
OPERATIONS AND MAINTENANCE MANUAL STORMWATER MANAGEMENT FACILITIES

for

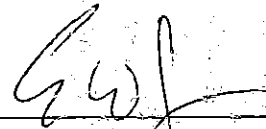
DRP GIBBSTOWN LOGISTIC CENTER-PHASE 1
Township of Greenwich, Gloucester County
New Jersey

Prepared For:

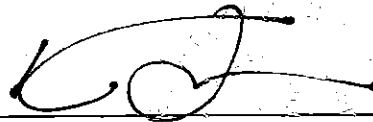
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LANGAN

29 April, 2016
130088802

TABLE OF CONTENTS

1.0 INTRODUCTION	1
1.1 Purpose of Manual	1
1.2 Introduction and Description of Facilities	1
1.3 Project Contacts	2
2.0 INSPECTION AND MAINTENANCE	2
2.1 Purpose of Inspections and Maintenance	2
2.2 Routine Inspection and Maintenance of the Stormwater Management Facilities	3
2.2.1 Preventative Maintenance Procedures	3
2.2.2 Corrective Maintenance	6
2.2.3 Aesthetic Maintenance Procedures	8
2.2.4 Summary of Maintenance Procedures	9
2.3 Maintenance Equipment and Materials	10
2.4 INSPECTION CHECKLISTS AND LOGS	11

LIST OF FIGURES

Figure 1 Site Location Map

LIST OF APPENDICES

Appendix A Stormwater Maintenance Facilities Inspection and Maintenance

- Maintenance Work Order and Checklist for Stormwater Management Facility
- Maintenance Log for Stormwater Management Facility
- Inspection Checklist for Stormwater Management Facility
- Inspection Log for Stormwater Management Facility
- Annual Infiltration Basin Maintenance Estimate
- Drawdown Calculations

1.0 INTRODUCTION

1.1 Purpose of Manual

The intent of this manual is to provide guidance and instruction for the proper operation and maintenance of the proposed stormwater management facilities as part of the project known as DRP Gibbstown Logistics Center-Phase 1. The facilities are proposed to manage the stormwater quantity and quality aspects of the runoff generated by the proposed development, with the goal of assuring the predevelopment peak discharge rate, volume, timing and pollutant load are not exceeded in the post developed condition. Failure to properly operate and maintain these facilities can result in serious adverse impacts in the form of aesthetic problems, increased pollutants in downstream waterways, downstream flooding and potentially hazardous conditions for residents and visitors.

This manual has been prepared using the NJDEP guidance documents entitled, "Stormwater Management Facilities Maintenance Manual" and "State of New Jersey Dam Safety Manual" and from a handbook entitled, Operation, Maintenance, & Management of Stormwater Management Systems as produced by the Watershed Management Institute. We fully acknowledge these documents as primary sources essential to producing this manual.

1.2 Introduction and Description of Facilities

The total site is part of Block 8, Lot 4 in the Township of Greenwich, Gloucester County, New Jersey, which is a portion of the former DuPont Repauno tract. The site is bounded on the north by undeveloped wooded areas, to the east by residential homes and an active day care facility, and to the south and west by 'A' Line Road.

The stormwater management for this project consists of a combination of two connected wet ponds that provide water quantity attenuation and water quality treatment. The ponds discharge into wetlands located northwest of the site. All peak flow reductions are in accordance with the NJDEP Stormwater Regulatory Rules. All stormwater management facilities shall be maintained and inspected by the Owner.

The wet ponds include side slopes of 3'H: 1'V, safety ledges, and an emergency spillway. Table 1 provides elevations and basin properties. Basin 1 is located in the middle of the site, and Basin 2 is located northwest of the warehouse.

Table 1 – Basin Elevations

Basin	N.W.S	Bottom EL	Safety Ledge 1	Safety Ledge 2	Emergency Spillway
Basin 1	3.00	-3.00	0.50	-	-
Basin 2	3.00	-1.00	0.50	4.00	6.90

In the event of a storm event greater than the 100-year storm, discharge from the basin will flow over the top of the emergency spillway and into existing wetlands.

