Fishers Island Garbage and Refuse District

Fishers Island, New York

Post-Closure Monitoring and Maintenance Manual

Fishers Island Landfill

Fishers Island, New York

September 2003

DVIRKA AND BARTILUCCI
CONSULTING ENGINEERS
A DIVISION OF WILLIAM F. COSULICH ASSOCIATES, P.C.

RLA/JOBS/FISHERIS1468(09/07/03)

- D R A F T -

POST-CLOSURE
MONITORING AND MAINTENANCE MANUAL

FISHERS ISLAND LANDFILL
FISHERS ISLAND, NEW YORK

Prepared For

FISHERS ISLAND GARBAGE AND REFUSE DISTRICT

By

DVIRKA AND BARTILUCCI CONSULTING ENGINEERS
WOODBURY, NEW YORK

AUGUST 2003

FISHERS ISLAND LANDFILL

POST-CLOSURE
MONITORING AND MAINTENANCE MANUAL

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

List of Appendices

List of Figures

List of Tables

Section 1

1.0 INTRODUCTION

In accordance with Title 6 New York Codes, Rules and Regulations (6 NYCRR) Part 360, this Monitoring and Maintenance Manual has been prepared to provide 30-year post closure care and monitoring following the closure of the Fishers Island Landfill, Fishers Island, New York.

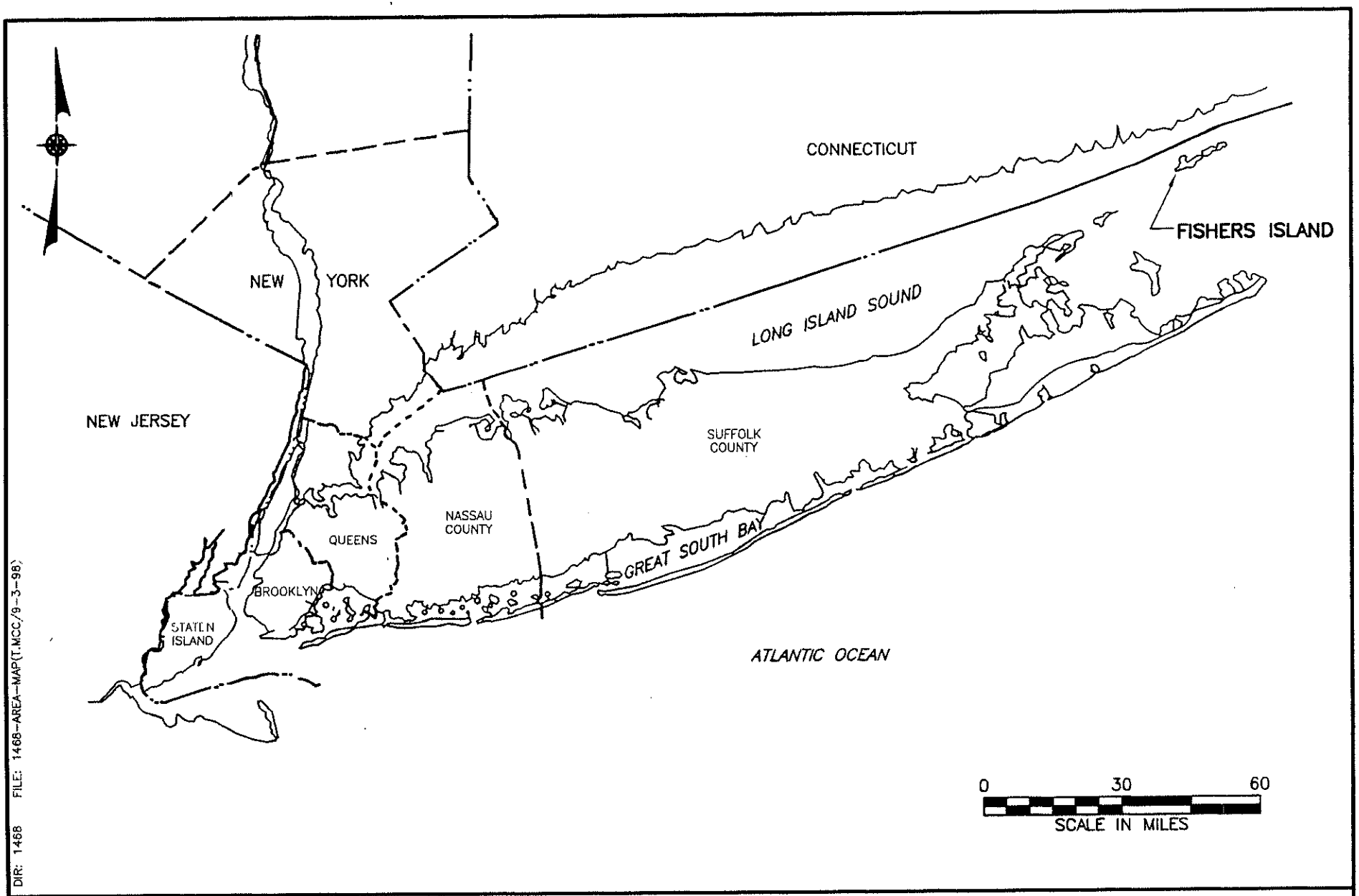
1.1 Site Description and History

The Fishers Island Landfill is an inactive municipal landfill located between Oriental Avenue and Ferry Road on Fishers Island, Suffolk County, New York (see Figure 1-1).

The landfill property is approximately 10 acres, of which approximately 6 acres have been used for landfilling. Based on available information, the landfill was in operation from the early 1950s until 1991, when it was closed. The main portion of the landfill is an upland area that was trenched and landfilled with municipal solid waste. A low-lying spread and cover waste fill area also existed and was located in the eastern portion of the landfill adjacent to a wetlands area. The waste mass in the upland area of the landfill comprises an average thickness of approximately 6 to 7 feet with a maximum thickness of about 18 feet and had an average soil cover thickness of 1 to 2 feet prior to closure. The thickness of waste in the spread and cover area varies from a few feet up to 8 feet. To the east of the landfill area, the waste grades into the adjacent wetlands.

1.2 Landfill Closure Design

The current contour elevations and drainage characteristics of the closed Fishers Island Landfill (see Figure 1-2) reflect the intent of the New York State Department of Environmental Conservation (NYSDEC) - approved Final Closure Plan design and the results of construction activities for closure/capping of the landfill.



DIR: 1468 FILE: 1468-AREA-MAP(T.MCC/9-3-98)

FISHERS ISLAND LANDFILL
SUFFOLK COUNTY, NEW YORK

FISHERS ISLAND LOCATION MAP

Dvirka and Bartilucci
Consulting Engineers
A Division of William F. Cosulich Associates, P.C.

