FINAL WASTEWATER FACILITY PLAN, NOVEMBER 2006

TOWN OF LINCOLN, RHODE ISLAND

FINAL
WASTEWATER FACILITIES PLAN

NOVEMBER 2006

Prepared by:

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C&E Project No. J0506

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Executive Summary

The Town of Lincoln is located in the northeast area of Rhode Island, bordered by the Towns of Smithfield and North Smithfield to the west, the city of Woonsocket to the north, the Town of Cumberland to the north and east, the City of Central Falls to the east, and the Town of North Providence and City of Pawtucket to the south. The total size of the Town is approximately 12,100 acres (18.9 square miles). The Rhode Island Statewide Planning Program reports an estimated 2005 population of 21,449 people for the Town of Lincoln and a projected 2025 population of approximately 24,000.

The Town identified the need for and established the task to develop a Town – wide wastewater facilities plan in its 2003 Comprehensive Plan update. The Wastewater Facilities Plan is intended to address the current and anticipated future needs for management of wastewater generated within the Town of Lincoln. This Plan is prepared in accordance with the requirements and guidelines established by the Rhode Island Department of Environmental Management as necessary for the Town to utilize financing obtained through the State Revolving Fund (SRF) Program. This Wastewater Facilities Plan also is intended serve as part of the Town response to the April 2003 Notice of Deficiency (NOD) issued by the Rhode Island Department of Environmental Management (RIDEM) as a result of raw sewage discharges to water bodies that occurred between 1999 and 2002 due to pump station and sewer line operational problems experienced in Lincoln during that period.

Municipal sewers are available to approximately 99% of the geographic area of the Town. Areas where municipal sewer service is not available are served by individual sewage disposal systems (ISDS). All sewage flow conveyed by the Town facilities is directed to the Narragansett Bay Commission (NBC) system for treatment and disposal at the Bucklin Point Wastewater Treatment Facility in East Providence or the Field's Point Wastewater Treatment Facility in Providence. The Town does not own or operate any municipal wastewater treatment facilities.

Although the Town has an extensive existing system of municipal wastewater pumping stations and gravity collection sewers, these facilities could not be constructed in strict accordance with the proposed sewer system planning documents prepared in 1971 and amended in 1984. Proposed gravity conveyance facilities apparently were deemed to be infeasible due to various constraints necessitating additional pumping stations. Wastewater facilities for subsequent development were constructed as needed to satisfy the wastewater disposal needs for individual areas, resulting additional small pumping stations scattered throughout the collection system.

Review of the planning and record documentation indicates that the criteria used to develop estimated wastewater volumes and size the existing facilities was conservative in comparison to recent water use records. The system design was premised upon saturation development of the zoning conditions in existence at that time, in addition to relatively high per unit wastewater generation rates, with the result that the sewer system is sized to accommodate a peak day design flow of 19.6 MGD. The peak day wastewater flow projected by this Facilities Plan is 4.28 MGD based upon metered water use data and the capacity of the existing facilities was determined to be satisfactory for the future conditions.

The majority of the existing wastewater facilities were installed during the major sewer system construction program conducted during the late 1980s to early 1990s. The gravity sewers installed during this program are expected to remain serviceable to beyond the end of the planning period, but the pump stations are approaching 20 years in service and replacement of equipment is anticipated for all stations during the planning window. Additionally, gravity sewers pre-existing the major sewer construction program remain in service at various locations of the system. In some cases, generally within the older mill village centers, these sewers are estimated to be over 100 years old. Rehabilitation of existing sewers is expected to be necessary.

During the preparation of the Facilities Plan flow metering data obtained from the NBC was reviewed and evaluated for the purpose of gaining insight into whether Infiltration / Inflow (I/I) is a significant issue in Town. A detailed analysis was not conducted within the framework of this project due to lack of available data, but the existence of excessive extraneous flows occurring within the existing sewers is suggested by the limited evaluations performed. NBC interceptor sewer system investigations are ongoing and findings reports are expected to be available prior to the implementation of this Facilities Plan. These reports should be utilized as references in planning and identifying where similar investigation of the Town's sewer system should be conducted.

Although sewers are available to most of the Town, on site individual sewage disposal systems (ISDS) must remain in use in isolated areas where convenient access to sewers does not exist. An excessive failure rate was not identified during review of RIDEM information on ISDS applications and no need was found to extending sewers to the isolated areas to address unsuitable ISDS conditions.

The primary recommendations of this Plan include:

- Investigation and evaluation of existing collection sewers (specifically those pre-dating 1980) to identify sources of potentially excessive extraneous flows and specific rehabilitation requirements.
- Staged sequence of rehabilitation for the existing pump stations.
- Continued employment of ISDS treatment in areas isolated from the existing sewer system.

The estimated total capitol cost of implementing the recommended plan is $6,390,000. Based upon the assumption that the cost will be 100% user financed, and SRF loans with an interest rate of 4% over 30 years are available, the cost to the average sewer system user is estimated to be approximately $50 per year.

Chapter 1 – Introduction

1.1 Purpose and Scope

The purpose for developing a Wastewater Facilities Plan for the Town of Lincoln is to provide a comprehensive plan for managing wastewater generated within in the Town for the 20-year planning period. Facilities planning considers various factors, including existing wastewater systems, environmental and economic impacts, and geophysical conditions, such as geology, topography, water quality, land use and demographic information, to develop alternatives and establish recommendations for wastewater management. The Facilities Plan will assess current conditions and address existing and future needs for wastewater facilities within the Town to establish compliance with the Federal Water Pollution Control Act. The Rhode Island Department of Environmental Management Office of Water Resources has developed guidelines describing the required components and analyses to be included in the planning process and is the primary regulatory agency for review of wastewater facilities planning documents. This Facilities Plan will be prepared in accordance with these guidelines as applied to the specific concerns of the Town of Lincoln.

As municipal sewer service currently is available to a majority of the Town, a primary concern of this Facilities Plan will be the proper management and maintenance of the existing sewer systems and related pumping facilities. The current conditions and anticipated useful service life for the existing wastewater pump stations is a significant consideration in addressing this concern. A conditions assessment study was conducted in order to establish necessary information for the pump stations and allow for the Facilities Plan recommendations to be developed. Available record documents, operation and maintenance information, operating histories and significant events reported by Town personnel, and observations made during on site inspections conducted at each of the Town's 31 pump stations were utilized to perform the conditions assessment.

An inventory of the existing gravity sewers also is needed to address the proper management of the Town facilities. A Town - wide sewer system map was developed

from available manhole location surveys previously mapped by the Town, record plans of sewer construction projects, and coordination inquiries with the Town's Engineering and Sewer Departments. Once the Town – wide map was developed, assessment of the current system was performed and conclusions regarding operations, maintenance, and any need for subsequent detailed studies, such as capacity analyses and specific infiltration and inflow (I/I) investigations, were developed. The Town-wide sewer system map also was evaluated in effort to determine if any potential system modifications to improve operations and / or reduce the number of individual pump stations were feasible wastewater management alternatives.

To address the wastewater needs of areas where municipal sewers are not available, the Facilities Plan includes assessments, evaluations, and recommendations regarding any need for improvements to current sewage disposal practices or expansion of sewers to serve these areas. The Town-wide sewer system map provided the basis and reference point for evaluating potential future sewer systems and assessing the feasibility of various alternatives for extending sewers to unsewered areas.

The Facilities Plan documents the information collected, the evaluations conducted, the alternatives investigated, and the recommendations and conclusions reached during planning process. The evaluation of alternatives encompasses financial aspects of probable costs of implementation and maintenance, technical feasibility of addressing specific wastewater needs, potential environmental impacts, and overall constructibility to arrive at the recommended plan to address the Town's specific wastewater management needs.

The last facet of the planning process is public participation. Public participation and awareness is of utmost importance to the planning process and the effectiveness of the Facilities Plan lies greatly in the clarity with which the specific wastewater needs of the Town are presented. Public meetings and hearings are conducted so that the citizens may understand fully these needs and so that the views and opinions of the community may be

considered when concluding specific measures to be recommended to address wastewater management in the Town.

1.2 Planning Area

The planning area for this Facilities Plan is the entire Town of Lincoln, Rhode Island. The Town of Lincoln is located in Providence County and is bordered by the Towns of Smithfield and North Smithfield to the west, the City of Woonsocket to the north, the Town of Cumberland to the north and east, the City of Central Falls to the east, and the Town of North Providence and City of Pawtucket to the south.

The Comprehensive Plan divides the Town into eight districts that include seven local villages, and the industrial corridor generally bounded by State Highway Route 116 and Interstate Highway Route 295. The eight districts are identified as follows:

- Lonsdale
- Fairlawn
- Limerock
- Albion
- Saylesville
- Quinnville
- Industrial Areas
- Manville

Figure 1-1 depicts the general location of the planning area within the State and identifies the eight planning districts of the Comprehensive Plan.