1.3 Project Contacts

Municipal Engineer:

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Site Operator:

Delaware River Partners LLC
C/O Fortress Worldwide Transportation and
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1345 Avenue of the Americas, 46th Floor
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(305) 520-2382

2.0 INSPECTION AND MAINTENANCE

2.1 Purpose of Inspections and Maintenance

The stormwater management facilities provide storage of runoff during rain events. The wet ponds have been designed to provide water quality and to provide runoff storage to attenuate the 2-, 10- and 100-year storm runoff volumes. Without proper routine inspection and maintenance, the facilities may lose some or all of their capability to function to their full capacity. Lack of adequate maintenance at these facilities could lead to failure of the stormwater management system, as designed.

The consulting professional engineer should perform regularly scheduled maintenance inspections of the stormwater facilities at least twice each year. The primary purpose of these inspections is to ascertain the operational condition and safety of the facilities, particularly the condition of embankments, outlet control structures and other safety-related aspects. Inspections will also provide information on the effectiveness of regularly scheduled Preventative and Aesthetic Maintenance Procedures. They will help to identify where changes in the extent and scheduling of the procedures are warranted. Finally, the facility inspections should also be used to determine the need for and timing of Corrective Maintenance procedures.

Routine inspection and maintenance of these facilities should follow the recommendations discussed in Section 2.2 of this manual.

2.2 Routine Inspection and Maintenance of the Stormwater Management Facilities

Routine maintenance of these facilities should be separated into two basic types: Functional Maintenance and Aesthetic Maintenance. Functional Maintenance is further broken down into two categories: Preventative and Corrective. Aesthetic Maintenance, which is necessary to maintain the visual appeal and aesthetic quality of these facilities should be, incorporated on the same schedule as the preventative maintenance efforts. Listed below are the Preventative, Corrective and Aesthetic Maintenance Procedures to be performed on a routine basis.

2.2.1 Preventative Maintenance Procedures

The purpose of Preventative Maintenance is to insure that the stormwater management aspects of the basins remain operational and safe at all times, and to minimize the need for emergency or corrective maintenance. These procedures are as follows:

- a) Algae and Weed Growth
Excessive algae growth can cause severe oxygen depletion, causing the development of anaerobic conditions. These low oxygen conditions will eventually result in the emission of foul odors and other unpleasant side effects. Weeds associated with detention basins typically fall into three categories: submergent, floating and emergent. All three are typically found, to some extent, in a healthy pond system. However, excessive growth of any of these weeds can lead to problems. Submergent vegetation is the most difficult to detect, and can cause the most significant problems with any water level control features.

The basins should be evaluated regularly to determine whether excessive algae or plant growth is evident. Algae growth can often be attributed to the misuse of fertilizers on adjacent lands. A correction in the application of fertilizers can often solve these problems. Weeds that have become a problem can be cleared through harvesting by professional pond maintenance technicians.

- b) Maintenance of Adjacent Areas
Grass areas, trees, and shrubs adjacent to the basins require periodic fertilizing, de-thatching and soil conditioning in order to maintain healthy growth and to provide bank stabilization. The application of fertilizers should follow manufacturer's instructions to reduce run-off of these compounds into the basins. Additionally, provisions should be made to re-seed and re-establish grass cover in areas damaged by sediment

accumulation, stormwater flow or other causes. These tasks should be performed, or at least evaluated, on a quarterly basis.

c) Removal and Disposal of Trash and Debris

A regularly scheduled program of debris and trash removal will reduce the chance of outlet structures, trash racks, catch basins and other components becoming clogged and inoperable during storm events.

Additionally, removal of trash and debris will prevent possible damage to vegetated areas and eliminate potential mosquito breeding habitats. Debris and trash must be properly hauled off the site and transferred to an approved disposal site. These tasks should be performed on a quarterly basis and after any major storm event.