FIGURE 1-1

Figure 1-2

(As-built to be included upon completion)

The final cover for the Fishers Island Landfill was designed to: (1) support vegetation; (2) protect the hydraulic barrier layer (i.e., the geomembrane) from physical damage; (3) restrict precipitation from infiltrating the landfill waste mass; and (4) provide passive venting of the landfill gases. The installed capping system consists of the following, from the surface downward:

- Topsoil Layer: A 6-inch surface layer of uncompacted soil capable of supporting vegetation;
- Barrier Protection Layer: A 12-inch layer of clean fill;
- Geomembrane Cap: A high-density textured 60-mil flexible polyethylene (HDPE) geosynthetic liner;
- Gas Venting Layer: A 6-inch layer of sand with a minimum coefficient of permeability of 1×10^{-3} cm/sec. Passive gas vents are placed within the sand to collect gas from this layer and vent the gases to the atmosphere; and
- Prepared Subgrade: The prepared subgrade surface serves as the graded and compacted surface upon which the veneered layers of the capping system are sequentially constructed. The prepared subgrade surface was achieved through a combination of activities which included: excavation of waste in areas of cut, relandfilling of excavated waste in areas of fill, in particular, from the spread and cover area, and placement of contour grading material (general fill) to achieve the subgrade contours. The subgrade was completed within a 6-inch layer of soil. A geotextile was used between the final subgrade layer and gas venting layer to maintain the gas venting layer.

The above-described capping system was constructed over the entire landfill waste mass.

1.3 Purpose and Scope

The purpose of the Fishers Island Landfill Post-Closure Monitoring and Maintenance Manual is to define the procedures for personnel performing routine inspection, maintenance or repair work on the landfill following its closure. The Manual is based upon the site remaining in an as-built and fully passive state. Any change in use requires the Fishers Island Garbage and Refuse District (FIGRD) and NYSDEC approval and revision, update and/or modification of this

Manual. This Manual has been prepared in accordance with 6 NYCRR Part 360 requirements effective November 24, 1999. The Manual is intended to ensure the following:

- Site is maintained effectively and efficiently;
- Site is monitored for the prescribed parameters;
- All parties are aware of the specific monitoring and maintenance needs of the site; and
- Provide a smooth transition of the site from the closure construction phase to the post-closure monitoring and maintenance phase.

The guidelines and procedures presented in this Manual are based on site-specific information, including:

- Site visits
- Fishers Island Landfill General Construction Contract (Contract No. 2001)
- Fishers Island Landfill Final Closure Plan
- As-built construction conditions

The Post-Closure Monitoring and Maintenance Manual includes the following information:

- Site Inspection Guidelines
- Maintenance and Repair Procedures
- Groundwater Monitoring Plan
- Personnel and Equipment Requirements
- Contingency Plan
- Post-closure Cost Estimate

- Communication Procedures
- Record Keeping and Reporting

Section 2

2.0 SITE INSPECTION GUIDELINES

Following closure of the Fishers Island Landfill, the site will be monitored in accordance with 6 NYCRR Part 360-2.15 criteria. The monitoring process requires the inspection of the site at least four times a year by qualified, trained landfill personnel. In addition, inspections will also be performed after a specified rainfall event (5-year storm or greater as required by NYCRR Part 360). The results of these inspections will be recorded on the Post-Closure Site Inspection Checklist, a copy of which is provided in Appendix A. The location and extent of any damage discovered during an inspection will be noted on the inspection checklist form, along with any necessary additional information. Any irregularities found during these site inspections will be remediated according to the guidelines provided in Section 3 of this Manual. A copy of all the inspection reports will be maintained on file in the offices of the Fishers Island Garbage and Refuse District (FIGRD) and included in the facility's annual report.

2.1 Cap Integrity

During closure construction, a minimum of 18 inches of soil cover was placed over the geomembrane. The cap must be inspected to assure its continued integrity.

2.1.1 Soil Cover

The soil cover will be visually inspected for signs of erosion damage, settlement, cracking, vectors, leachate or waste breakthrough, vandalism, litter and unauthorized dumping. Erosion, settlement or cracking of the cover soil will be considered damaging, based upon whether the function of the final cover had been impaired in the affected area, e.g., ponded storm water. The minimum final cover thickness must be maintained at 18 inches.

The FIGRD will perform visual observation to determine if settlement has occurred. The following will be noted on inspection logs:

- Visible debris or litter (housekeeping);

- Visible waste (indication of damage to the cap);
- Signs of unauthorized dumping or vandalism, such as vehicular tracks or disturbed cover soil; and
- Evidence of surface leachate (indication of damage to the cap).

2.1.2 Vegetation

The soil cover was vegetated during the cap construction according to the seeding specifications approved through the submittal process. Inspections of the vegetation will be performed to monitor the vegetative growth and identify problem areas which require reseeding. The vegetative cover will be inspected for bare spots, dead species and undesirable species. Bare or dead areas of vegetation will be further examined for the possibility of landfill gas, erosion or vector damage. The apparent cause of any damage will be noted in the inspection report.

2.2 Storm Water Collection and Conveyance System

The storm water control system for the Fishers Island Landfill closure construction consists of open drainage swales and a culvert, which convey collected storm water runoff on the eastern portion of the landfill to the wetlands and in the western portion of the landfill to a retention pond and wetlands (see Figure 1-2).

The drainage swales and a culvert will be monitored for wear, damage or blockage and the results of these inspections will be reported in the inspection logs. Any necessary repairs will be performed in according to the guidelines provided in Section 3 of this Manual.

All of the storm water collection and conveyance structures will be visually inspected for obstructions, siltation, ponded water and erosion damage, such as washouts. The location of any obstruction or damage and its cause, if known, will be noted in the inspection logs. Drainage swales will also be inspected for loss of vegetation, collection of debris or damage to the erosion control fabric.

The drainage swales consist of stone fill. Erosion of soil beneath or around the swales or signs of slippage of the stone, will be noted on the inspection logs.

Open drainage swales were constructed to convey storm water runoff from around the landfill to the wetlands/retention pond. The eastern boundary of the landfill is bordered by a 5-foot wide row of stone to reduce siltation of the wetlands. The southeastern portion of the landfill is bordered by a stone swale and energy dissipater also designed to minimize siltation of the wetlands on the east side of the landfill. Storm water from the southwestern portion of the landfill is directed in an open drainage swale, under the access/maintenance road via a culvert and into a retention pond prior to discharge to the wetlands west of the landfill. Storm water from the northeastern portion of the landfill is directed to a grassy swale and energy dissipater before discharging to the wetlands on the east. The northwestern portion of the landfill is bordered by a stone swale which discharges to the wetlands on the western side of the landfill. The drainage swales and culvert will be examined on a regular basis for signs of debris, erosion and/or sediment buildup, and noted in the inspection logs.