The total area of the Town is approximately 12,100 acres (18.9 square miles), with approximately 11,890 acres of land area and approximately 210 acres of surface waters. The U.S. Census Bureau reports an estimated 2004 population of 22,188 people for the Town of Lincoln and the Rhode Island Statewide Planning Program projects the 2025 population will be approximately 24,000.

The Town government is in the form of and elected Town Administrator and five member elected Town Council with Home Rule Charter. The term of office for the Town

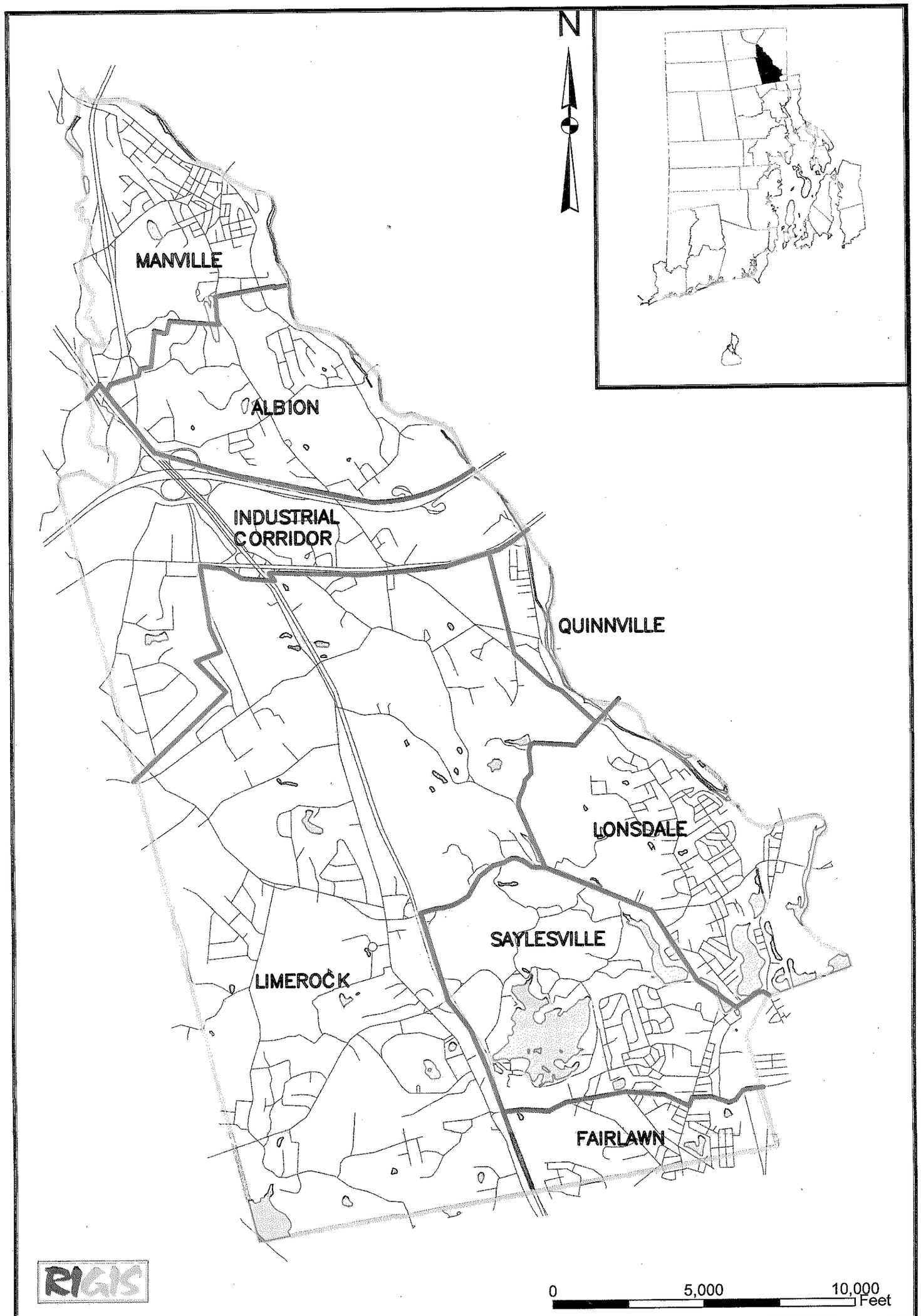

FIGURE NO.
1 – 1

TOWN OF LINCOLN Incorporated 1871

WASTEWATER FACILITIES PLAN
PLANNING AREA

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Administrator and Town Councilors is two years with elections held biennially. All powers of the Town are vested in the Town Council. The Town Administrator is responsible for execution of the Town laws and administration of the Town government. These responsibilities include administration of the Town Department of Public works.

The Comprehensive Plan assigned the task of developing a wastewater facility plan to the Department of Public Works. The head of the Department of Public Works is the Director of Public Works who reports to the Town Administrator. The departments of concern within the Department of Public Works in regard to wastewater facilities are the Engineering Department and the Sewer Department. The Sewer Department is responsible for the operation and maintenance of the Town gravity sewers and wastewater pumping facilities. The Sewer Department Supervisor manages the department's staff of operations and maintenance personnel under the supervision of the Director of Public Works.

Duties of the Engineering Department include providing technical support to all Town departments, review and approval of development plans, maintaining engineering records and maps, and design of Town infrastructure and facilities. The Town Engineer manages the Engineering Department staff to perform these duties under the supervision of the Director of Public Works. The task of developing this Facilities Plan has been assigned to the Engineering Department.

The Sewer Department operating budget is provided from sewer system user fees. All residential users pay an annual flat rate fee per residential dwelling unit connected to the Town sewer system. Fees for non-residential users derived from a minimum fee as adjusted for annual water consumption above a predetermined volume. The current residential user fee is $75.00 and minimum non-residential user fee is $75.00 per annum. The fee for non-residential users with annual water consumption above 90,000 gallons is calculated by multiplying the $75.00 base fee by the total annual water consumption in gallons and dividing by 90,000. Sewage treatment and disposal is provided by the

Narragansett Bay Commission; treatment and disposal fees are charged directly to individual customers based upon metered water use.

Capital costs for sewer system components are assessed at a flat rate fee per structure for residential structures. Non-residential structures are assessed at a flat rate fee per connection for structures up to 10,000 square feet of floor area and are assessed an additional flat rate fee for each additional 10,000 square feet of portion thereof of building floor area. The current sewer assessment is $1,900.00 per structure / connection for residential and non-residential structures up to 10,000 square feet, with non-residential structures charged and additional $1,900.00 for each additional 10,000 square feet or fraction thereof of building area.

Chapter 2 – Discharge Limitations

The Town of Lincoln does not hold a Rhode Island Pollutant Discharge Elimination System (RIPDES) permit to discharge treated wastewater to the waters of the State. Town wastewater flows are conveyed to the Narragansett Bay Commission (NBC) wastewater collection and treatment facilities either by direct connection or indirectly via the municipal sewer systems of the Town of North Providence and City of Pawtucket. These wastewater flows ultimately are conveyed to the NBC system for treatment. Sewage from most of the geographic area of the Town is conveyed to the NBC Bucklin Point Wastewater Treatment Facility. Sewage from the southwesterly portion of Town that is tributary either to the NBC Louisquisset Pike Interceptor or North Providence sewers is conveyed to the NBC Field's Point Wastewater Treatment Facility. As such, the Town is subject to meeting the discharge limitations and requirements of these entities. The activities recommended in this Facilities Plan will not impair state water quality goals, standard and objectives.

Chapter 3 – Current Conditions

3.1 General

The Town of Lincoln is located in the northeast area of Rhode Island, bordered by the Towns of Smithfield and North Smithfield to the west, the city of Woonsocket to the north, the Town of Cumberland to the north and east, the City of Central Falls to the east, and the Town of North Providence and City of Pawtucket to the south. The planning area for this Facilities Plan is the entire Town of Lincoln.

The Town has a rolling topography and is tributary to two major drainage areas, the Moshassuck River and the Blackstone River. Land use within the Town is diverse, ranging from developed urban areas to historic villages to commercial / industrial campuses to suburban and pastoral landscapes. The Town has an extensive existing wastewater collection and conveyance system with approximately 100 miles of gravity sewers and thirty-one pumping stations.

3.2 Planning Area

3.2.1 Geophysical

Climate: Rhode Island experiences all of the four weather seasons with the predominate direction of prevailing weather patterns moving from west to east. The Atlantic Ocean also impacts weather conditions and seasonal transitions due to its proximity to the State. Table 3-1 provides seasonal and annual average temperature and precipitation figures for Rhode Island as reported by the National Climatic Data Center based upon data collected by the National Oceanic & Atmospheric Administration (NOAA) between from 1895 to 2005. Precipitation is distributed evenly throughout the year, with Summer average precipitation only slightly lower than the other three seasons. NOAA data indicates 104ºF and minus-13ºF as the highest and lowest temperatures, and 36.0 inches as the average annual snowfall amount, as recorded for Providence for the 51-year period through 2004.