d) Sediment Removal and Disposal

The above- and below-ground facilities should be evaluated for excessive deposition of sediment. Accumulated sediment should be removed before it threatens the storage volume of the above ground facility or clogs the below ground facility. Sediment removal should take place when the facility is thoroughly dry. Consideration should be given to evacuating all standing water from the facility before desilting activities are performed. This may be accomplished by means of pumping the water out of the above or below ground facility. An appropriate stand-by pump should be available for this procedure. These tasks should be performed at the completion of construction and thereafter on a quarterly basis. In addition, the below ground facilities require these tasks to be performed after every storm even greater than 1" of rainfall. Disposal of sediment must comply with all local, county, state and federal regulations. Only suitable disposal sites should be utilized. If stable, soil conditions exist around the above ground facility area sediment deposition should not be a problem. Normal sediment removal should be approximately a ten (10) year cycle. Should a recurrent problem develop, the inspector should identify the upstream sources of sediment and recommend required stabilization measures.

e) Structural Components

All structural components must be inspected for cracking, subsidence, spalling, erosion, and deterioration at least annually.

Drain or Drawdown Duration

When necessary, the above- and below-ground facilities shall be drained by a mechanical pump capable of discharging:

- 763 gallons per minute (1.70 cfs) for Basin 1 and 2.

Pumping rates determined by meeting a 40-hour system drain time requirement.

The submersible pump along with a portable generator will be transported to the emergency spillway via pick-up truck equipped with an electric winch. The pump will be lowered by electric winch to the pond bottom. The discharge hose will be placed into the outlet structure. The pump discharge rate is far less than the normal operating discharge rate of the outlet structure so that downstream erosion will not be an issue. No additional permits will be required to discharge at this location.

The submersible pumps required for the underground detention system will be small and will therefore be readily available for use in emergencies. The submersible pump along with a portable generator will be transported to an inspection port above the underground recharge facility via pick-up truck equipped with an electric winch. The pump will be lowered by electric winch to the pond bottom. The discharge hose will be placed in the outlet structure.

- f) Elimination of Mosquito Breeding Habitats
The most effective mosquito control program is one that eliminates potential breeding habitats. Almost any stagnant pool of water can be attractive to mosquitoes, and become the source of a large mosquito population. A maintenance program dedicated to eliminating potential breeding areas is certainly preferable to chemical means of controlling mosquitoes. The most important maintenance function is removal of all obstructions to natural flow patterns before stagnant water conditions can develop.
- g) Inspection
Regularly scheduled maintenance inspections of the above ground facility should be performed by the consulting professional engineer at least once a year. These inspections are separate from the "Routine" inspections discussed above. The primary purpose of these inspections is to ascertain the operational condition and safety of the facility, particularly the condition of embankments and other safety-related aspects. Inspections will also provide information on the effectiveness of regularly scheduled Preventative and Aesthetic Maintenance Procedures, and will help to identify where changes in the extent and scheduling of the procedures are warranted. Finally, the facility inspections should also be used to determine the need for and timing of Corrective Maintenance procedures. It should be noted that, in addition to regularly scheduled inspections, the owners of the dam or their representatives should perform an informal inspection during every visit to the basin.
- h) Reporting

The recording of all maintenance work and inspections provide valuable data on the facility condition. Review of this information will also help to establish more efficient and beneficial maintenance procedures and practices. All recorded information should be directed to the owners of the dam for review and subsequent follow-up on recommendations. Data obtained from informal inspections should be retained; however, this data does not have to be submitted to NJDEP.

2.2.2 Corrective Maintenance

a) Removal of Debris and Sediment

Sediment, debris and trash that threaten the discharge capacity of the basins should be removed immediately and properly disposed. As noted previously, it is recommended that all water be evacuated from the basins before any significant amount of sediment, settled debris or trash is removed from the basins. The lack of an available disposal site should not delay the removal of trash, debris and sediment.

Temporary disposal sites should be utilized if necessary.

b) Structural Repairs

Structural damage to outlet and inlet structures, trash racks and headwalls because of vandalism, flood events or other causes must be repaired promptly. The urgency of the repairs will depend upon the nature of the damage and its effects on the safety and operation of the facility. The analysis of structural damage and the design and performance of structural repairs should only be undertaken by the consulting professional engineer.

c) Embankment and Slope Repairs

Damage to embankments and side slopes must be repaired promptly. This damage can be the result of rain or flood events, vandalism, animals, vehicles or neglect. Typical problems include settlement, scouring, cracking, sloughing, seepage and rutting. The urgency of the repairs will depend upon the nature of the damage and its effect on the safety and operation of the facility. The analysis of damage and the design and performance of geotechnical repairs should only be undertaken by qualified personnel at the direction of the consulting professional engineer.

