W. Villa Dunes Dr. to S. Old Cove Rd.)
- 3C (S. Old Cove Rd. to S. Marina Dr.)

Exhibits outlining the zone areas are attached in Appendix A Drainage Maintenance Zones

1.13. Maintenance Scheduling

Scheduling of routine maintenance work is dependent upon the availability of personnel to perform in association with other scheduled remedial or related work priorities. In general, the following schedule is developed based upon two full-time Facilities Maintenance personnel dedicated to conducting routine maintenance work:

Zone 1: Cycle 1- July through August, Cycle 2- January through February

Zone 2: Cycle 1- September through October, Cycle 2- March through April

Zone 3: Cycle 1- November through December, Cycle 2- May through June

It should be noted that certain drainage maintenance work may require additional field personnel to complete specific tasks, (i.e. pipe jetting, infrastructure repair, etc.). Scheduling may vary due to weather events, division project priorities and remedial work priorities.

1.14. Maintenance Resources

Personnel and equipment necessary to perform maintenance work will be supplied by the Department of Public Services. For routine maintenance activities a 2-man field crew will conduct daily work and be supplemented by additional Facilities Maintenance personnel as the need arises. Equipment needs will be provided with the following equipment: backhoe, dump truck, trailer mounted sewer jetter, utility vehicle outfitted with a flail mower, utility vehicle outfitted with a ditcher head assembly. Other equipment in the Public Services inventory may be used to accomplish specific maintenance tasks. Staff and equipment needs will be reviewed annually for inclusion in the next fiscal year budget.

1.15. Maintenance Agreements

North Carolina Department of Transportation

As noted in Table A.1, approximately 36% of the stormwater conveyances are the responsibility of the North Carolina Department of Transportation (NCDOT).

Pursuant to NCDOT policies and procedures, outlet ditches will be maintained to provide adequate drainage thereof.

Table A.1

Drainage Facilities in the Town of Nags Head (approximate)

	<u>Miles</u>	<u>Percentage</u>
Town of Nags Head	35.27	64.26%
NC - DOT	19.42	35.38%
On Private Property	0.2	0.36%
Totals	54.89	100%

Drainage along the following rights-of-way are the responsibility of the NC Department of Transportation:

- S. Croatan Hwy. (US Hwy 158)- spanning from the Town northern corporate limits to Whalebone Junction
- S. Virginia Dare Trail (NC 12) – spanning from the Town northern corporate limits to Whalebone Junction
- S. Virginia Dare Trail (US Hwy 64) – spanning from Whalebone Junction to the eastern approach of Washington Baum Bridge
- S. Old Oregon Inlet Rd (NC1243) – spanning from Whalebone Junction and the Town southern corporate limits.

A separate operation and maintenance schedule is currently being coordinated with NCDOT which addresses maintenance activities in NCDOT rights-of-way.

Coordination with NCDOT Division 1- Dare County Maintenance Office is required for individual work requests related to drainage infrastructure repairs and maintenance activities. Any material improvements scheduled within the NCDOT right-of-way shall require a right-of-way encroachment to be submitted to the NCDOT Division 1 Resident's Engineers Office in Elizabeth City, NC.

North Carolina Department of Environmental Quality- Aquatic Weed Control Program

An annual cost share agreement is currently in place between the Town and the North Carolina Department of Environmental Quality- Water Supply Planning Division- Aquatic Weed Control Program. Aquatic weed spray consists of a state approved Polaris Imazapyr application with 0.75% solution applied via a hand gun by way of a 50 gal. tank. The solution is targeted to eradicate alligatorweed, which becomes invasive in the wet surface areas of ditches during the growing season.

The application schedule consists of an initial application in June, at the beginning of the growing season and a second application in the beginning of August for vegetative abatement.

NCDOT also conducts a periodic aquatic weed spray program. The Town/NCDEQ spray application shall be coordinated with NCDOT aquatic weed spray program to ensure timely scheduling and minimize duplicative efforts.

Maps of the areas encompassed by the Aquatic Weed Spray Program are included in *Appendix B*.