Table 3-1

Average Temperature and Precipitation
Rhode Island 1895 - 2005

Period	*Temperature (ºF)*	*Precipitation (Inches)*
Winter (Dec-Feb)	30.5	11.1
Spring (Mar-May)	46.1	11.3
Summer (Jun-Aug)	68.2	9.8
Fall (Sep-Nov)	52.9	11.3
Annual	49.4	43.5

Source: NOAA - National Climatic Data Center

Soils: The Soil Survey of Rhode Island published by the U.S. Department of Agriculture National Resources Conservation Service (NRCS), formerly the Soil Conservation Service, presents data on soil properties and characteristics throughout the State. This data was reviewed to determine the soil types and conditions that occur in the Town planning area. The potential for development depends significantly upon these documented soil properties, which establish the suitability for particular land use of the various soil classifications. NRCS classifies various soil groups with common characteristics by series and within each series, soils are subdivided further into phases by texture, degree of slope, and other physical characteristics.

Soils in Lincoln are generally classified as glacial till. Topography generally varies from nearly level to gently sloping to sloping areas. Based on mapped areas, less than 10% of Town soils are identified as very steep with slopes exceeding 15%. The Soil Survey maps and tables identify fifty-six (56) soil phases within the Town. The soil series occurring most frequently in the Town are described further below.

Canton and Charlton is the predominant mapped soil series in Lincoln, occurring on 5,300 acres scattered throughout the Town. This series consists of well drained sandy loams found in areas of varying slope from nearly level to moderately steep. These soils can have a surface layer typically in the range of 2 to 6-inches thick, a subsoil layer from 19 to

25-inches thick, and a substratum to 60-inches and greater depths. Permeability generally is moderate to moderately rapid in the surface and subsoil layers and rapid in the substratum. These soils generally are suitable for community development, except in steeper sloped areas; on-site sewage disposal systems designs must carefully consider potential for effluent seepage to the surface in rock outcrop areas. Canton and Charlton soils are found in areas of irregular shape ranging in size from 5 to 250 acres.

Hinckley series soils are mapped for more than 700 acres in Lincoln and generally are found in areas of irregular shape ranging from 5 to 75 acres in size. This series consists of excessively drained sandy loams occurring in level to hilly areas. Steeper sloped areas are found generally along the Blackstone River and milder slopes are scattered to the westerly side of the Town. Surface layers in this series typically fall between 2 and 6-inches, subsoil layers between 11 and 20-inches, and substratum to 60-inches and greater depths. Permeability is rapid in the surface and subsoil layers and very rapid in the substratum. Hinckley series soils are suitable for community development except in steeper sloped hilly locations. On-site sewage disposal systems require careful design and installation to prevent groundwater pollution, and to prevent effluent seepage to the surface in hilly areas.

Ridgebury series soils are poorly drained sandy loams found in level to nearly level areas in drainageways in glacial uplands. Top surface layer thickness can vary from 4 to 10-inches thick, subsoil layer generally falls between 16 and 18-inches thick, and substratum extends to 60-inches and greater depth. Permeability is moderate to moderately rapid in the surface and subsoil layers, and generally is slow in substratum. These soils are poorly suited to community development due to high water table and low permeability. On-site sewage disposal systems cannot be used without extensive filling. Soils in this series occur in long and narrow shaped areas ranging from 5 to 150 acres in size and are found on over 1,200 acres scattered throughout the westerly and southwesterly areas of the Town.

Sutton series soils are identified on over 800 acres primarily occurring in the southwestern section of Lincoln. These moderately well drained soils are fine sandy loams found in nearly level to gently sloping areas of irregular shape ranging in size from 3 to 150 acres. The surface layer in this series is about 3-inches thick, the subsoil layer is 22-inches, and the substratum extends to 60-inches and beyond. Permeability is moderate to moderately rapid. Seasonal high water table levels to within 20-inches of the ground surface are associated with these soils from late fall to mid-Spring. These soils are suitable for community development but on-site sewage disposal system design and installation requires special consideration of the seasonal high water table conditions.

Urban Land and Urban Land complexes are identified on over 1,850 acres in Lincoln. Urban land consists of developed areas of buildings, roads, parking lots and other urban structures. Areas mapped as Urban Land complexes consist of urban land interspersed with other soil series. The size and distribution of individual areas within the mapped complex area prevents the soil types from being shown separately on the soils maps. Urban Land and Urban Land complex soils are found in densely built up areas of mill village areas, in industrial parks, and in specific use locations including the Amica corporate campus, Davies School, the Community College of Rhode Island, Lincoln Mall and Lincoln Park. Development in Urban Land and Urban Land complex areas requires on site investigations to establish the suitability for specific uses.

Hydrology: The NRCS soil survey identifies four (4) hydrologic soils groups on the basis of infiltration rates as follows.

Group A: Soils having a high infiltration rate / low runoff potential when thoroughly wet consisting of well drained to excessively drained sands or gravels. Group A soils have a high rate of water transmission.

Group B: Soils having a moderate infiltration rate when thoroughly wet consisting of moderately well drained to well drained soils with moderately fine to moderately coarse texture. Group B soils have a moderate rate of water transmission.

Group C: Soils having a slow infiltration rate when thoroughly wet with a layer that impedes downward water movement or have moderately fine to fine texture. Group C soils have a slow rate of water transmission.

Group D: Soils having a very slow infiltration rate / high runoff potential when thoroughly wet consisting of clay soils with a high shrink-swell potential, soils with a permanent high water table, soils with a clay layer at or near the surface, and very shallow soils over nearly impervious materials. Group D soils have a very slow rate of water transmission.

Soils within the Canton and Charlton series are classified as hydrologic Type B soils. Soils within the Hinckley series are classified as Group A soils. Soils within the Ridgebury series generally are Group C soils; the Whitman phase soils within this series are Group D. Soils within the Sutton series are Group B soils. Canton – Urban land complex soils are classified as Group B and Merrimack – Urban Land complex soils are classified as Group A. NRCS does not identify a hydrologic group for Urban Land or Udorthents – Urban Land complex soils. Urban Land generally is comprised of impervious surfaces and Udorthents – Urban Land soils include impervious urban surfaces and disturbed soils that have been cut or filled.

Development in Group A soils must consider the potential for impact to and pollution of groundwater due to high permeability and rapid infiltration rates. On-site sewage disposal systems require special design and construction techniques in Group A soils where public sewers are not available. Some Group B soils with higher permeability rates can require similar special considerations for development. Development in Group C soils must address the lower permeability and slower infiltration rates associated with these soils. Again, special design and construction considerations are necessary for development in

Group C soils where public sewers are not available and on-site sewage disposal is required. Development in Group D soils is restrictive and these soils are not suitable for on-site sewage disposal methods. A majority of the Town soils are classified as Group B. Development constraints based upon soils conditions as mapped by RIGIS are presented in Figure 3-1.

Topography: Topographic characteristics impact significantly upon the design of sewer collection, transmission and conveyance systems. The existing characteristics of ground slope and natural drainage patterns generally dictate the required layout of gravity sewers and necessary locations for pumping stations. The design of sewer systems should utilize the natural slope and drainage patterns to the extent practical to minimize the need for pumping.

The nearly level to sloping soils occurring in Lincoln provide a gently sloping topography that can be well suited to various types of development. Very few areas of Lincoln have slopes greater than 15% and development in the Town generally is not limited due to steeply sloped conditions. However, the rolling terrain of Lincoln has resulted in the many segregated gravity collection systems and thirty-one (31) wastewater pump stations that comprise the Town's existing wastewater facilities.

Lincoln lies within two (2) major drainage basins, the Blackstone River basin and Moshassuck River basin, as depicted in Figure 3-2. In general, the areas north of Route 116 and the easterly side of Town that lies in the river valley drain to the Blackstone River, and the southwesterly areas of Town drain to the Moshassuck River. Twelve (12) of the wastewater pump stations are located in the Blackstone River Basin and nineteen (19) are in the Moshassuck Basin.