d) Weed Harvesting

It may be necessary to remove congested weeds from the basin. Companies with specialized harvesters should be contacted to perform these operations. Note that such work may require the approval of various regulatory agencies.

e) Extermination of Mosquitoes

If neglected, a detention basin can readily become an ideal mosquito breeding area. The extermination of mosquitoes will usually require the services of the County Mosquito Commission. If mosquito control in the facility becomes necessary, the preventative maintenance program should be re-evaluated, and more emphasis should be placed on control of mosquito breeding habitats.

f) Erosion Repair

Vegetative cover or other protective measures are necessary to prevent the loss of soil due to the forces of wind and water. Where a re-seeding program has not been effective in maintaining a non-erosive vegetative cover, or other factors have exposed soils to erosion, corrective steps should be initiated to prevent further loss of soil that may result in danger to the stability of the facility. Soil loss can be controlled by a variety of materials and methods, including rip-rap, gabion lining, sod, seeding, concrete lining and regrading. When establishing or restoring vegetation, biweekly inspections of vegetation health should be performed during the first growing season or until the vegetation is established. Once established, inspections of vegetation health, density and diversity should be performed at least twice annually during both the growing and non-growing season. If vegetation has greater than 50 percent damage, the area should be reestablished in accordance with the original specifications and the inspection requirements presented above. All use of fertilizers, mechanical treatments, pesticides and other means to assure optimum vegetation health must not compromise the intended purpose of the infiltration basin.

g) Elimination of Trees, Brush, Roots and Animal Burrows

The stability of basins can be impaired by large roots and animal burrows. Additionally, burrows can present a safety hazard for maintenance personnel. Trees and brush with extensive, woody root systems should be completely removed from dams to prevent destabilization and the creation of seepage routes. Roots should also be completely removed to prevent decomposition within the dam. Root voids and burrows should be filled with material similar to the existing material, and capped just below grade with stone, concrete or other material. If the filling of the burrows does not discourage the animals from returning, further measures should be taken to either remove the animal population or to make critical areas of the facility unattractive to them. All vegetated areas should be inspected at least annually for unwanted growth, which should be removed with minimum disruption to the remaining vegetation and basin subsoil.

h) Snow and Ice Removal

Accumulations of snow and ice can threaten the functioning of the inlets, outlets and emergency spillways. Provision of the equipment, material

and personnel to monitor and remove snow and ice from critical areas will assure the function of the facility during the winter months.

2.2.3 Aesthetic Maintenance Procedures

a) Graffiti Removal

The timely removal of graffiti will restore the aesthetic quality of the basins and the dams. Removal can be accomplished by paint or other cover, or removal with scrapers, solvents or cleansers. Timely removal is important to discourage further graffiti and other acts of vandalism.

b) Landscape Maintenance

The lawn areas around the basins shall be mowed on a regular basis as necessary to maintain the lawn at a height of 2" to 3". These areas shall also be fertilized twice a year, once in the spring and once in the fall. Fertilizer for lawn areas shall be 10-20-20 applied at a rate of 14 lbs. per 1,000 s.f. or as determined by a soil test. Any bare, dead or damaged lawn areas shall be reseeded in accordance with the original procedures as outlined in the Soil Erosion and Sediment Control Plans using the same mix and seeding rates. Stabilization of bare or damaged areas shall be done in a timely fashion so as to avoid exposing the soil to erosion.

If season prevents the re-establishment of turf cover, exposed areas should be stabilized with straw or salt hay mulch as described in the Soil Erosion and Sediment Control Plans until permanent seeding can be done. Seeding can be done between May 1st and August 15th, only if adequate water is provided.

The shrubs around the basins should also be maintained in order to promote a neat appearance and healthy, vigorous growth. All shrubs should be allowed to grow together in masses as shown on the plans and not pruned into individual plants. The planting beds should be mulched with hardwood mulch every two (2) years in order to provide a suitable growing medium for the shrubbery and to retain moisture around the root zones.