National Park Service – Special Use Permit

A Special Use Permit has been acquired from the National Park Service for the performance of drainage ditch maintenance on the National Park Service property for a length of approximately 400 feet. The permitted maintenance activities shall be limited to snagging accumulated debris and vegetation that blocks the free flow of ditch. The approved methods of removal are via boat or by foot. All materials removed from the water shall be removed and hauled off to an approved off-site facility. The permit expires 5/9/2023. A copy of the permit approval is attached in *Appendix C*.

Village @ Nags Head

Four separate entities are responsible for drainage maintenance within the Village at Nags Head: Town of Nags Head, Village at Nags Head Property Owners Association, North Carolina Department of Transportation, and Clubcorp Golf of North Carolina, LLC. Currently, the Town of Nags Head's areas of responsibility consist of drainage improvements along all Town public rights-of-ways. The following is a brief overview of the main Town responsible areas:

- Baymeadow Dr.
- Drainage ditch along the north side of the Municipal Complex
- Portions of the drainage ditch along W. Forrest St.

Coordinated maintenance efforts shall be conducted with NCDOT Division 1 Maintenance office, Village at Nags Head POA Association Manager, and Clubcorp Golf of North Carolina, LLC representatives. At a minimum, this should be conducted annually.

1.16. Remedial Maintenance & Project Prioritization

- 1) Identified remedial maintenance of existing drainage facilities shall be coordinated through the *Facilities Maintenance Superintendent* and the *Stormwater Program Administrator* for immediate action or inclusion into future fiscal year budgets. Remedial work will be evaluated based upon a pre-determined set of criteria to include, but not limited to: magnitude and extent of deficiency, system condition, public safety concerns, contributing tributary are served, available funds, etc.. An annual prioritized repair/replacement schedule shall be prepared and implemented immediately, dependent upon available funds, or included in future fiscal years budgets. Other considerations in the development of an annual project prioritization list may include the following:
 - i. Localized flooding problems/citizen complaints;
 - ii. Observed system failures – collapsed culverts, for example;
 - iii. Annual ditch/swale maintenance.
 - iv. Drainage improvements identified as part of current or historical studies or plans.
 - v. Coordinated efforts with scheduled roadway or waterline improvements.

- 2) Once a project priority list has been compiled, a determination will be made whether the work is to be performed by Town forces or by contracted services. An opinion of probable construction costs shall be prepared via a coordinated effort of Public Services staff accounting for equipment, labor (man power estimates as applicable), and necessary materials will be determined for each project. Materials will be ordered allowing adequate delivery time for any items not readily available in Dare County. Projects will be completed in the order of their priority and as staff workload permits. If a project's completion is affected by equipment problems, inquiry will be made to other divisions of Public Services to determine the availability of an equivalent piece of equipment – Water Distribution's backhoe, for example.

- 3) As soon as a project has been completed, the *Stormwater Program Administrator*, *Facilities Maintenance Superintendent*, or *Public Services Officer Manager*, will fill in all required fields in the Towns asset management software to document work status (see sample of form in *Appendix D*)

1.17. Post-Storm Maintenance

- 1) Following all significant rain events (greater than 2 inches in a single rainfall event), all known problem areas will be inspected. This includes areas of typical overwash, whether from the ocean, or the sound. Any problems due to damaged infrastructure will be analyzed for the necessary reconstruction, required materials ordered and repairs scheduled as soon as receding waters permit. Detailed records of all materials, man-hours, and equipment used will not only be entered in the Towns asset management software, but also turned in to the Public Services Office Manager for possible post-storm reimbursement from FEMA, or the state.

1.18. Maintenance Map Documents

- 1) Records of all performed maintenance work activities shall be reflected on the Town Infrastructure maps. This information may be depicted in a GIS format, asset management software package, or o electronic (PDF format) form. At a minimum, the information will indicate the location and type of maintenance work performed. This information will be updated and posted annually and published on the Town website. Maps are located at www.nagsheadnc.gov/264/Drainage-and-Elevation-Maps

1.19. Citizen Complaint Documentation

Complaints received by received by citizens shall be recorded with the following information:

- a) Staff contact
- b) Name of complainant
- c) Complainant contact information
- d) Location of concern (address)
- e) Date of Complaint
- f) Date of Response
- g) Action taken
- h) Comments (as required)

Information regarding a citizen complaint shall be documented and input into the Towns asset management software. The complaint documentation shall be maintained and utilized for planning purposes and the development of future drainage infrastructure improvements and repair work.