Geology: Geologic characteristics also impact upon the design of sewer systems and on-site sewage disposal systems. Shallow depth to bedrock adversely affects the treatment performance of on-site disposal systems were sewer service is not available and can result

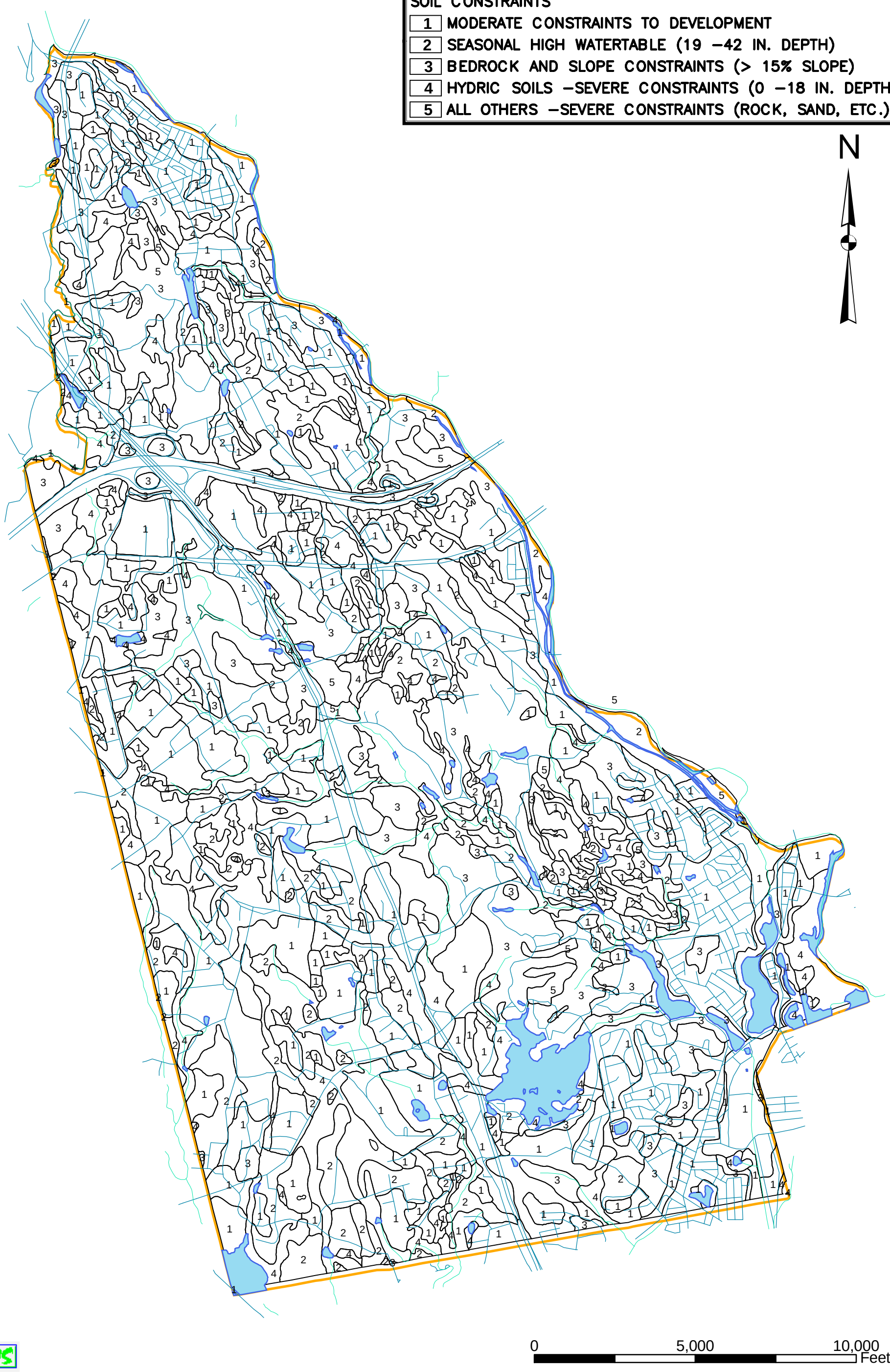

FIGURE NO.
3–1

TOWN OF LINCOLN
Incorporated 1871

WASTEWATER FACILITIES PLAN
SOIL CONSTRAINTS

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in increased construction costs for conventional sewer system installations. While depth to bedrock is greater than 60-inches in most areas, shallower depths and rock outcrops occur in various areas most predominantly in Lincoln Woods State Park north of Olney Pond, and west of Old Louisquisset Pike between Wilbur Road and Route 116.

The geological deposits of Rhode Island primarily were formed from glacial deposits. The geology of the Town of Lincoln generally can be grouped into two classifications, upland till plains and outwash deposits. Upland till plains are characterized by unconsolidated drift deposited by glaciers on hills, ridges, and side slopes. Outwash deposits are areas of stratified materials sorted by ice melt runoff and deposited on terraces, plains and valleys. Upland till soils are found throughout the Town and outwash deposits occur near natural drainage channels and mostly along or near the Blackstone River.

3.2.2 Demographic and Land Use Data

The 2000 Census population was 20,898 residents; the Rhode Island Economic Development Corporation (EDC) reports that 265 of the 8,508 total housing units reported for the 2000 Census were vacant. The US Census Bureau estimates the 2004 population for the Town at 22,188. Utilizing the 2000 Census and EDC data to determine a population density per housing unit results in a figure of 2.54 persons per household. Applying this density to the estimated 2004 population results in approximately 8735 occupied housing units. This Facilities Plan will utilize these figures as baseline existing conditions. Population figures by census tract for the 2000 Census are provided in Table 3-2.

Historically, land use in Lincoln grew from development around the mill villages along the Blackstone River. These villages along with the major transportation corridors through the Town, State Routes 116 and 146, Interstate Route 295, serve as the general framework and boundaries for land use within the Town.

Table 3-2

Population by Census Tract

	1970	1980	1990	2000
Tract 115	4,593	4,717	5,207	6,186
Tract 116	3,079	3,925	4,421	5,701
Tract 117.01	4,740	4,479	4,453	4,859
Tract 117.02	3,770	3,828	3,964	4,152
Total	16,182	16,949	18,045	20,898

In general, lot sizes are smaller and residential density is higher in the mill villages along the Blackstone River than in the areas in the westerly portions of the Town developed more recently. The mill village centers have a mixture of residential, commercial and industrial usage and for the most part are now well developed with limited potential for growth. New industrial development is limited to the industrial corridor generally bounded by State Route 116 and Interstate Route 295, and the industrial parks along Albion Road. Residential land use is dominant throughout the rest of the Town interspersed with specific areas of institutional, commercial and recreational uses. Table 3-3 provides an inventory by acreage for residential and business land use categories.

Table 3-3

Residential and Business Land Use Inventory

Category	1995 Acres
Residential	3,298
Business	919
Total	4,217
Residential to Business Land Use Ratio	3.6

Source: Town of Lincoln, RI 2003 Comprehensive Plan

3.2.3 Surface Water

The Town of Lincoln has various inland water surface bodies within its borders. The most prevalent surface water body is the Blackstone River, which forms the Town's municipal boundary to the east. Other significant inland surface water bodies lying either fully or in part within the Town of Lincoln include the Moshussuck River, West River, Crookfall Brook, Barney Pond, Olney Pond, Handy Pond, Scott Pond and Wenscott Reservoir, as well as various other small ponds, creeks and drainage tributaries. No coastal surface water occurs within the Town.

The major drainage basins and the tributary areas of the Town of Lincoln are depicted on Figure 3-2. The Town lies within the major drainage basins of the Blackstone River and Moshassuck River. Generally, the easterly portion of the Town lies in the valley that slopes directly to Blackstone River. The northwesterly area of Town also is tributary to the Blackstone River via the Town Line Swamp and Crookfall Brook. The southwesterly area of the Town generally bounded to the east by State Route 123 (Jenckes Hill Road) and State Route146 drains to the Moshassuck River via the West River, the Wenscott Reservoir, and several smaller tributaries. The remaining area of the Moshassuck basin generally lies east of State Routes 123 and 146 and west of the Blackstone basin. This area drains to the Moshassuck River directly and via various tributaries including streams from Olney Pond and Barneys Pond.

RIDEM has established surface water criteria in the Water Quality Classification Descriptions dated August 6, 1997 provided as Appendix A of the current State Water Quality Regulations. All surface waters of the state are categorized according to the water use classifications of the regulations based on considerations of public health, recreation, propagation and protection of fish and wildlife, and economic and social benefit.

RIDEM Freshwater Use Classifications are as follows:

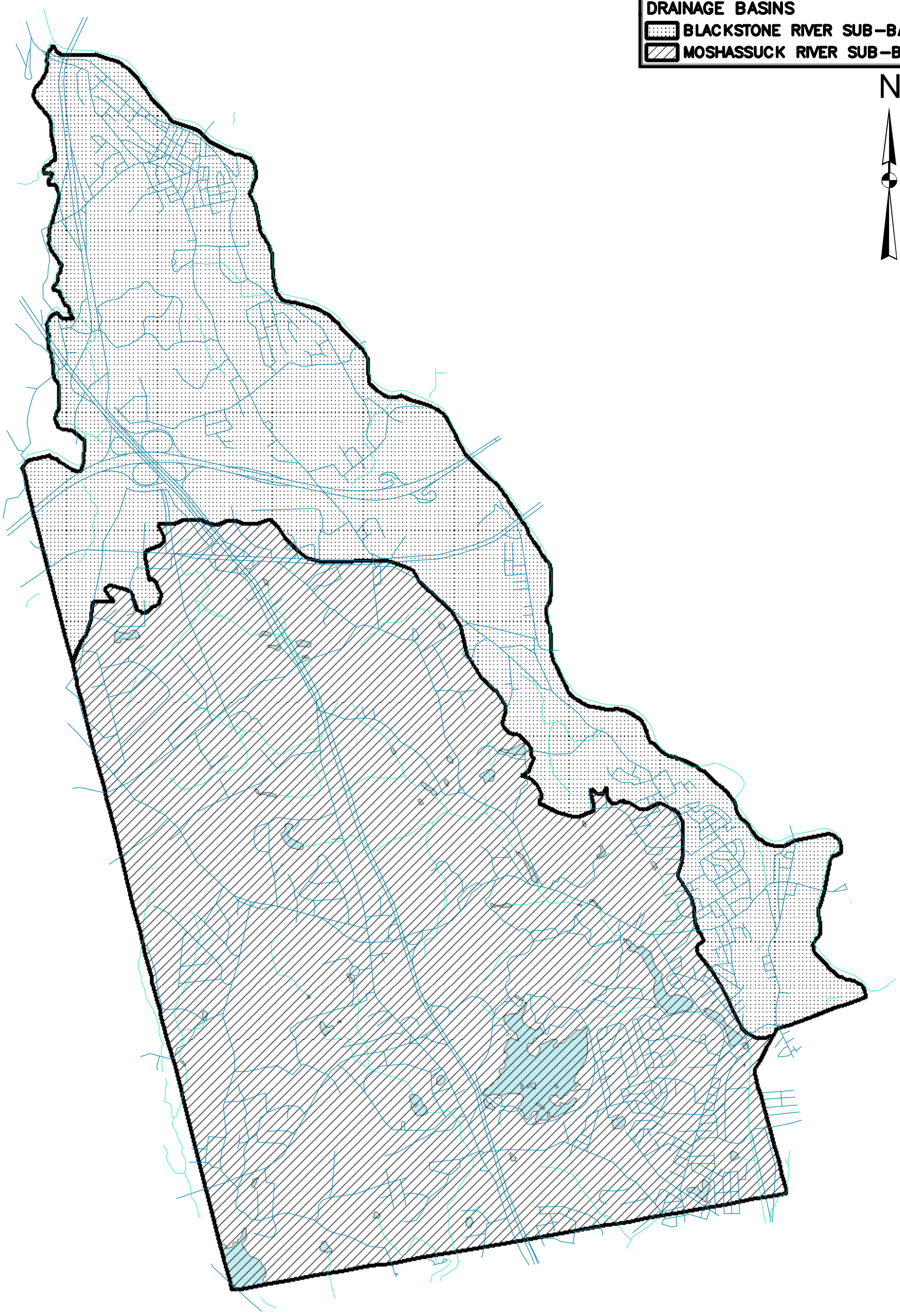

FIGURE NO.
3-2

TOWN OF LINCOLN
Incorporated 1871

WASTEWATER FACILITIES PLAN
DRAINAGE BASINS

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- Class A – These waters are designated as a source of public drinking water supply, for primary and secondary contact recreational activities and for fish and wildlife habitat. They shall be suitable for compatible industrial processes and cooling, hydropower, aquacultural uses, navigation, and irrigation and other agricultural uses. These waters shall have good aesthetic value.

- Class B – These waters are designated for fish and wildlife habitat and primary and secondary contact recreational activities. They shall be suitable for compatible industrial processes and cooling, hydropower, aquacultural uses, navigation, and irrigation and other agricultural uses. These waters shall have good aesthetic value.

- Class B1 – These waters are designated for primary and secondary contact recreational activities and fish and wildlife habitat. They shall be suitable for compatible industrial processes and cooling, hydropower, aquacultural uses, navigation, and irrigation and other agricultural uses. These waters shall have good aesthetic value. Primary contact recreational activities may be impacted due to pathogens from approved wastewater discharges. However all Class B criteria must be met.

- Class C – These waters are designated for secondary contact recreational activities and fish and wildlife habitat. They shall be suitable for compatible industrial processes and cooling, hydropower, aquacultural uses, navigation, and irrigation and other agricultural uses these water shall have good aesthetic value.

The Blackstone River from the Massachusetts border through Lincoln and into Central Falls is classified by RIDEM as B1. Scott Pond and its tributaries are Class B waters. Crookfall Brook including Woonsocket Reservoir No. 3 and its headwaters is Class A. The Moshassuck River from its headwaters, including Bleachery and Barney Ponds in Lincoln is a Class B waterbody. Olney Pond in Lincoln Woods State Park is Class B. The West River headwaters in Lincoln and the Wenscott Reservoir are also Class B waters.

RIDEM has not classified any waters as Class C in Lincoln. The RIDEM Water Quality Regulations also stipulate that all streams tributary to Class A waters shall be Class A waters; all freshwaters hydrologically connected by surface waters and upstream of Class B waters shall be Class B waters unless otherwise identified; all other fresh waters, including, but not limited to, ponds, kettleholes and wetlands not listed in the regulations shall be considered as Class A.

Rhode Island is required to develop a list of impaired waters for the State in accordance with the requirements of Section 303(d) of the federal Clean Water Act. The list identifies waterbodies that may not meet current state water quality standards for aquatic life, drinking water supply, shellfishing, fish consumption and swimming.

RIDEM published the 2004 303(d) List of Impaired Waters - Final in May 2005. This list identifies Scott Pond, Barney Pond and the Blackstone River as surface water locations within Lincoln that do not attain state standards. The cause(s) identified by RIDEM for not meeting the state water quality standards for these water is listed in Table 3-4.

Table 3-4

List of Impaired Waters

Water Body	*Impairment*
Scott Pond	Low Dissolved Oxygen, Excess Algal Growth, Phosphorus
Barney Pond	Phosphorus
Blackstone River	Copper, Pathogens, Biodiversity Impacts, Lead

Additionally, the 2004 303(d) List identifies sections of the Moshassuck River and West River as not meeting state standards for pathogens. However, the RIDEM description of the impaired sections of these rivers identifies locations downstream of the portions of these waterbodies within the Town. The 2003 Comprehensive Plan indicates that area of the upper reaches of the Moshassuck River and Limerock Quarry area are noted for good

water quality. RIDEM has assisted the Blackstone River Watershed Council in development of a Draft Blackstone River Watershed Action Plan with the objective to restore impaired sections, including implementing the Total Maximum Daily Load (TMDL) process, of the Blackstone River and its tributaries.

The RIDEM 2004 Section 305(b) State of the State's Waters Report indicates that the beach at Lincoln Woods was closed for six days during 2002 and that the beach at Camp Meehan was closed seventeen days during 2003 due to elevated fecal coliform bacteria levels. The report identifies elevated rainfall and temperatures for Lincoln Woods in 2002 and wildlife for Camp Meehan in 2003 as problems related to the beach closures.

3.2.4 Groundwater

RIDEM establishes and regulates groundwater quality standards and divides groundwater into the following four (4) classifications: GAA, GA, GB and GC.

Groundwater that is protected to maintain drinking water quality is classified as GAA and GA. Class GB and GC groundwaters are known or presumed as unsuitable drinking water sources. Groundwater aquifers in Lincoln are stratified drift type. Areas overlying groundwater aquifers and groundwater aquifer recharge areas within the Town of Lincoln are depicted on Figure 3-3.

Class GAA groundwater resources are known or presumed to be suitable for drinking water use without treatment and are located in one of the following three areas.

- The states's major stratified drift aquifers that are capable of servicing as a significant source for a public water supply ("groundwater reservoirs") and the critical portion of their recharge area as delineated by RIDEM
- The RIDEM delineated wellhead protection area for each community water supply well or another delineation accepted by RIDEM