Pruning of shrubs should also be done on a regular basis to maintain the shape and appearance of the shrub masses. The height of the shrubs may vary according to the plants natural growth habits, but should not exceed 6 feet. Pruning should be done as necessary throughout the year to remove dead branches and to control new growth. Any pruning, other than the removal of dead branches, should be done in either late winter/early spring or after the shrub has flowered in the spring.

In the event that a shrub should experience more than 2/3 die back, it should be replaced in kind as soon as possible in either the spring or fall planting season. The replacement shrub should be the same species as

the original and installed at the size and condition as specified on the original landscape plans. If, for any reason, a substitution of species or size must be made, it shall be subject to the approval of the project Landscape Architect.

The trees surrounding the basin areas shall be maintained regularly to ensure good health and exhibit an attractive appearance. Their maintenance should include fertilization twice annually, with one application in the spring and another in early fall. The trees shall be pruned in the late winter or early spring. However, dead branches should be removed as soon as they are noticed. Care should be taken to avoid cutting off the central leader of a tree if one is present.

If a tree is severely damaged or experiences more than 2/3 die back, it should be replaced in either the spring or fall planting season, whichever comes first. The only exception to this is if the replacement tree has a fall transplanting hazard. In this case, it should be replanted in the spring. Replacement trees should be planted at the same size and condition as specified on the landscape plans. If it is necessary to make a substitution of species or size, it shall be subject to the approval of the project Landscape Architect.

c) Control of Weeds

Although a regular grass maintenance program will minimize weed intrusion, some weeds will appear. Periodic weeding, either chemically or mechanically, will help to maintain a healthy turf, and keep grassed areas looking attractive. Application of chemicals should be monitored closely so as not to affect the ecosystems within the detention basin. Excessive growth of weeds within the basin can be controlled mechanically as discussed in the previous section.

The recording of all maintenance work and inspections provide valuable data on the facility's condition. Review of this information will also help to establish more efficient and beneficial maintenance procedures and practices. All recorded information should be directed to the owners of the dam for review and subsequent follow-up on recommendations. Data obtained from informal inspections should be retained; however, this data does not have to be submitted to NJDEP.

2.2.4 Summary of Maintenance Procedures

PREVENTATIVE MAINTENANCE

- a) Algae and Weed Growth
- b) Grass and Vegetative Cover Maintenance
- c) Removal and Disposal of Trash and Debris
- d) Sediment Removal and Disposal
- e) Structural Components

- f) Elimination of Mosquito Breeding Habitats
- g) Inspection
- h) Reporting
- i) Underground Facilities Inspection Procedures
- j) Manufactured Treatment Device Maintenance

CORRECTIVE MAINTENANCE

- a) Removal of Debris and Sediment
- b) Structural Repairs
- c) Embankment and Slope Repairs
- d) Weed Harvesting
- e) Extermination of Mosquitoes
- f) Erosion Repair
- g) Elimination of Trees, Brush, Roots and Animal Burrows from the Dam Structure.
- h) Snow and Ice Removal

AESTHETIC MAINTENANCE

- a) Graffiti Removal
- b) Landscape Maintenance
- c) Control of Weeds

2.3 Maintenance Equipment and Materials

GRASS MAINTENANCE EQUIPMENT

- a) Riding Mowers
- b) Hand Mowers
- c) Gas Powered Trimmers
- d) Gas Powered Edgers
- e) Seed Spreaders
- f) Fertilizer Spreaders
- g) De-thatching Equipment
- h) Pesticide and Herbicide Application Equipment
- i) Grass Clipping and Leaf Collection Equipment

VEGETATIVE MAINTENANCE EQUIPMENT

- a) Saws
- b) Pruning Shears
- c) Hedge Trimmers
- d) Wood Chippers

TRANSPORTATION EQUIPMENT

- a) Trucks for Transportation of Materials
- b) Trucks for Transportation of Equipment
- c) Vehicles for Transportation of Personnel

DEBRIS, TRASH AND SEDIMENT REMOVAL EQUIPMENT

- a) Loader
- b) Backhoe
- c) Grader
- d) Dredging Equipment
- e) Portable Pump for Dewatering

MISCELLANEOUS EQUIPMENT

- a) Shovels
- b) Rakes
- c) Picks
- d) Wheel Barrows
- e) Painting Equipment
- e) Gloves
- f) Standard Mechanics Tools
- g) Tools for Maintenance of Equipment