1.20. Town Drainage Infrastructure Maps

Drainage runoff is primarily conveyed via a network of ditches, pipes and canals to (17) points of discharge to the adjoining surface waters, (see map below).



Five of the seventeen discharge points are connected to the Atlantic Ocean with the remaining twelve connected to Roanoke Sound. Notably, outfall pipes to the ocean belong to the North Carolina Department of Transportation for the purpose of draining NCDOT rights-of-way and not for the purpose of draining the entire Town as some may think. Installation of additional outfalls in the future is prohibited by current state laws as well as any discharges into the sound waters which are regulated by NCDEQ.

Drainage infrastructure inventory is accessible via GIS format and the Town's asset management software. Copies of the Town Drainage Infrastructure Maps are available on the Town website at Maps are located at www.nagsheadnc.gov/264/Drainage-and-Elevation-Maps

SECTION 2.0 – STORMWATER PLANNING PROCESS

2.1 Overview

Town staff currently uses a structured approach to planning stormwater projects which effectively identifies, prioritizes and implements projects as funding allows.

Steps in the process include:

1. Identify projects
2. Rank projects according to established criteria
3. Generate prioritized list

2.2 Project Identification

Stormwater improvement project identification are currently identified by Town staff, and aided by information provided by historical data and information provided by residents, business owners, and others. Information about the potential projects is gathered, and brief descriptions of each are prepared.

2.3 Project Criteria

Project ranking is an important component of the process. After information about identified projects is compiled by Town staff, each project should be reviewed utilizing a consistent set of criteria in relation to other projects to determine their relative importance. The following criteria are recommended to develop a prioritized list for funding:

Flood frequency – How often does flooding occur?

- Frequent - Several times per year
- Occasional - Once every two to five years
- Infrequent - Once every five years or less

Flooding impact – What is the impact of the flooding on structures, infrastructure and residents?

- Minor – yard and nuisance roadway flooding
- Moderate- extended road and yard flooding
- Major – large area impacted with significant property damage and/or injury

Residences Impacted – The number of residents impacted

- Major – greater than fifteen residences
- Moderate – five to fifteen residences
- Minor – less than five residences

Condition – What is the condition of the system component?

- Poor/failing – needs immediate repair or frequent maintenance
- Fair condition – minor defects noted, occasional maintenance necessary

- Good condition – no defects noted or reactive maintenance required

Water quality – How does the project impact water quality?

- Neutral – no impact or marginal decrease in water quality
- Minimal – marginal (coincidental) water quality benefits
- Significant – significant measurable improvement in water quality

Maintenance – What impact does the project have on existing maintenance levels?

- Lower – same or less than existing maintenance needed
- Same – no change in maintenance needed
- Higher – greater than existing maintenance needed

Safety – Does the project improve safety?

- High – significant positive impact on safety
- Medium – positive impact on safety
- Low – no impact on safety improvement

Flood Source- What is the origin of the flooding?

- Rainfall – from rainfall events or elevated water table from wet weather periods
- Tidal – elevated groundwater conditions from oceanfront or soundside tidal influence
- Overwash – flooding resulting from ocean or sound overwash

Physical or Environmental Constraints- What constraints exist that impact solutions?

- High – Significant limitations imposed by existing physical and/or environmental constraints
- Medium– Moderate limitations imposed by existing physical and/or environmental constraints
- Low – Minimal limitations imposed by existing physical and/or environmental constraints

Budgetary Constraints- What are budgetary limitations for project implementation or maintenance?

- High – Significant cost impacts associated with design, construction and annual maintenance
- Medium– Moderate cost impacts associated with design, construction and annual maintenance
- Low – Minimal cost impacts associated with design, construction and annual maintenance

Location of Flooding- Where is the location of flooding?