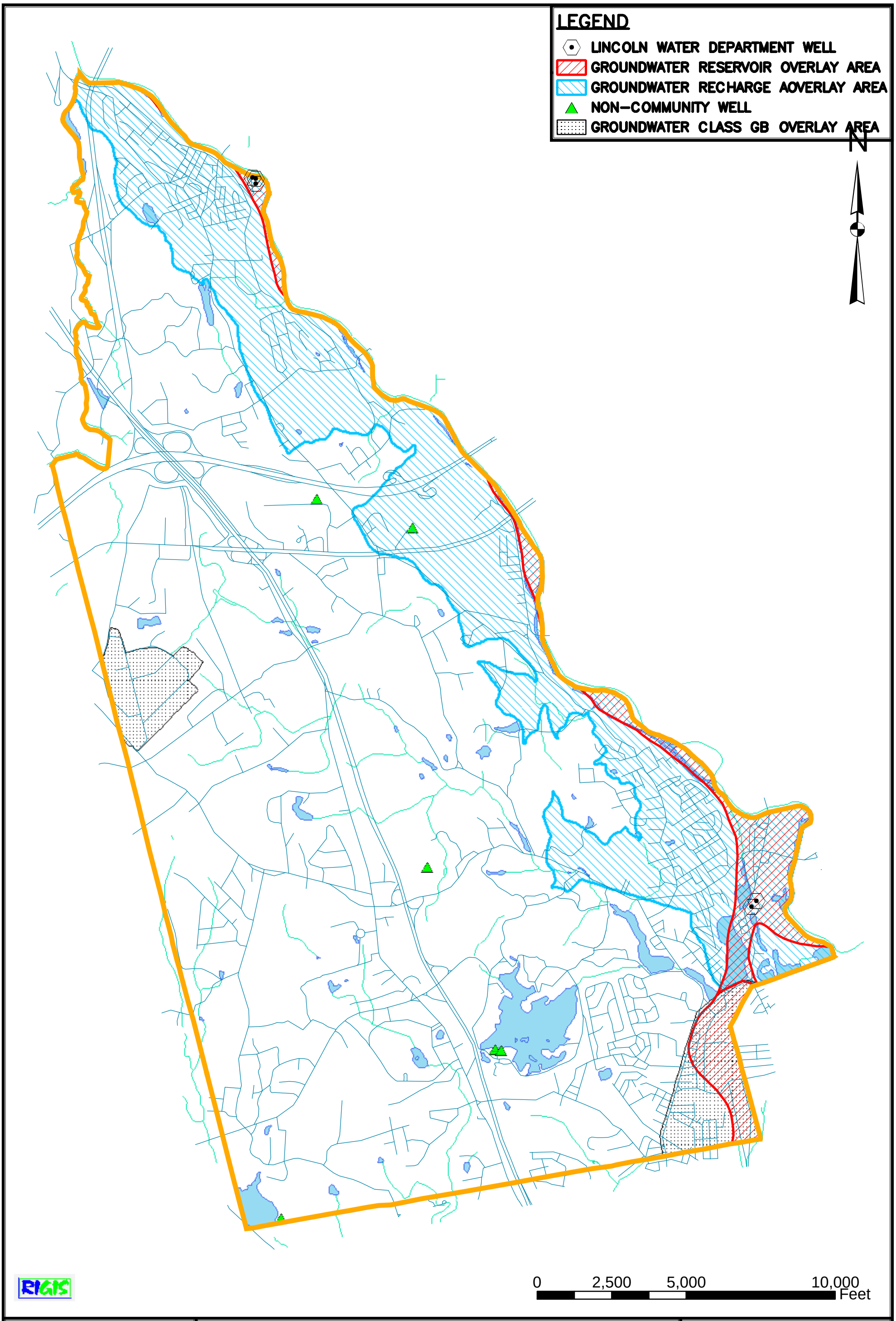

FIGURE NO.
3-3

TOWN OF LINCOLN Incorporated 1871

WASTEWATER FACILITIES PLAN
GROUNDWATER AQUIFERS

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- Groundwater dependent areas that are physically isolated from reasonable alterative water supplies and where the existing groundwater warrants the highest level of protection.

Approximately 23% of groundwater area within the Town is Class GAA. Areas classified as GAA occur along the easterly side of Lincoln in the general vicinity of the Blackstone River.

Class GA groundwater resources are known or presumed to be suitable for drinking water use without treatment, but do not fall within any of the three priority areas associated with Class GAA resources. Approximately 71% of groundwater area within the Town is Class GA. When combined with GAA areas, approximately 94% of the groundwater areas within the Town are known or presumed to be suitable drinking water sources without treatment.

Class GB groundwater is groundwater that may not be suitable for drinking water use without treatment due to known or presumed degradation. RIDEM utilized data from known sources of contamination and land use in delineating Class GB areas. All Class GB areas are served by public water supply systems. Remediation of Class GB areas to restore drinking water quality is not mandated, but may be necessary to address public health and environmental considerations. Class GB groundwater areas in Lincoln occur at the industrial area in the vicinity of Wellington, Powder Hill and Albion Roads, and in the Saylesville and Fairlawn sections east of Smithfield Road and Walker Street. Less than 4% of the groundwater areas in Lincoln are Class GB.

Class GC groundwater is or may be unsuitable for drinking water use due to certain waste disposal practices that are associated with RIDEM permitted solid waste landfills. No Class GC groundwater areas occur in Lincoln.

Locations occur within Class GAA and GA areas where groundwater conditions do not meet the appropriate standards for these classes due to contamination associated with specific sources. The groundwater classification for these non-attaining areas remains GAA or GA and the goal is to restore the water quality to compliance with the applicable standards. Groundwater non-attaining areas include portions of Quinnville and Lonsdale along the Blackstone River impacted by the Peterson Puritan Superfund site and areas impacted by various releases from the industrial parks at Wellington Drive, Powder Hill Road, and Albion Road. EPA groundwater treatment and monitoring associated with the Peterson Puritan Superfund site is expected to continue for 20 to 30 years. Some cleanup reportedly has occurred at sites in the industrial park. Several sites in Lincoln are listed as awaiting priority determination for eligibility for funding under the EPA Superfund program.

Lincoln receives most of its water from the Scituate Reservoir, but does utilize groundwater from well sources in Town to supplement supply as needed. Lincoln's Zoning Ordinance (adopted November 15, 1994) has been amended to include a watershed and wellhead protection district. New construction and substantial alternation to structures or buildings within this district is subject to an additional review by the Zoning Enforcement Officer. The review addresses minimizing the flow of runoff into the water supply, removing or prohibiting any potentially polluting uses, and assuring consistency of development with the Lincoln Comprehensive Plan.

3.2.5 Water Use

Water use records can be used to estimate generated wastewater flow rate volumes in the absence of metered wastewater flow data. The Lincoln Water Commission provides public drinking water in the Town of Lincoln. The Lincoln Water Commission is not affiliated with the municipal government of the Town and is not funded by local taxes. The Lincoln Water Commission provided the information presented in Table 3-5 for metered flow billed to its customers in 2004.

The primary source of public water supply in Lincoln is via direct wholesale purchase from the Providence Water Supply Board. The Lincoln Water Commission also utilizes Well No. 4 in Lonsdale as a supplemental source of supply. Historically, 90 to 95 percent of the water consumed is from the Providence Water Supply Board wholesale source and 5 to 10 percent from Well No. 4. The Lincoln Water Commission maintains other wells in Lonsdale and Manville in "inactive" status for emergency use in the event of the failure of all other sources. Public water is available to nearly 100 percent of the Town and approximately 95 percent of the Town is connected to the system.

Table 3-5

2004 Water Consumption

Water District	*Accounts*	*Total Gallons*
Saylesville	1376	113,129,113
Lonsdale	987	77,627,918
Manville, Albion, Fairlawn	1618	150,608,915
Limerock	1597	168,326,907
Apartments	237	55,114,600
Commercial (Monthly)	56	155,323,700
Commercial (Quarterly)	76	29,207,700
Commercial (Annual)	128	9,601,300
Total Billed	6075	758,940,153

The water use data in Table 3-5 reveals higher per service residential water use in the Limerock and Manville, Albion, Fairlawn water districts. This difference is attributed to non-consumptive water uses, such as swimming pools and landscape watering that typically are less prevalent in higher density residential areas. The average residential service (excluding apartments) used approximately 250 gpd based upon metered water use and number of service connections, and the average residential service used 185 gpd based upon serving 21,079 people (95 percent of 2004 population) and a density of 2.54 person/unit, or approximately 73 gpd per person. This Facilities Plan will utilize a water

use figure of 200 gpd per residential water service for future water use projections. This figure is approximately 80 gallons per person per day based upon the density of 2.54 person/unit, and is consistent with water use figures indicated the Comprehensive Plan.

The Comprehensive Plan identifies a total of 1,727 acres available for business use and 919 acres of current business land use in 1995, or approximately 53 percent of the total available commercial land. Utilizing commercial coverage and water use figures indicated in the Comprehensive Plan and adjusting to account for lower density coverage of commercial recreational zones results in an estimate of 957 acres of current commercial land use. This estimate represents approximately 55 percent of the total available commercial land and compares favorably with the documented land use for 1995. 2004 Commercial water consumption was approximately 767 gpd/acre based upon metered water use and adjusted for commercial recreation zones. The average commercial water service used approximately 2,040 gpd based upon metered water use. This Facilities Plan will utilize a water use figure of 1,500 gpd/acre for future commercial water use projections.

3.2.6 Environmental Conditions

3.2.6.1 Air Quality

Rhode Island is in compliance with the National Ambient Air Quality Standards (NAAQS) established under the federal Clean Air Act for all categories except Ozone according to RIDEM Office of Air Resources. RIDEM indicates that the entire state is in non-attainment for this category and Ozone levels are a concern throughout Rhode Island as well as neighboring states. Ozone problems are associated with motor vehicle exhaust and industrial emissions. RIDEM has implemented a plan for compliance with the NAAQS for Ozone and reports that Rhode Island is on track for attainment by 2007. Because Ozone and pollutants that form it can be transported hundreds of miles by wind currents, Ozone levels and attainment of NAAQS for Ozone in Rhode Island are dependent on upon emissions from upwind states. The RIDEM Ozone attainment plan identifies one facility

in Lincoln, BICC General Cable, in the Rhode Island VOC Point Source Emission Inventory.

Odorous emissions from wastewater conveyance facilities also are an air quality concern. Many of the Town's pump stations are located in residential areas in close proximity to adjacent homes and odor complaints can be problematic with these conditions. While odor complaints have been received for various facilities, the Town does not identify odors as an issue of concern or recurrent problem for any specific location.