MATERIALS

- a) Topsoil
- b) Fill
- c) Seed
- d) Soil Amenities (Fertilizer, Lime, etc.)
- e) Chemicals (Pesticides, Herbicides etc.)
- f) Mulch
- g) Paint Removers
- h) Spare Parts for Equipment

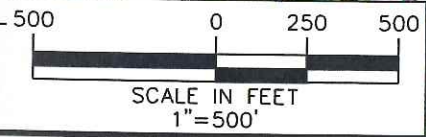
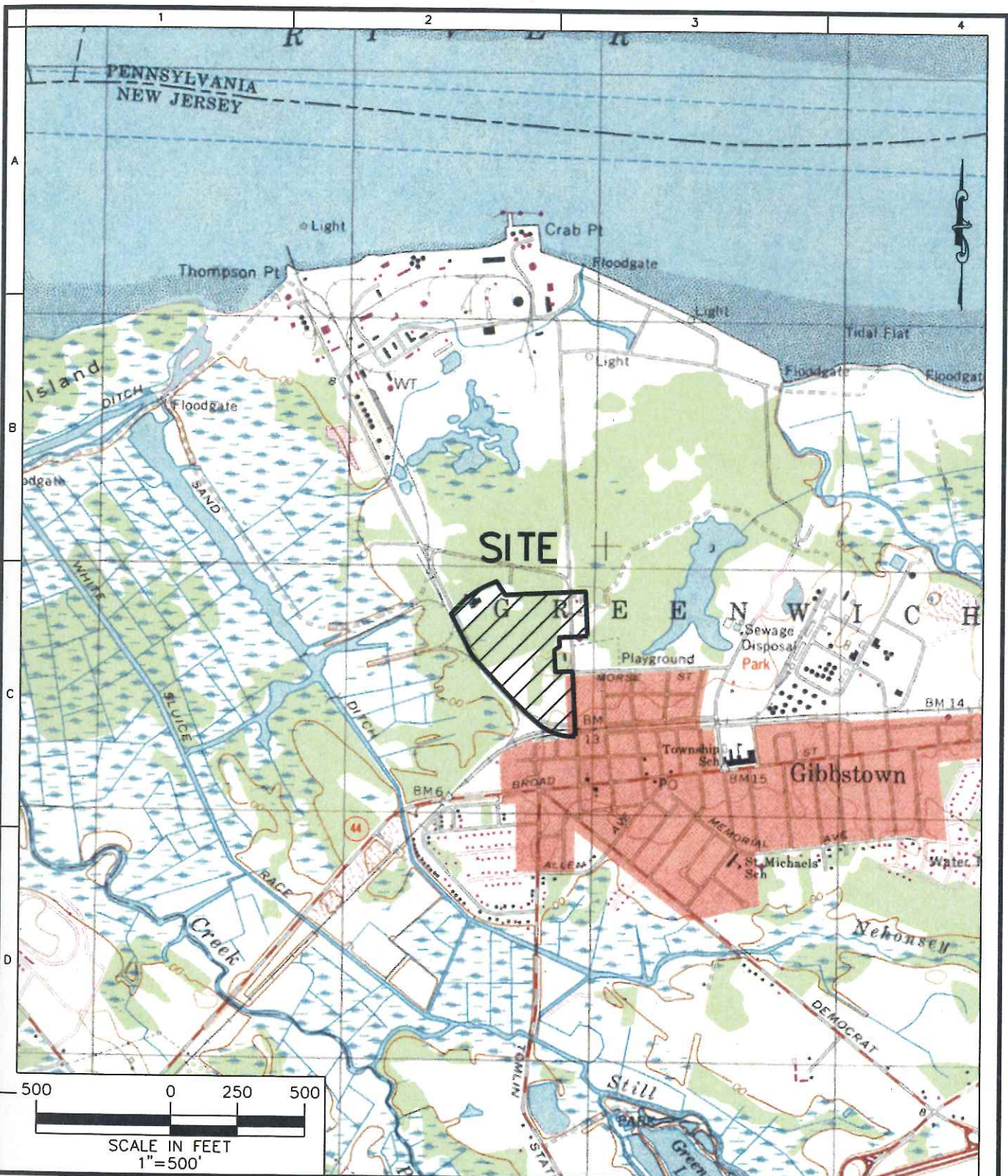
2.4 INSPECTION CHECKLISTS AND LOGS