- Town Right-of-Way – Significant cost impacts associated with design, construction and annual maintenance
- NCDOT Right-of-Way– Moderate cost impacts associated with design, construction and annual maintenance
- Private Property – Minimal cost impacts associated with design, construction and annual maintenance

These criteria and assigned numerical ratings are summarized in the Table Below

Description	Rating		
	<i>Frequent</i>	<i>Occasional</i>	<i>Infrequent</i>
Flood Frequency	6	4	2
Flooding Impact	6	4	2
System Condition	3	2	1
Water Quality	4	2	1
Maintenance	4	2	1
Residences Impacted	6	4	2
Safety	6	3	1
Flood Source	4	2	1
Constraints	6	4	2
Budgetary	6	4	2
Location	4	2	1

Other metrics that may be assigned and considered as a measure of a project's priority can be considered based upon the following criteria:

High Priority

- Mandated by regulations
- Increases existing service levels by 50% improvement in reduction of flood frequency and flood depth.
- Can be combined with other infrastructure project work and reduces project cost
- Reduces losses in revenue or provides for increased revenues
- Increases or prolongs system longevity

Medium

- Increases existing service levels up to 50 % improvement in reduction of flood frequency and flood depth
- Can be combined with other infrastructure project work and reduces project cost

- Results in increased efficiency or improved service delivery
- Increases or prolongs system longevity

Low

- Can be combined with other infrastructure project work and reduces project cost
- Maintains existing service levels
- Improves quality of life
- Increases or prolongs system longevity

Each project is evaluated based upon all or a portion of criteria noted above, assigned a score per category and notated in a project matrix. The individual project scores are added and ranked to determine the overall prioritization level.

2.4 Stormwater Account:

The Stormwater Management program enhances flood control and water quality through collection and transportation of stormwater through infrastructure and, where possible, implements treatment prior to discharging into receiving waters. The program prioritizes a balance between stormwater management issues while adhering to strict regulations.

The Stormwater account (625) which is part of the general fund is an account that is limited to fund stormwater management activities. It is appropriate to maintain sufficient reserves to accommodate routine fluctuations in revenues and expenses. The account contains three main categories of work, *operating expenses*, (i.e. utilities, fuel, equipment maintenance and repair, professional fees and department supplies), *contracted services* (i.e. professional services, contracted construction and repair work, equipment rental) and *debt service* (i.e. principal and interest payments and financed purchases of equipment and services).

Operating expenses typically average 4% of the overall annual account budget. A majority of the expenditures are applied to Contracted Services with the remaining budgeted funds attributed to Debt Service expenditures which vary depending on financing commitments of prior or current fiscal years.

It is prudent to protect the Town's multi-million dollar investment in stormwater assets. The Town therefore establishes a capital replacement reserve and funding strategy. These reserves should enable the Town to support future replacement needs without extraordinary rate increases, while recognizing the responsibility of existing customers to fund both current and future replacement needs on a regular basis. It is intended that all replacement projects that are to be funded on a pay-as-you-go basis. This requires that the Town carefully plan and schedule replacement projects so that the integrity of the stormwater capital reserve account is maintained.

The Town also recognizes that a significant portion of the existing infrastructure is in excess of 30-yr old and nearing the end of life-cycle. Pavement settlement, pavement cracking and sinkhole development are typically signs of compromised storm pipe and potential indicators of potential failure. Funds to handle emergency situations should be available when needed. A minimum allowance of 1% of the overall budgeted funds should be available for emergency repairs.

Should the emergency reserves fall below the target level, or should the target level be increased, additions to the reserve will be budgeted to reach and maintain that level within no more than two budget years.

2.5 State and Local Regulations:

Local, State and Federal regulations impact development and infrastructure activities. The following is a summary of applicable regulations:

a. NCDEQ Regulations

For development activities that result in excess of 1-acre land disturbance in the 20 coastal counties, the North Carolina Division of Environmental Quality, Division of Water Resources requires a state stormwater permit. The high-density stormwater permit type requires new development and redevelopment, where applicable, and draining to SA designated surface waters, to temporarily store and infiltrate runoff from the 1.5 in. +/- of rainfall runoff generated from the addition of impervious surfaces. The Roanoke Sound, which borders the western portion of the Town, is classified with the SA surface water designation which prohibits the creation of new points of discharge or increasing flows to exiting outfalls. The state regulations focus is on water quality control.

b. Town of Nags Head Regulations

Chapter 34 Stormwater, Fill, & Runoff Management of the Town of Nags Head Code of Ordinances, sets forth the requirements for stormwater management in the Town. Stormwater management is categorized in (3) main categories; Commercial Development, Residential Subdivision Development and Individual Lot level development.