On occasion, storm water control structures may become damaged and diminished in function by intense rainfall events or by alternating freeze-thaw cycles. Stone fill is particularly susceptible to movement by erosion and undermining. Care should be taken to inspect the swales after intense rainfall events. If erosion or undermining is observed, the FIGRD should notify NYSDEC immediately and corrective action should be taken.

Eroded vegetated areas will be promptly filled with imported soil fill, compacted and seeded. Eroded or undermined armored channels will have the subgrade material repaired with material equivalent to the original construction. Any sediment buildup will also be promptly removed with hand tools and will be spread over existing grassed sideslopes.

2.3 Access/Maintenance Road

The access/maintenance road for the Fishers Island Landfill consists of one main road off Wilderness Road and west of the landfill cap. The road is constructed of a recycled concrete

aggregate having a minimum thickness of 6 inches (Figure 1-2). The maintenance road over the cap is constructed of a minimum of 12 inches overlying geotextile. Visual inspections of the road will be conducted for potholes, erosion gullies, loss of aggregate cover and obstructions. The results of these inspections will be noted on the inspection logs and repairs made, if required.

2.4 Landfill Gas Vents

A passive venting system was installed on the landfill to allow venting of landfill gases through the geomembrane. During the post-closure monitoring period, these vents will be inspected for damage, such as excessive settlement which causes stress on the geomembrane or signs of vandalism. The vents will also be inspected for signs of vector infestation. The inspection report will reflect any damage noticed during the inspection. The inspection report will include the details of any gas vent damage and the appropriate action that will be taken to correct the problem, as presented in Section 3 of this Manual.

2.5 Groundwater Monitoring Wells

Four groundwater monitoring wells, one upgradient well (NW-4) and three downgradient wells (NW-2, W-6 and NW-13) will be sampled to determine background/ambient groundwater quality and monitor the landfill's impact on groundwater quality.

Groundwater monitoring wells will be visually examined during each routine inspection and the functioning of each well will be checked during each quarterly sampling event. The details of the groundwater sampling program are presented in Section 4 of this Manual. If a monitoring well is damaged or cannot provide representative groundwater samples, the well will be evaluated to determine whether the problem can be corrected. This determination will be facilitated by comparing data from previous monitoring activities to determine the cause of the problem. In particular, the following signs of damages or deterioration will be examined:

- Encrustation and corrosion;

- An exceptional increase in solids content (e.g., from the breakdown of the screen);
- An appreciable decrease in groundwater elevation, perhaps the result of these problems.

The inspection report will include details of any well damage and the appropriate action that will be taken to correct the problem, as presented in Section 3 of this Manual. Damaged wells that cannot be rehabilitated will be decommissioned by appropriate methods (i.e., overdrilling, pulling of casing or grouting in place) and replaced by construction of a replacement groundwater monitoring well to re-establish the integrity of the groundwater monitoring program.

Section 3

3.0 MAINTENANCE AND REPAIR PROCEDURES

The need for maintenance or repair work will be governed by the observations made during the regular site inspections previously described in Section 2, and records of this work will be maintained in the permanent landfill files at the Fishers Island Garbage and Refuse District (FIGRD) office. This section describes the maintenance and repair procedures which will be followed during the post-closure inspection and monitoring period for the Fishers Island Landfill. The personnel and equipment requirements for this 30-year period are presented in Section 5 of this Manual.

3.1 Maintenance

Routine maintenance work will be performed, as necessary, during the 30-year post-closure monitoring period. Mowing, regrading of the cover soils, access/maintenance road repair, additional seeding, vector control and the removal of undesirable vegetation species are considered typical maintenance tasks and are discussed in this section.

3.1.1 Landfill Gas Control

Maintenance of the gas vents will occur during the post-closure period. The vents will be inspected and maintained on a regular basis.

3.1.2 Drainage and Erosion Control

Surface drainage features to control and convey storm water runoff have been designed for the 25-year, 24-hour storm. The drainage swales will be maintained with grassed and stone channels. Complete vegetative and stone coverage will be maintained and will be inspected at the same time the landfill cap is inspected. Areas of erosion will be noted and repaired as soon as possible to maintain the integrity of the cap and drainage system. Discharge areas will be

inspected for foreign debris and sediment which may interfere with its proper functioning, and for areas of erosion which may degrade the integrity of the cap and drainage system.

The culvert piping will be periodically inspected for debris, sedimentation and visual settlement of the culvert. Debris and sediment in the culvert will be periodically cleaned. The cleaning will consist of rodding or flushing of the pipeline with appropriate pipe cleaning devices and by hand.

3.1.3 Vegetative Cover

The vegetative (grass) cover will be mowed at the discretion of the FIGRD to control the growth of wild and deep-rooted species, and to minimize the potential for the introduction of vector habitats. The frequency of each mowing event will be determined by the site conditions. Undesirable species, such as saplings or other vegetation with penetrating roots discovered during inspections, will be removed if their presence poses a threat to the integrity of the cover system. Herbicides and insecticides will not be used to control undesirable plant and/or animal species unless non-chemical methods do not yield desired results. The NYSDEC will be notified of the use of herbicides and insecticides prior to use. Areas of the cap with dead vegetation or lack of vegetation will be inspected by qualified personnel for possible causes of defoliation and devegetation. Bare areas of the cap will be seeded according to the seeding specification provided in the Landfill Closure Construction Contract Documents (Contract No. 2001).

3.1.4 Regrading

The effects of landfill subsidence, vandalism or gulleying from minor precipitation events (i.e., not causing extensive damage to the site) may result in the need to reestablish the affected areas of the cap system. The areas of erosion or landfill subsidence which affect the performance of the cap system will be restored to original grade to prevent collection of water and surface ponding on the cap membrane. Deterioration of the access/maintenance road will be repaired by regrading where possible and/or placement of additional RCA, if necessary, to provide access for

routine inspections and maintenance activities. If vandalism is detected on the site, such as off-road vehicle tracks, the FIGRD will pursue additional efforts to further restrict access to the site.

3.1.5 Vector Control and Aesthetics

Vectors common to active landfill operations are not expected to be a problem at the closed landfill. However, suspected rodent or insect infestation will be addressed by contacting qualified licensed exterminators. Prior to initiating an extermination program, the FIGRD will advise the NYSDEC of the situation and, if necessary, develop and submit to NYSDEC an extermination work plan for review and approval. Details of the communication procedures for non-routine events are provided in Section 9 of this Manual.

3.1.6 Access

Access to, and onto the landfill will be continually maintained. Vehicle access will be limited to authorized personnel and will only be accomplished through the main site entrance off Wilderness Road. The access/maintenance road will be inspected for foreign objects, vegetative growth, settlement and erosion which could degrade the integrity of the road and inhibit access.

3.2 Repairs

This section details the procedures which could be used to perform non-routine repairs of the cap system and, as such, are considered to be outside of the scope of the normal maintenance procedures for the landfill. These activities may include, but not be limited to, repair of the drainage swales, geomembrane, gas vents, groundwater monitoring wells and vegetative cover.