Appendix A of this report contains sample Checklists and Logs regarding various aspects of the basin maintenance and inspection. They include:

- MAINTENANCE WORK ORDER AND CHECKLIST is a comprehensive form for recording both required and completed maintenance work.
- MAINTENANCE LOG provides a summary table for recording of all maintenance work at the site.
- INSPECTION CHECKLIST provides a comprehensive checklist of inspection items for use by the inspectors.
- INSPECTION LOG provides a summary table for recording the results of all inspections of the basin.

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Figure 1
USGS Site Location Plan



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 Langan CT, Inc.
 Langan International LLC
 Collectively known as Langan
 NJ CERTIFICATE OF AUTHORIZATION No. 24GA27996400

Project
FLAGLER REPAUNO
 BLOCK No. 08, LOT No.04
 TOWNSHIP OF GREENWICH
 GLOUCESTER COUNTY NEW JERSEY

Drawing Title
**SITE LOCATION
 MAP**

Project No.
 130088802
 Date
 11/02/15
 Scale
 1" = 500'
 Drawn By
 AMS
 Checked By
 EFW
 Submission Date

Drawing No.
CS701
 Sheet 1 of 1

APPENDIX A

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Appendix A
STORMWATER MAINTENANCE FACILITIES
INSPECTION AND MAINTENANCE

MAINTENANCE WORK ORDER AND CHECKLIST FOR STORMWATER MANAGEMENT FACILITIES

MAINTENANCE LOG FOR STORMWATER MANAGEMENT FACILITIES

INSPECTION CHECKLISTS FOR STORMWATER MANAGEMENT FACILITIES

INSPECTION LOG FOR STORMWATER MANAGEMENT FACILITIES

ESTIMATE OF ANNUAL COSTS FOR INSPECTION AND MAINTENANCE

DRAWDOWN CALCULATIONS

C. Aesthetic Maintenance

Work Items

- 1. Graffiti Removal

--	--	--	--	--	--	--	--	--	--

- 2. Landscape Maintenance

--	--	--	--	--	--	--	--	--	--

- 3. Weeding

--	--	--	--	--	--	--	--	--	--

- 4. Other:

--	--	--	--	--	--	--	--	--	--

Remarks (Refer to Item No., If Applicable):

Inspection Checklist for Stormwater Management Facilities

Name of Facility: _____ Date: _____
 Location: _____ Weather: _____

Facility Item	O.K. ¹	Routine ²	Urgent ³	Comments ⁴
1. Embankments and Side Slopes				
A. Vegetation				
B. Linings				
C. Erosion				
D. Settlement				
E. Sloughing				
F. Trash and Debris				
G. Seepage				
H. Aesthetics				
I. Other:				

2. Bottoms (Detention & Infiltration)				
A. Vegetation				
B. Erosion				
C. Standing Water				
D. Settlement				
E. Trash and Debris				
F. Sediment				
G. Aesthetics				
H. Other:				

3. Low Flow Channels (Detention)				
A. Vegetation				
B. Linings				
C. Erosion				
D. Settlement				
E. Standing Water				
F. Trash and Debris				
G. Sediment				
H. Other:				

Facility Item O.K.¹ Routine² Urgent³ Comments⁴

4. Ponds (Retention)

A. Vegetation				
B. Shoreline Erosion				
C. Aeration Equipment				
D. Trash & Debris				
E. Sediment				
F. Water Quality				
G. Other				

5. Inlet Structure

A. Condition of Structure				
B. Erosion				
C. Trash & Debris				
D. Sediment				
E. Aesthetics				
F. Other:				

6. Outlet Structure (Detention & Retention)

A. Condition of Structure				
B. Erosion				
C. Trash & Debris				
D. Sediment				
E. Mechanical Components				
F. Aesthetics				
G. Other:				

7. Emergency Spillway

A. Vegetation				
B. Lining				
C. Erosion				
D. Trash & Debris				
E. Other:				

8. Perimeter

A. Vegetation				
B. Erosion				
C. Trash & Debris				
D. Fences & Gates				
E. Aesthetics				
F. Other:				

9. Access Roads

A. Vegetation				
B. Road Surface				
C. Fence & Gates				
D. Erosion				
E. Aesthetics				

Facility Item O.K.¹ Routine² Urgent³ Comments⁴

10. Miscellaneous

A. Effectiveness of Exist. Maint. Program				
B. Dam Inspections				
C. Potential Mosquito Habitats				
D. Mosquitoes				
E.				
F.				
G.				