- i. Commercial Development requires on-site stormwater management facilities designed to accommodate 4.3 inches of rainfall runoff generated from impervious surfaces. This is the local flood control requirement which approximates the 10-yr-2hr rainfall event.

- ii. Residential Subdivision Development requires on-site stormwater management facilities to manage the first 1.5 inches of rainfall generated from impervious surfaces.
- iii. Individual Lot level development requires on-site stormwater management facilities to manage or improve of up to a 1.5 inch rainfall depth equivalent.

c. NCDOT Regulations

As noted in Table 1 in the previous section, approximately 35% of the Town's drainage infrastructure is located within the North Carolina Department of Transportation's Right-of-Way. Although annual maintenance has been performed by this agency, limited funding has significantly reduced these activities. As a result, the Town of Nags Head has focused additional funds and resources to adequately design infrastructure, remove impediments, replace pipes, stabilize channels and outlets, and document record conditions in an effort to mitigate chronic flooding. It should be noted that NCDOT policies prohibit additional drainage connections to this system or the diversion of draining surface waters in a watershed.

2.6 Applicable Standards:

If not noted specifically hereon, when conducting planning, construction and maintenance activities, the following standards shall be enforced:

- *North Carolina Department of Transportation NC Roadway Drainage Maintenance Manual, October 1997, or current version.*
- *Town of Nags Head Standard Recommended Details, dated February 6, 2019, or current version.*
- *NCDEQ Erosion and Sediment Control Planning and Design Manual, revised May 2013, or current version.*
- *Town of Nags Head Code of Ordinances, Chapter 34 Stormwater, Fill and Runoff Management, current version.*
- *Town of Nags Head Code of Ordinances, Chapter 36 Streets, Sidewalks and other Public Places, current version.*
- *Occupational Safety and Health Administration Standards, 29 Code of Federal Regulations (CFR) Part 1926 construction, current version.*

Appendix A – Drainage Maintenance Zones

Town of Nags Head Infrastructure

Zone 1

Legend

- Zone1
- StormManholesZone1
- CulvertsZone1
- SWGravityMainZone1
- SWVirtualDrainlinesZone1
- StormInletsZone1
- StormCulvertsZone1

0 0.050.1 0.2 0.3 0.4 Miles



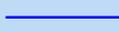
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community

Town of Nags Head Infrastructure

Zone 2

Atlantic Ocean

Legend

-  Zone2
-  SWCulvertsZone2
-  SWGravityMainZone2
-  SWVirtualDrainlinesZone2
-  SWPressureMainZone2
-  SWNetworkStructuresZone2
-  SWManholesZone2
-  SWWeirsZone2