3.2.1 Storm Water Structures

Should settlement of the drainage swales or culvert be observed during routine maintenance, the FIGRD will monitor the area where the settlement has occurred in order to

determine the nature of the settlement and whether the geomembrane cap may have been damaged or disrupted.

3.2.2 Geomembrane

If the geomembrane cap has been damaged or disrupted, the FIGRD will immediately notify the NYSDEC of the problem and propose a plan to repair the liner. This proposed plan will incorporate the requirements for repair of the cap membrane. Upon approval by the NYSDEC of the proposed repairs, the FIGRD will proceed and implement the repairs as set forth in the proposal.

Once the geomembrane cap has been repaired, or if excavation reveals that the geomembrane cap has not been damaged, the FIGRD will backfill the area of settlement with compacted backfill material. Proper construction procedures will be followed as set forth in the closure design drawings and specifications for the Fishers Island Landfill.

3.2.3 Gas Venting System

Landfill gas vent damage will most likely occur during normal maintenance of the site, such as during mowing. If damage occurs to a gas vent, the vent will be replaced according to the approved closure construction documents. Breakage of landfill vents, which can damage the geomembrane beneath the cover soils or the watertight seal around the pipe penetration of the geomembrane, will be examined. The cover soils will be removed and the membrane and pipe penetration boot inspected for damage. If damage has not occurred, the soil layers around the vent will be replaced by hand and compacted to a minimum thickness of 18 inches. All repairs will be such that replacement layers will match and tie directly into the undisturbed portion of the cap. Damage to the geomembrane or the pipe penetration boot will be repaired according to the guidelines provided in Section 3 of this Manual.

3.2.4 Groundwater Monitoring Wells

The repairs required for groundwater monitoring wells may involve:

1. Redevelopment of the well;
2. Removal and replacement of the well screen; or
3. The installation of a new monitoring well.

The repair technique used will be determined by the extent of the damage observed. However, any corrective measures will be discussed with and approved by the NYSDEC prior to implementation.

Damaged monitoring wells that cannot be rehabilitated will be abandoned in accordance with the closure construction documents to prevent potential contaminant migration downward through/along the monitoring well.

The monitoring well abandonment procedures will follow NYSDEC protocols and comprise the following:

- Removal of surface protective casing and concrete slabs, as appropriate;
- Overboring and removal of the casing, if present, to the greatest extent possible (minimum 5 feet);
- Perforation of any casing remaining in the borehole;
- Pressure grouting of the borehole from the base of the borehole with cement-bentonite grout to a depth of 5 feet below the ground surface using the tremie method;
- Backfilling the remaining 5 feet with native soil and compacting to avoid settlement;
- Grouted area will be periodically inspected for possible settlement; and

- If subsequent settlement occurs, soil will be placed into the depression and repacked to grade level. If severe settlement occurs, the settled portion will be regrouted and backfilled with soil.

Section 4

4.0 GROUNDWATER MONITORING PLAN

The procedures described below will be followed during the sampling and analysis of samples associated with the groundwater monitoring plan. These procedures are expected to continue to be followed for all routine sampling and analysis of groundwater conducted at the landfill. Detailed sample collection and quality assurance control procedures and requirements are provided in Appendix B.

The groundwater monitoring well network consists of four monitoring wells (NW-4, NW-2, W-6 and NW-13) at the landfill (see Figure 1-2). Groundwater sampling will be conducted on a quarterly basis, with three events consisting of analysis for 6 NYCRR Part 360 Routine Parameters and one event consisting of analysis for Baseline Parameters in accordance with Part 360 requirements. Quarterly sampling will be conducted for a minimum of 2 years. Once a baseline has been established, the results will be evaluated to determine if the frequency, number of wells and monitoring parameters can be modified/reduced. During each sampling event, each well will be purged a minimum of three well volumes prior to sample retrieval. Either dedicated or disposable bailers will be used to collect samples after this purging procedure. Chain of custody documents for each sample retrieved will be maintained by both the FIGRD and the laboratory performing the quarterly sampling and analysis.

Field measurements will be obtained for temperature, conductivity and pH, and the static water level of each well will be determined prior to purging each groundwater monitoring well. The results of the groundwater sample results will be provided to NYSDEC.

Section 5

5.0 PERSONNEL AND EQUIPMENT REQUIREMENTS

The post-closure monitoring of the Fishers Island Landfill will be performed by the Fishers Island Garbage and Refuse District (FIGRD) personnel or subcontractors retained for this purpose. FIGRD personnel or subcontractors retained for this purpose will be responsible for the entire site's routine operation and maintenance. In the event that a component of the landfill becomes damaged, inoperative or requires repair, the procedures outlined in Section 3 of this Manual will be followed. The personnel and equipment requirements described below represent an estimate of the time that will be required to maintain and repair the landfill closure system. This estimate assumes that major storm events (i.e., those causing extensive damage to the landfill site) will not occur during the post-closure period and that other contingencies will not occur as discussed in Sections 6 and 8 of this Manual.

5.1 Staffing Plan

The personnel required to conduct quarterly inspections and perform routine maintenance and repairs will be furnished on a part-time basis. Periodic training will be provided to FIGRD personnel to satisfy the requirements for the monitoring and maintenance activities at the landfill. Equipment needed for operations and maintenance activities will be provided by the FIGRD on an as-needed basis during the post-closure period. For events occurring outside the scope of the routine maintenance and repair program, the guidance described in Sections 6 and 8 of this Manual will be followed. Sections 5.1.1 and 5.1.2 provide a summary of the required training for monitoring and maintenance personnel. Records will be routinely kept for FIGRD personnel and are described in Section 9 of this Manual.

5.1.1 Staff Training

Selected FIGRD personnel should be trained on specific duties at the site. These personnel should be given additional training in the recognition of, and response techniques to first aid, confined space entry and basic firefighting. These training programs will be updated annually and as newly developed procedures are implemented. FIGRD personnel training

will include conducting comparative data (laboratory and field) analyses and identifying when significant changes occur in data from period to period, as well as identifying unusual occurrences. If unusual circumstances or conditions occur, the FIGRD will make arrangements for and acquire professional assistance, if required. Evaluations of alternatives and implementation of solutions will be directed by the FIGRD.

5.1.2 Safety Plan

The Fishers Island Landfill after closure is not expected to expose personnel to waste or hazardous substances, and routine monitoring and maintenance activities are expected to be conducted using general site safety equipment personal protective equipment under normal conditions. Health and safety procedures for the performance of routine operations and maintenance of the site are outlined in this section. A site specific health and safety plan for the closure of the landfill was prepared by the construction contractor to address the conditions associated with the construction of the landfill capping system and appurtenances. This plan is provided as a reference document and as a resource in the event that extensive or invasive activities or repairs become necessary in the future. The document may need to be updated to address the activities to be undertaken.