3.2.6.2 Noise Levels

Specific noise studies were not conducted for this Facilities Plan. High traffic volume along major highway Routes 295, 146 and 116 in the planning area can be a source of noise. Air traffic to and from the North Central Airport and industrial processes in the adjacent industrial park also can be noise sources. The higher density of development in the mill villages also is associated with higher traffic volumes and increased noise levels. Noise levels are not considered to be an issue of concern with respect to this Facilities Plan.

3.2.6.3 Wetlands

Lincoln has a variety of wetlands areas scattered throughout the Town, with approximately 15% of the total land area identified as wetlands. Wetlands occur where water covers or is very near the soil surface for varying periods and include open water areas, such as rivers, ponds and streams, and vegetated areas, such as swamps and forested wetlands. Wetlands are valuable natural resources that serve to store water and control flooding during wet weather, maintain stream flow during dry periods, and filter and treat nutrients and stormwater pollutants, which is beneficial in maintaining both surface and groundwater quality. Wetlands provide habitat and support a wide array of plant and animal species and also have important aesthetic and recreational value. Mapped wetlands areas in Lincoln are shown on Figure 3-4.

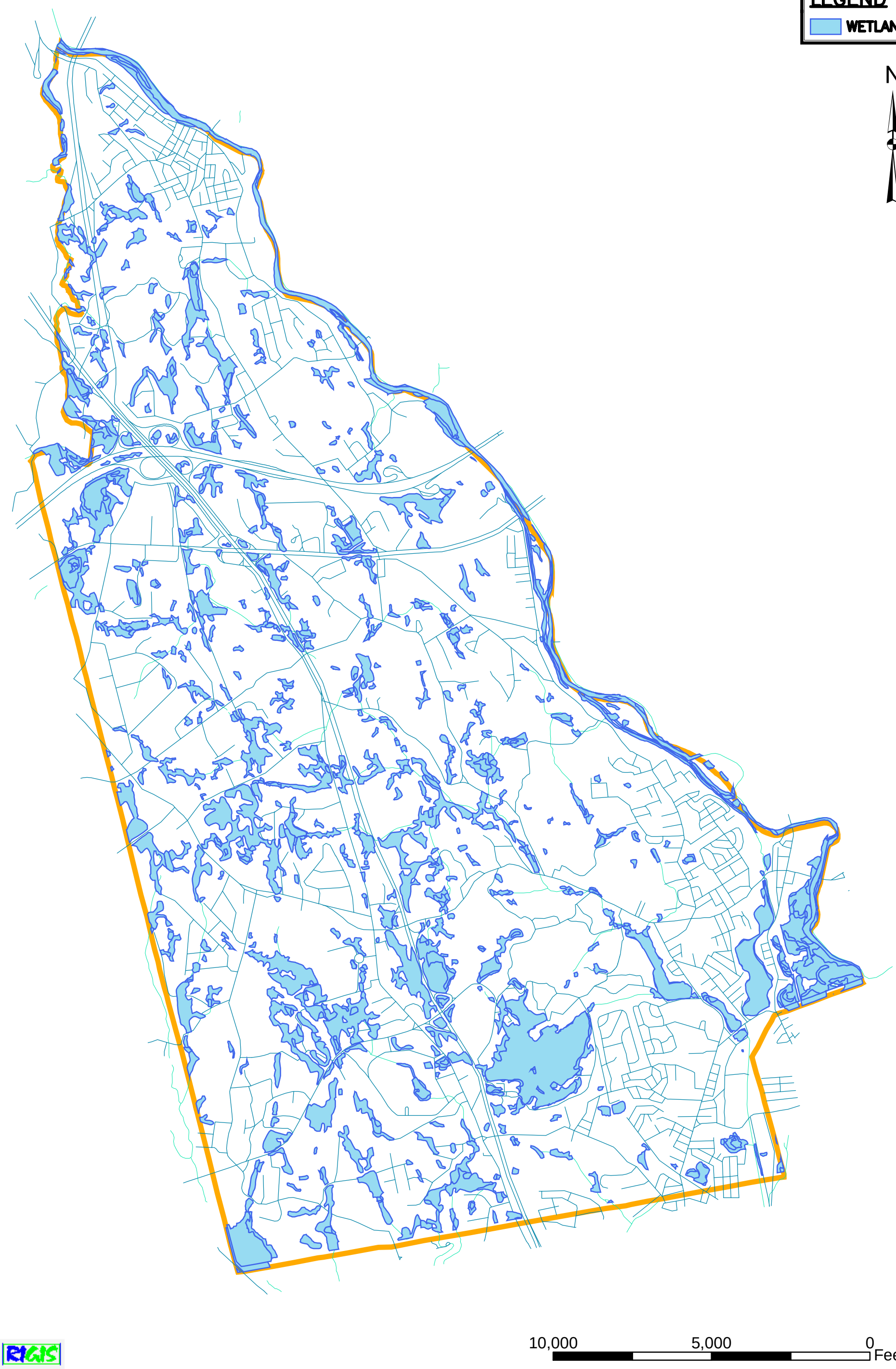

FIGURE NO.
3–4

TOWN OF LINCOLN
Incorporated 1871

WASTEWATER FACILITIES PLAN
WETLANDS AREAS

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Palustrine System wetlands, as defined by the United States Geologic Survey (USGS), is the dominant wetlands classification occurring in Lincoln. Palustrine wetlands include all non-tidal wetlands dominated by trees and shrubs traditionally identified as marsh, swamp, bog, fen and prairie, and also include small shallow water bodies often called ponds. Over 70% of the wetlands in Lincoln fall within the Palustrine classification. The remaining wetlands fall under the Riverine and Lacustrine Systems defined by USGS. Riverine Systems include wetlands habitats not dominated by vegetation that are contained in a channel. Water usually, but not always, is flowing in Riverine wetlands. Lacustrine Systems include wetlands habitats situated in a topographic depression that have vegetative coverage of less than 30% in area. Lacustrine wetlands generally are greater than 20 acres in size. Lacustrine and Riverine wetlands respectively account for approximately 20% and 7.5% of the wetlands in Lincoln. No Estuarine (coastal) or tidal wetlands are identified in Lincoln.

Wetlands can become clogged and degraded if they are overloaded. Development must be sensitive to wetlands habitat to prevent overloading from surface runoff or wastewater effluents, as well as filling and water diversion that can reduce the capacity of the wetlands and also result in overloading. Development in wetlands is strictly regulated and wetlands generally are not suitable for on-site sewage disposal systems because high water tables. However, where development occurs in areas where public sewers are not available and is in the vicinity of wetlands habitats, special considerations need to be taken in the design of on-site sewage disposal systems in order to prevent negative impacts.

The Town has identified the following areas of special concern for protection of wetlands:

- The periphery area of Lincoln Park that be reused at some point in the future.
- Conklin Quarry, where wetlands now are protected as open space.
- Lonsdale Marsh Restoration Project along the Blackstone River (site of former Lonsdale Drive-In).

- Moshassuck River Valley in East Limerock where much of the remaining developable land is found.
- The West Limerock and Twin River areas and Crookfall Brook watershed along Route 146 where infill development may occur.

3.2.6.4 Floodplains

Floodplains provide water storage when the capacity of rivers and streams channels is exceeded. The Federal Emergency Management Administration (FEMA) defines 100-Year Flood as the flood elevation that has a 1% chance of being equaled or exceeded each year. Areas mapped within the 100-Year floodplain in Lincoln occur along the Blackstone River, Moshassuck River and Crookfall Brook. Little developable land is located in the 100-year floodplain. Figure 3-5 depicts FEMA floodplains in Lincoln.

3.2.6.5 Historical and Archaeological Significance

The Town of Lincoln has many locations, sites and structures of historical and archeological importance. The Comprehensive Plan provides a detailed listing of Historic Resources of Lincoln based upon information gathered from the Rhode Island Historical Preservation Commission, the Blackstone River Valley National Heritage Corridor Commission and the National Register of Historic Places. The following areas are identified as National Register Districts in Lincoln:

Albion Historic District	Blackstone Canal Historic District
Great Road Historic District	Limerock Village Historic District
Lonsdale Historic District	Old Ashton Historic District
Saylesville Historic District	Crookfall Brook District *
Lincoln Woods State Park *	

* - Candidate eligible for listing or being considered for eligibility.