¹The item checked is in good condition, and the maintenance program is adequate.

²The item checked requires attention, but does not present an immediate threat in the facility function or other facility components.

³The item checked requires immediate attention to keep the facility operational or to prevent damage to other facility components.

⁴Provide explanation and details if columns 2 or 3 are checked.

Remarks(Refer to Item No., If Applicable):

Inspector: _____

10. Miscellaneous

A. Effectiveness of Exist. Maint. Program														
B. Dam Inspections														
C. Potential Mosquito Habitats														
D. Mosquitoes														
E.														
F.														
G.														

- 1 The item checked is in good condition, and the maintenance program is adequate.
- 2 The item checked requires attention, but does not present an immediate threat to the facility function or other facility components
- 3 The item checked requires immediate attention to keep the facility operational to prevent damage to other facility components

Remarks (Refer to Item No., If Applicable):

ENGINEER'S ESTIMATE

PROJECT NAME: DRP Gibbstown Logistics Center
MUNICIPALITY: Greenwich, New Jersey
PREPARED BY: AMS

DATE: 04/14/16
PROJECT NO. 130088802
REVIEWED BY: EFW

**ANNUAL WET PONDS
 MAINTENANCE GUARANTEE ESTIMATE**

ITEM NO	DESCRIPTION	APPROX.		UNIT PRICE	TOTAL
		QTY	UNIT		
1	Inspection of Wet Pond (Quarterly)	4	EA.	\$1,000.00	\$4,000.00
2	Mow Grass (12 per Yr.)	12	EA.	\$500.00	\$6,000.00
3	Vegetation Health Inspection (1 per Yr.)	1	EA.	\$250.00	\$250.00
4	Inspection of Structural Components (4 per Yr.)	4	EA.	\$300.00	\$1,200.00
5	General Trash and Debris Removal (12 per Yr.)	12	EA.	\$150.00	\$1,800.00
6	Embankment and Slope Maintenance (2 per Yr.)	2	EA.	\$400.00	\$800.00
Estimated Construction Cost					\$14,050.00
% Project Contingency Cost					\$0.00
Total Project Cost					\$14,050.00

Remarks:

**TWENTY YEAR WET POND
 MAINTENANCE GUARANTEE ESTIMATE**

ITEM NO	DESCRIPTION	APPROX.		UNIT PRICE	TOTAL
		QTY	UNIT		
1	Inspection of Wet Pond (Quarterly)	80	EA.	\$1,000.00	\$80,000.00
2	Mow Grass (12 per Yr.)	240	EA.	\$500.00	\$120,000.00
3	Vegetation Health Inspection (1 per Yr.)	20	EA.	\$250.00	\$5,000.00
4	Inspection of Structural Components (4 per Yr.)	80	EA.	\$300.00	\$24,000.00
5	Sediment Removal (at 10 year intervals)	2	EA.	\$10,000.00	\$20,000.00
6	General Trash and Debris Removal (12 per Yr.)	240	EA.	\$150.00	\$36,000.00
7	Embankment and Slope Maintenance (2 per Yr.)	40	EA.	\$400.00	\$16,000.00
Estimated Construction Cost					\$301,000.00
% Project Contingency Cost					\$0.00
Total Project Cost					\$301,000.00

Remarks:

Drawdown Calculations

Basin 1 and 2

NWS: 3.00 (ft)

Volume: 5.62 (ac-ft)

= 1,831,284 (gal)

The regulations require the pond be drained within 40 hours (2400 min).

Required pump rate =

$$\frac{1,831,284}{2,400} \leq 763.04 \text{ gallons per minute}$$