Personnel involved in the post closure monitoring and maintenance of the landfill should familiarize themselves with the health and safety program which was implemented during closure construction, but should recognize that it represents conditions with heavy construction, earthwork and activities directly involving the excavation and relandfilling waste.

Based on available information, it appears that the landfill contains the following potential chemical and physical hazards:

- Methane gas;
- Open drainage swales;
- Severe weather; and

- Ticks.

The items listed above are not meant to be all inclusive, but are a minimum listing of hazards which should be taken into consideration during the post-closure monitoring and maintenance period, and which should be considered in the approach taken during post-closure activities. The FIGRD should include other hazards as it determines appropriate. The landfill personnel must be made aware of these potential hazards, given special instructions as needed, and utilize issued safety equipment (as necessary), all in conformance with the FIGRD's health and safety program, and in conformance with the Occupational Safety and Health Administration (OSHA) requirements.

Methane Gas

Methane, an odorless, colorless and tasteless gas, is an asphyxiant under high concentrations. There are no systemic effects, either at 5 percent concentration or for long-term exposure. Neither are there any OSHA Permissible Exposure Limit (PEL), National Institute of Occupational Safety and Health (NIOSH) recommended exposure limit, or American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit values. The prime concern associated with methane is the hazard of fire and explosion. The Lower Explosive Limit (LEL) for methane is 5 percent of air volume and the Upper Explosive Limit (UEL) is 15 percent of air by volume.

Post-closure monitoring personnel must be aware of: 1) the presence of methane gas on site; 2) the potential hazards associated with methane gas; and 3) the procedures to be followed to detect methane. Personnel must avoid generating arcs, sparks or flames in areas where methane gas is detected at levels of 10 percent of the LEL or greater and are prohibited from smoking on site. An explosive gas/oxygen analyzer will be used to detect the presence of methane gas and determine its concentration.

Open Drainage Swales

There are drainage swales, approximately 2 to 3 feet deep, located around the southern and northern boundaries of the landfill. Consistent with typical industry practice, the swales and retention pond are not fenced and, therefore, could be a potential physical hazard to personnel traveling around the site. Personnel performing inspection, maintenance or repair work at the landfill should be aware of this potential hazard and the necessary precautions needed to be taken to avoid it becoming a hazard.

Severe Weather

The Fishers Island Landfill is open and exposed to both the sun and the wind, which can aggravate extremes of temperature. In the winter, there is little protection from the wind, and in summer, there is no screening from the sun. These conditions can potentially contribute to physical hazards, such as hypothermia, dehydration and frostbite in the cold weather, and heat rash, heat cramps, heat exhaustion and heat stroke in hot weather. Personnel performing inspections, maintenance and repair work at the landfill will be advised of the severe weather hazards and necessary precautions as part of the safety orientation program.

Ticks

Personnel working at the landfill should take the precautions described below against possible tick bites, in particular, deer ticks. Deer ticks are carriers of the spirochete (borrelia bergdorfi), which causes Lyme Disease, that can be transmitted to humans when bitten.

Signs and symptoms of Lyme Disease may include the following:

- The most well-known warning sign is a rash, classically described as a small red area that starts at the site of a tick bite and gradually enlarges over several days. The rash, which does not appear until three to 30 days after the tick bite, may grow to several inches in diameter and is circular with a central clearing. It may be obvious or very faint. Multiple, usually smaller, rashes without central clearing may develop in some individuals.

- Flu-like symptoms may precede or accompany the onset of the rash. Symptoms may include chills and fever, headache, malaise and fatigue, stiff neck and, in some cases, pain in the joints.

- If the initial stage is not discovered and treated promptly, later stages may develop. Chronic arthritis, and in some cases heart and nervous system disorders may develop weeks to months after the tick bites.

Some infected individuals may not develop either rash or symptoms. Therefore, anyone bitten or thought to be bitten by a deer tick, or developing signs or symptoms of Lyme Disease, is advised to see a physician promptly for an examination and possibly a blood test.

To prevent tick bites, personnel should wear long pants made of light-colored, tightly woven cloth; tuck pants legs inside of socks; use an insect repellant; check themselves frequently; and wash themselves thoroughly at the end of each day.

5.2 Equipment

The equipment utilized for post-closure monitoring and maintenance of the Fishers Island Landfill will consist of standard construction equipment from the FIGRD's inventory or from that of subcontractors retained by the FIGRD for monitoring and maintenance purposes. In addition, the FIGRD's standard maintenance equipment, such as mowers and trimmers, will be used at the discretion of the FIGRD to maintain the site following its closure.

5.2.1 Minimum Requirements for Maintenance

The principal operations to be performed by the FIGRD on a regular basis during the post-closure period will be maintenance of the vegetative cover and the repair of cover soil erosion. Mowing operations will require the use of a heavy equipment mower which can be operated safely on steep sideslopes. The soils repair will be accomplished with a front-end loader, bulldozer or other equipment, as necessary, depending on the size and depth of the area which has been eroded. This equipment may be available in the FIGRD's inventory or will be rented or leased, or provided

by subcontractors retained by the FIGRD for monitoring and maintenance purposes. The equipment must be outfitted with rollover protection cabs and backup alarms meeting the OSHA requirements for this type of machinery. The equipment will be maintained according to the FIGRD's current maintenance schedule and additional equipment for emergencies should available from the inventory of subcontractors retained by the FIGRD. Because the FIGRD will utilize necessary additional equipment from its subcontractors, resources will not be designated solely for landfill post-closure activities at the landfill.

5.2.2 Firefighting Equipment

Fire extinguishers will be carried on all equipment used on the site for maintenance or repair work. In addition, the local fire company will provide assistance and/or equipment, as needed, to control any fires which may occur at the site.

Section 6

6.0 CONTINGENCY PLAN

The objective of the Contingency Plan is to address the events which may occur outside of the scope of the routine maintenance program. The Contingency Plan will be implemented following the discovery of a condition at the landfill which cannot be covered by routine scheduled maintenance and repair. Natural occurrences, such as storms, drought and landfill settlement, are considered "expected occurrences" and have been addressed in the previous sections of this Manual. Other situations, such as war, an earthquake or other catastrophic events, cannot be reasonably expected to occur and, therefore, are not specifically addressed in this Manual.

The Contingency Plan which follows addresses new degradation of the groundwater quality and the possibility of a fire on the landfill. The guidelines which follow will be used to determine when the Contingency Plan should be implemented and which corrective measures should be implemented. The appropriate regulatory agencies and public officials will be notified of any emergency which is governed by this Plan.