0 0.1750.35 0.7 1.05 1.4 Miles

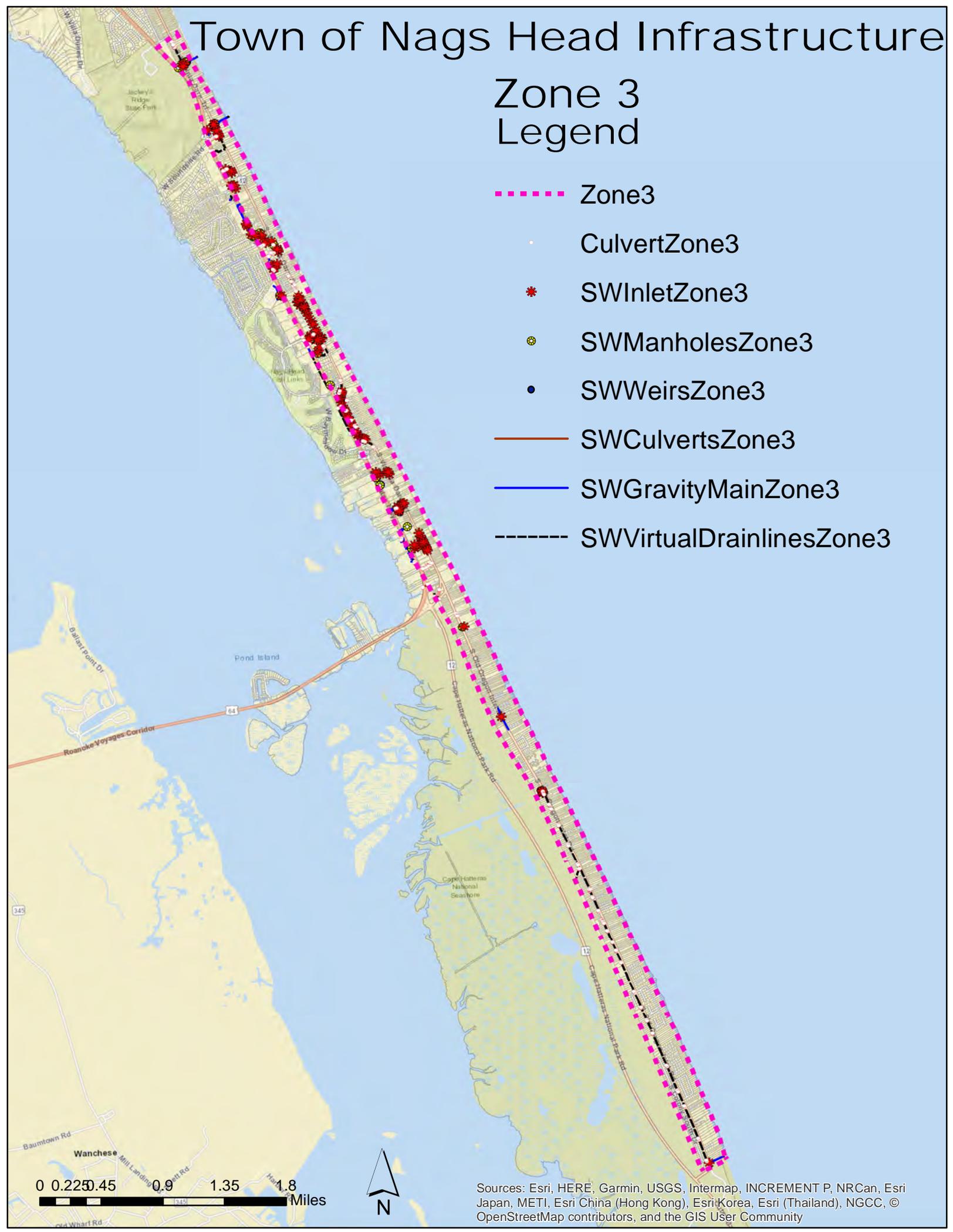


Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community

Town of Nags Head Infrastructure

Zone 3 Legend

- Zone3
- CulvertZone3
- SWInletZone3
- SWManholesZone3
- SWWeirsZone3
- SWCulvertsZone3
- SWGravityMainZone3
- SWVirtualDrainlinesZone3



Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community

Appendix B – Aquatic Weed Spray Program Areas

Red Drum Ditch
Length: 300 l.f.

S VIRGINIA DARE TRI - NC 12





Town Hall Ditch
Length: 250 L.F.

EPSTEIN DR

PHASE DR

CROATAN HWY - US 138

S. CROATAN HWY - US 138

Baymeadow Ditch
Length: 825 L.F.



Finch St. Ditch
Length: 880 L.F.



Glidden St Ditch
Length: 300 L.F.



Glidden St Ditch-2
Length: 200 L.F.



GLIDDEN ST

S CROATAN HWY - US 158



Whalebone Park Ditch
Length: 450 L.F.



S CROATAN HWY - US 158

S CROATAN HWY - US 158

GULFSTREAM WAY

S. Old Oregon Inlet Rd. Ditch
Length: 2.96 miles



In process of being updated

Appendix C- National Park Service Special Use Permit