6.1 Groundwater Contamination

Groundwater will be monitored quarterly during the first two years of post-closure period according to the provisions of Section 4 of this Manual. In the event that a statistically significant increase in the level of contamination emanating from the landfill via the groundwater pathway occurs, the Fishers Island Garbage and Refuse District (FIGRD) will notify the NYSDEC. Based on this occurrence, the next round of sampling will include testing of the wells for the Part 360 Baseline Parameters. Should the elevated levels continue, or if new contaminants are discovered, a work plan may be developed that will investigate the nature, extent and cause of the contamination, including the possible installation of additional groundwater monitoring wells.

Upon development of the work plan and completion of the investigation involved, a report will be prepared describing the findings of the investigation and providing

recommendations for corrective measures, if necessary. At a minimum, any corrective measure will be accomplished in accordance with 6 NYCRR Part 360-2.20.

6.2 Landfill Gas Migration

Methane gas that is vented to the atmosphere does not present a risk to human health. However, migration of gas off-site and a buildup of gas within a confined space may create an explosion hazard. If it is suspected that methane gas generation poses a health hazard, the NYSDEC will be notified and an investigation undertaken to determine whether the vent system is functioning properly. The possible responses to a gas venting problem include replacing portions of the venting system, adding new vents or venting trenches, or installing an active gas withdrawal system.

In the event that methane gas is detected at a level equal to, or greater than 25 percent of the LEL (5 percent, by volume), the NYSDEC will be notified and all steps necessary will be immediately undertaken to ensure safety and protection of human health. If deemed necessary, the following will be implemented.

- Within seven days of detection, the FIGRD will submit to the NYSDEC a report of the methane gas levels detected and provide a description of the steps that will be taken to protect human health; and
- Within 45 days of detection, the FIGRD will submit a plan to implement a remediation plan for the methane gas releases and a schedule for implementation of the plan within 60 days after date of detection. The plan will assess the nature and extent of the gas release problem and describe the proposed remedy.

6.3 Fire and Explosion

The Fishers Island Landfill has been inactive since 1991. As a result, the likelihood of an underground fire in the waste is low. However, an aboveground (vegetation) fire is a possibility and will be reported to the local fire department immediately if it occurs. The appropriate response measure, including the safety of the personnel on the site, will be the responsibility of

the fire department. Any damage to the landfill closure structures will be repaired according to the guidelines in Section 3 of this Manual after extinguishing the fire.

6.4 Emergency Response

Emergencies are events which fall outside of the reasonable range of occurrence and have not been included in the Contingency Plan. Such events may include, but not limited to, a catastrophic failure of the storm water control features or a catastrophic failure of the landfill cap.

6.4.1 Notification Procedure

For emergencies that present an immediate danger or threat to human health and welfare, the police and fire departments will be notified, the affected area(s) secured and local residents warned or evacuated. For emergencies that do not present an immediate threat or danger, the NYSDEC will be notified.

6.4.2 Telephone Numbers

Telephone numbers for emergency response personnel are provided on the following page.

Table 6-1

EMERGENCY RESPONSE TELEPHONE NUMBERS

Fishers Island Landfill Contact: Fishers Island Garbage and Refuse District Commissioners	631-788-7455
Police Department	(631) 765-2600
Local Emergency Response Resources	911
Fire Department	911
Ambulance	911
Medical Services	911
Lawrence and Memorial Hospital 265 Montauk Avenue New London, CT 06320	(860) 444-5143
NYSDEC Region I Division of Solid and Hazardous Materials	(631) 444-0375
NYSDEC Albany Division of Solid and Hazardous Materials	(518) 402-9706
Suffolk County Department of Health Services	(631) 853-3081

Section 7

7.0 POST-CLOSURE COST ESTIMATE

This section of the Manual provides an estimate of the costs expected to be incurred during the post-closure monitoring and maintenance of the Fishers Island Landfill. This annual cost estimate is based on 2003 dollars and is presented on Table 7-1. The projected cost of the three basic components (inspection, monitoring and maintenance) is presented below. The total projected cost during the 30-year post-closure period, based on quarterly inspection and monitoring, and an escalation rate of 5 percent annually, is approximately $619,000. However, certain variables may affect these estimated costs:

- The extent or severity of storms which exceed the design standards and result in severe erosion or other natural calamities;
- Weather extremes, such as drought or extensive frozen ground;
- A change in groundwater quality which could require the installation of additional monitoring wells or additional testing of the existing wells;
- A change in groundwater quality which could require less testing;
- Increase in annual escalation rate, fees, special levies, changes in insurance rates or other unexpected administrative costs.

7.1 Inspection Costs

It is assumed that it will take one person to perform the inspection at an hourly rate of $30 per hour. Assuming that the inspection will be performed during a 1-hour period, this would amount to $30 per inspection. The landfill will be inspected four times per year; therefore, the annual estimated cost of performing the site inspections is estimated to be $120 per year.

Table 7-1

POST-CLOSURE COST ESTIMATE - ANNUAL SUMMARY

Inspection	$120
Routine Maintenance and Repair	5,240
Contingency Repair	980
Groundwater Monitoring	
Sample Collection	2,000
Laboratory Analysis	5,600
Record Keeping and Report Preparation	1,200
Total	**$15,140**

7.2 Maintenance Costs

Routine maintenance of the landfill cap is anticipated to include three activities: 1) repair of erosion damage to the landfill cap, drainage swales and culvert, and access/maintenance road; 2) mowing landfill vegetation; and 3) removal of silt and debris from the drainage swales and culvert. Estimating this work requires assumptions based on previous post-closure monitoring experience, as well as a knowledge of the site weather history. Repair costs will generally involve a minimum of two workers and appropriate equipment. Routine repairs are anticipated to involve one 8-hour day and routine repair to the access/maintenance road and landfill cover system is anticipated to take two days for each occurrence.

On average, it is expected that the erosion repair and maintenance of the swales will be performed once per year. Mowing (at the discretion of the Fishers Island Garbage and Refuse District (FIGRD)) will occur once per year. Routine erosion repair of the vegetative cover and to the road will probably occur once per year. The cost of these maintenance services, including general site maintenance, is anticipated to average approximately $5,240 annually (see Table 7-2). The cost of this maintenance work may be greater during the first 3 years of the post-closure period as the vegetative cover develops, but is expected to decrease to a lower value for the remainder of the 30-year post-closure period.

Other costs which may be incurred during the maintenance period include groundwater monitoring, monitoring well repair or replacement, gas vent repair or replacement, reconstruction of drainage structures, or repairs to the geomembrane or barrier protection cover. These costs are contingent upon need and, therefore, are unable to be estimated at this time. However, an amount equal to approximately 20 percent of the routine inspection and maintenance costs is estimated for contingencies. This amount for these non-routine (contingent) repairs is estimated to be approximately $980 per year. While it is not expected to be used each year, it is anticipated that over the post-closure life of the facility, non-routine repairs will occur that will necessitate the use of contingent monies. Unspent contingency budget monies should be carried over, and accrued, from year to year.

Table 7-2

ROUTINE MAINTENANCE AND MONITORING SCHEDULE
ANNUAL POST-CLOSURE BUDGET

Activity	No. of Personnel	Labor Combined Rates $/hr	Labor Combined Rates $/day	Days/yr.	Total Labor $/yr.	Equipment $/day	Equipment $/yr.	Sample Analysis $/sample	No. of Samples /yr.	Total Analysis $/yr.	Total $
Landscaping • Mowing (at the FIGRD's discretion)	1	30	240	1	240	500	500	--	--	--	740
Storm Water Control Features • Swales and Culvert	2	60	480	1	480	100	100	--	--	--	580
Environmental Monitoring • Groundwater Sampling and Analysis (first 2 years)	1	50	400	4	1,600	100	400	300 500	12 4	3,600 2,000	7,600
Contingency Repair	2	60	480	1	480	500	500	--	--	--	980
Access and Maintenance Roads	2	60	480	2	960	500	1,000	--	--	--	1,960
General Site Maintenance	2	60	480	2	960	500	1,000	--	--	--	1,960
Record Keeping and Report Preparation	1	30	240	5	1,200	--	--	--	--	--	1,200
Total					5,920		3,500			5,600	15,020

7.3 Monitoring Costs

7.3.1 Groundwater Monitoring

Four wells will be utilized to monitor groundwater during the post-closure period. It is anticipated that well sampling will be conducted by one field personnel, and that one (8-hour) day will be required for collection of a complete round of samples. With four rounds of monitoring required each year, a field labor budget of $1,600 is anticipated.

For the first two years after closure, groundwater sampling will be conducted on a quarterly basis, with three of the sampling events consisting of analysis for Part 360 Routine Parameters and one sampling event consisting of analysis for Baseline Parameters for each event for the first two years of sampling. The annual budget for each of the first two years' laboratory analyses of groundwater samples is estimated to be $5,600. An estimated cost of $400 per year will be required to cover costs for sampling equipment resulting in a total annual groundwater monitoring budget of $7,600 per annum for each of the first two years. It is anticipated that after the first two years of closure, the FIGRD will petition to reduce the sampling to semiannually for the next 8 years. Ten years after closure, it is anticipated that groundwater monitoring can be completed annually. The 30-year post-closure cost incorporates these assumptions.

Section 8

8.0 COMMUNICATION PROCEDURES

During the 30-year post-closure period at the Fishers Island Landfill, routine inspections will be performed quarterly as described in Section 2 of this Manual. In addition to these scheduled inspections, non-routine inspections may be necessary as a result of extraordinary incidences which may occur at the landfill, such as fires, natural disasters or significant vandalism. Sections 2 and 3 of this Manual identify the procedures to be followed for routine site inspections and scheduled maintenance and repair. The procedures outlined in Sections 2 and 3 will also be followed in the event that a non-routine inspection is required. This section of the Manual outlines the recommended communication procedures to be followed in the event that a component of the landfill site becomes damaged, inoperative or requires non-routine repairs.

Table 6-1 lists the telephone numbers of the appropriate authorities to contact in case of emergencies.

8.1 Vandalism

Routine inspection of the soil cover will reveal if any unauthorized dumping or vandalism has occurred on site. Should this occur, inspection personnel will record evidence of such activity (e.g., vehicle tracks) or attempt to identify source of the illegally placed waste and those who caused the vandalism, and immediately notify the Fishers Island Garbage and Refuse District (FIGRD). One form of vandalism that may occur on this landfill during the post-closure period will be the result of off-road vehicles using the area. These vehicles tend to damage vegetation and create ruts, possibly exposing the geomembrane and damaging it.

When vandalism, trespassing or unauthorized dumping has occurred, the FIGRD will evaluate site security procedures to identify the probable access route and will augment the security procedures to prevent such access, as needed. If the site cannot be secured through the use of existing resources, and the FIGRD determines that additional labor or materials are needed to protect the site, the FIGRD will obtain an appropriate commitment of specialty resources.

In addition, to determine if any of the landfill components have been damaged as the result of significant vandalism, an emergency site inspection will take place. The FIGRD Commissioners will coordinate and direct all emergency repairs.

8.2 Fires

All FIGRD equipment, or equipment used by subcontractors retained by the FIGRD, used for maintenance and/or repair work, will be equipped with fire extinguishers. However, should a fire occur which cannot be contained by on-site personnel or equipment, the local fire department will be contacted. In addition, the FIGRD Commissioners will be notified immediately so that the other on-site activities can be coordinated.

After a fire, the FIGRD will determine if any of the landfill components were damaged. A site investigation will be undertaken according to the procedures outlined in Section 2 of this Manual. The FIGRD will coordinate and direct all emergency repairs and notify the appropriate agencies of any adverse conditions at the site.

8.3 Natural Disasters

Some natural disasters that might occur at the site may include, but not be limited to, hurricanes, heavy rains, ice storms, lightning strikes and/or floods. Other natural phenomena, such as tornadoes and seismic events, are unlikely to occur at the site due to its geographic location. Should one or more of these events take place, FIGRD personnel (or personnel of subcontractors retained by the FIGRD) will follow emergency procedures to ensure protection and prevent personal injury during the event, and will notify the FIGRD of any evident damage or threatening conditions that have been created as a result of the event. Damage that might occur as a result of such events includes erosion of the cover system and clogging of storm water drainage system. Lightning strikes to trees could result in trees falling across site roadways and fire.

If a severe storm event or other natural phenomena has caused significant damage to the landfill, or if the landfill has sustained significant damage, an emergency site inspection will be undertaken to determine the extent of such damage. When the FIGRD determines that conditions are safe to inspect the site, it will dispatch a team of qualified personnel to inspect the site as described in Section 2 of this Manual. The FIGRD will coordinate and direct all emergency repairs and notify the appropriate agencies of adverse conditions at the site.

8.4 Vectors

During site inspections, vector infestation may be evidenced by the presence of burrow holes or nests. Should infestation be discovered to pose a potential threat to the integrity of the landfill cover system or other site components, the FIGRD will be notified of these conditions. The FIGRD will contact an appropriate extermination service to eliminate rodents or insects, as needed.

8.5 Dust

Prolonged dry periods are not expected to present the same problems at the closed/capped landfill as at an operating landfill because of the presence of vegetative cover. To prevent blowing dust, the landfill cap must maintain complete vegetative cover. This will prevent the cap from desiccation under prolonged dry conditions. However, during such periods, the use of areas that are not vegetated (e.g., access roads) will be minimized.

8.6 Storm Water Control System

The storm water control system will be inspected to determine if siltation has occurred or if debris has accumulated which would impede the flow of storm water through the drainage swales and culvert. In the event that siltation has occurred, it will be noted on the inspection form and the FIGRD will be notified so that the appropriate action can be taken to clean the drainage system.

8.7 Excessive Landfill Settlement

The landfill will periodically be visually inspected for cap integrity and differential settlement to determine if a change has occurred which could indicate potential malfunction of one of the landfill closure components. If it is determined through the evaluation that certain areas have settled to the point where the integrity of the cap system may be jeopardized, the FIGRD will notify the NYSDEC. Upon a physical examination of the site by the FIGRD and the NYSDEC, a work plan will be prepared to repair any damage that may have been caused to the landfill cover system.

8.8 Groundwater Contamination

Should there be a statistically significant increase in the level of contamination emanating from the site via the groundwater pathway, the NYSDEC will be notified and the FIGRD or its subcontractor will monitor for the Part 360 Baseline Parameters during the next round of sampling. Should the elevated levels continue, or if new contaminants are discovered, the FIGRD will prepare a work plan to investigate the nature, extent and cause of the contamination. The work plan will be submitted to the NYSDEC for approval. Following implementation of this work plan, the results will be evaluated and recommendations for corrective measures will be made to the NYSDEC.

Section 9

9.0 RECORD KEEPING AND REPORTING

9.1 Record Keeping

The Fishers Island Garbage and Refuse District (FIGRD) will maintain records of inspections, maintenance (routine and non-routine), and monitoring of the landfill. Table 9-1 presents a schedule summary of the overall inspection, record keeping and maintenance schedules for operations and monitoring to be conducted at the landfill. This information will be recorded and maintained in the FIGRD files. Some of the information will be reported to NYSDEC as presented in Section 9.2. The remaining information will be available in the files maintained at the FIGRD offices. Records also will be maintained regarding the results of the environmental monitoring plan as presented in Section 4 of this Manual.

9.2 Reporting

The FIGRD will prepare and submit quarterly reports to NYSDEC on groundwater monitoring, and an annual report to summarize the operation, maintenance and monitoring of the landfill as described below.

9.2.1 Groundwater Quality Reports

Groundwater Quality Monitoring Reports will be prepared and submitted to the NYSDEC Region 1 office quarterly. Summary groundwater quality data will be included as a component of the Annual Monitoring Report. These reports will contain the following information:

- Results of groundwater sampling events; and
- An analytical review of the data to determine exceedances of applicable water quality criteria, as well as discernable trends in data.

Table 9-1

INSPECTION, RECORD KEEPING AND MAINTENANCE SCHEDULES

Item	Activity Frequency
Inspect landfill area for litter dumping	Monthly
Equipment maintenance and repairs	As Required
Clean landfill access/maintenance road	As Necessary
Maintain access/maintenance road	As Necessary
Clean drainage swales and culvert	As Necessary
Mow vegetation	As Determined by the FIGRD
Maintain and resurvey vertical and horizontal control monuments	As Necessary
Perform topographic survey of landfill	As Necessary
Update Emergency Contingency Plan	As Necessary

Note:

All environmental controls and monitoring systems to be routinely checked for damage monthly, and inspected prior to forecasted major storms and after severe inclement weather.

9.2.2 Annual Monitoring and Maintenance Report

An annual report for the Fishers Island Landfill will be submitted to the NYSDEC no later than 60 days after the first day of January of each year. This report will include:

- A summary of all routine operations and maintenance activities;
- A summary of all routine inspections;
- A summary of all non-routine inspections;
- A compilation and summary of all emergency activities;
- A compilation and summary of all groundwater quality data collected during the year;
- A summary of all routine and contingent expenses incurred throughout the year; and
- Any changes from the approved reports, plans and specifications will be listed, with justification provided for each change.

Appendix A

APPENDIX A

POST-CLOSURE SITE INSPECTION CHECKLIST

FISHERS ISLAND LANDFILL

POST-CLOSURE SITE INSPECTION CHECKLIST

DATE: _____

INSPECTED BY: _____

Item	Acceptable	Not Acceptable	Present	Not Present	Location	Remarks
1) Vegetative Cover:						
a) Landfill Site:						
bare spots						
dead areas						
undesirable growth						
trees						
debris						
b) Drainage Structures:						
bare spots						
dead areas						
undesirable growth						
slippage of stone						
2) Groundwater Monitoring Wells:						
damage/vandalism						
settlement						
vector infestation						

ADDITIONAL COMMENTS:

_____

_____

_____

_____

_____

_____

_____

_____

FISHERS ISLAND LANDFILL

POST-CLOSURE SITE INSPECTION CHECKLIST

DATE: _____

INSPECTED BY: _____

Item	Acceptable	Not Acceptable	Present	Not Present	Location	Remarks
3) Soil Cover:						
erosion damage						
settlement						
holes						
vector infestation						
waste breakthrough						
leachate breakthrough						
vandalism						
unauthorized dumping						
litter						
4) Access/Maintenance Road:						
potholes/burrow holes						
erosion gullies						
loss of RCA cover						
obstructions						
settlement						
5) Gas Venting System:						
odor						
damage/vandalism						
settlement						
vector infestation						

ADDITIONAL COMMENTS:

_____

_____

_____

_____

FISHERS ISLAND LANDFILL

POST-CLOSURE SITE INSPECTION CHECKLIST

DATE: _____

INSPECTED BY: _____

Item	Acceptable	Not Acceptable	Present	Not Present	Location	Remarks
6) Storm Water Collection:						
a) Drainage Swales:						
damage/instability						
stone erosion						
erosion beneath						
silt accumulation						
ponded water						
wash outs						
vegetative cover						
debris						
b) Culvert:						
damage/instability						
soil erosion beneath						

ADDITIONAL COMMENTS:

Appendix B

APPENDIX B

QUALITY ASSURANCE/QUALITY CONTROL PLAN

FISHERS ISLAND LANDFILL
QUALITY ASSURANCE/QUALITY CONTROL PLAN

TABLE OF CONTENTS

List of Attachments

List of Tables

1.0 QUALITY ASSURANCE/QUALITY CONTROL PLAN

1.1 Objective and Scope

The objective of this project is to provide post closure monitoring of the Fishers Island Landfill. The post closure monitoring program includes groundwater monitoring.

The purpose of this Quality Assurance/Quality Control (QA/QC) Plan is to develop and describe the detailed sample collection and analytical procedures that will ensure high quality, valid data for use during post closure monitoring.

1.2 Data Usage

The data generated from the field sampling program will be used to evaluate the effectiveness of the landfill closure in accordance with Part 360. In addition, data will be used to monitor health and safety of workers at the site and the health and safety of persons off-site.

1.3 Sampling Program Design and Rationale

The following presents a general discussion of the sampling to be conducted during year 1 of post closure monitoring.

- Groundwater: Four rounds of 4 groundwater samples will be collected. Each round will consist of one sample from NW-4, NW-2, W-6 and NW-13.

For a discussion of the sampling program and sample locations, see Section 4.0 of the Manual.