The Blackstone River Valley National Heritage Corridor Commission was established in 1986 by the United States Congress. The Blackstone River Valley National Heritage

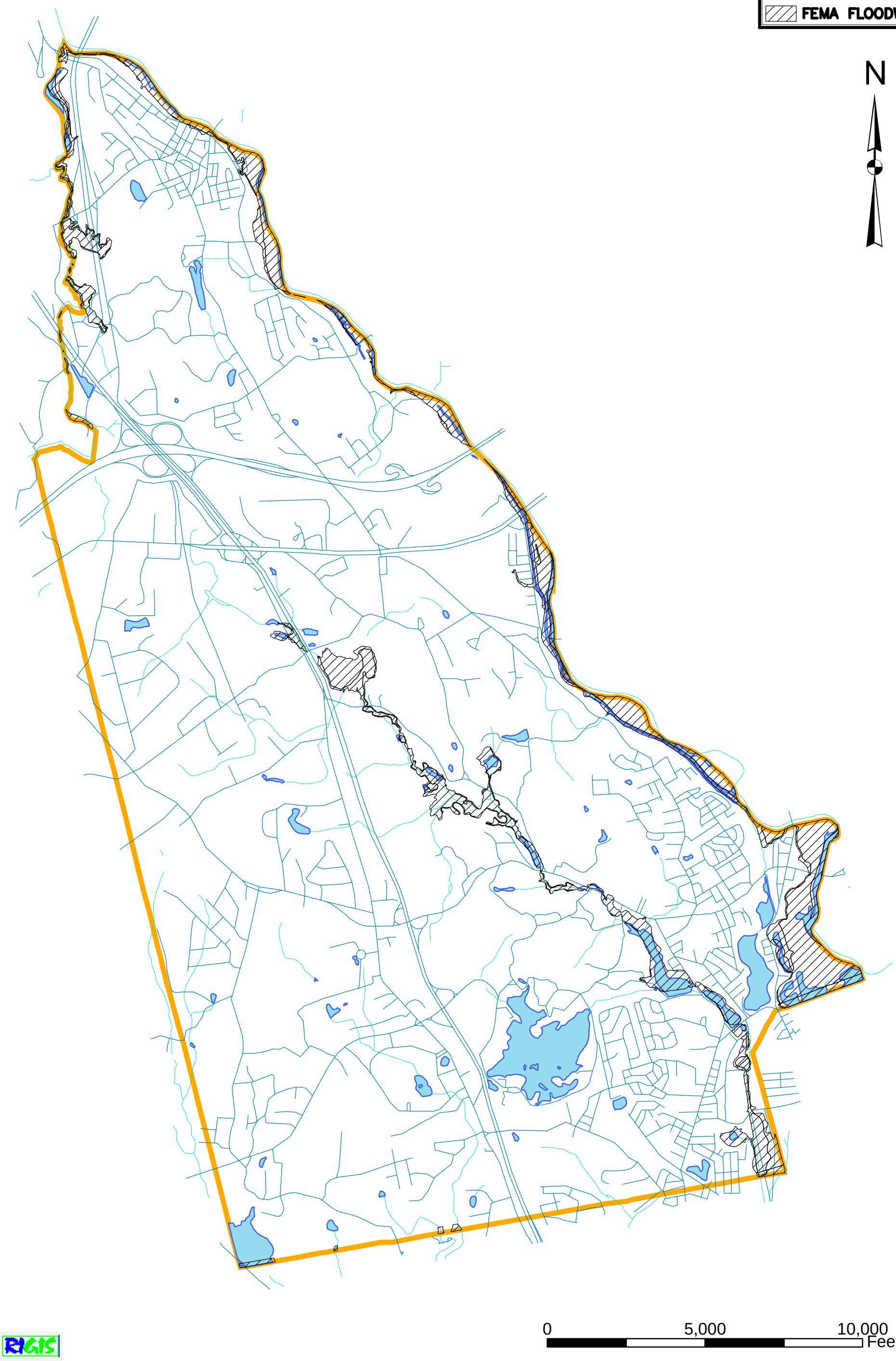

FIGURE NO.
3–5

TOWN OF LINCOLN
Incorporated 1871

WASTEWATER FACILITIES PLAN
100 YEAR FLOOD WAY

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Corridor is an affiliated area of the National Park System comprised of communities located along the river in both Massachusetts and Rhode Island, including Lincoln. The Blackstone River Valley National Heritage Corridor Commission promotes tourism and preservation of historic resources throughout the Corridor, and is committed to improving the health of the river system.

In addition to locations and structures of historical importance, Native America artifacts have been found at sites in Lincoln. The Rhode Island Historical Preservation Commission should be consulted for determination of potential impacts when considering development in areas of known or suspected archeological importance. Figure 3-6 depicts areas of historical and archeological significance.

3.2.6.6 Energy Use

Detailed energy usage studies were not performed for this Facilities Plan. The primary energy sources utilized in Rhode Island include electricity, petroleum, natural gas and propane, and coal. The Rhode Island Statewide Planning Program reports that petroleum products historically provide approximately three quarters of the states's primary energy consumption. Petroleum uses include transportation, heating, and fuel for power plants. Electric utility service is provided by National Grid. Natural gas utility service is provided by New England Gas Company where service is available. Fuel oil and propane are provided by various independent suppliers.

In addition to established energy efficiency policies, government agencies are promoting the use and investigation of alternative fuel sources in effort to reduce dependence on petroleum based fuels while maintaining energy supplies to support economic growth and prevent service disruptions. It expected that energy use in the Town generally will follow and reflect that of the State, including changes to alternative fuels, as they may develop.

The Town reports fluctuations in the electric utility power to various pump station locations have been observed that have resulted in interruptions to pumping operations.

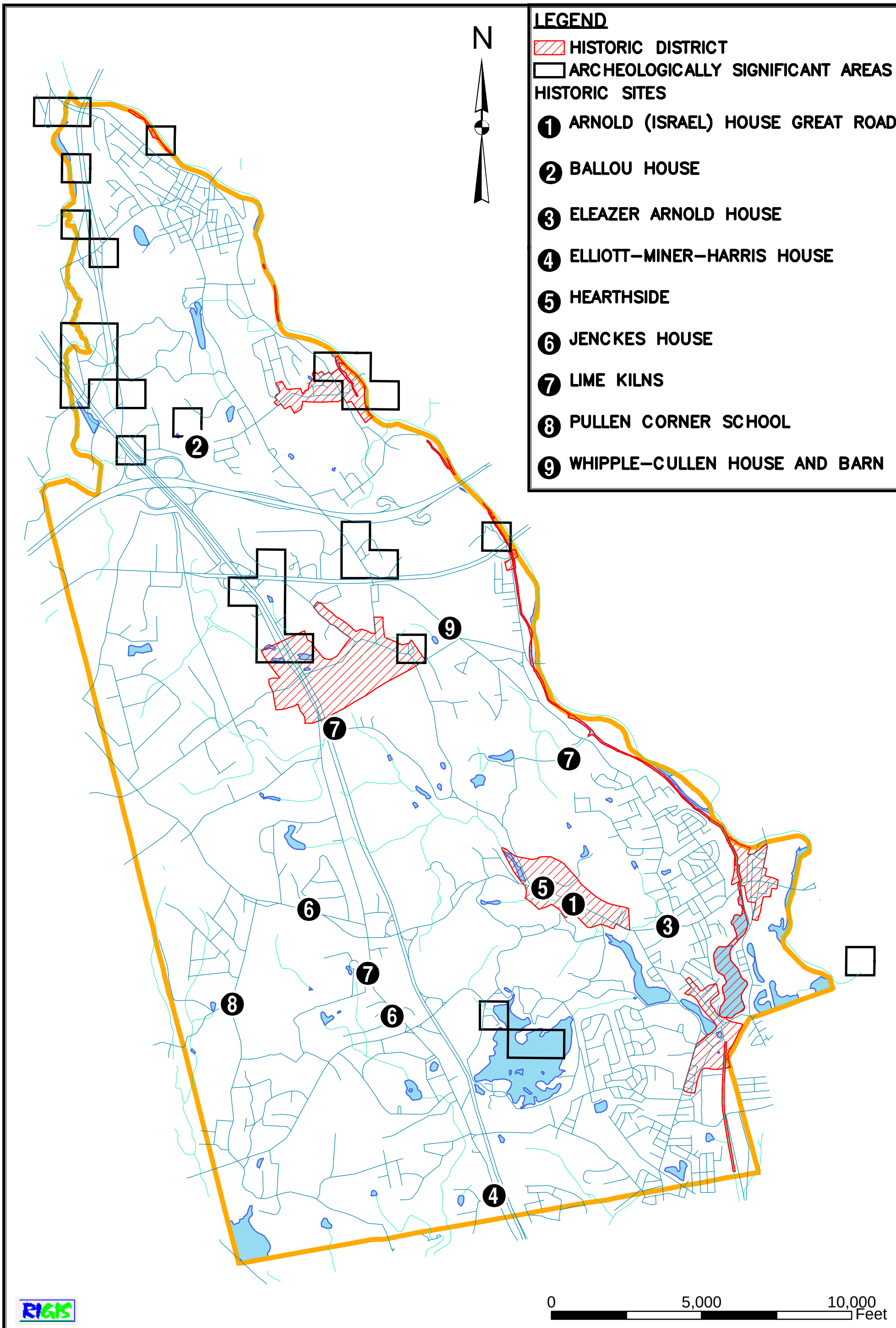

FIGURE NO.
3-6

WASTEWATER FACILITIES PLAN
ARCHEOLOGICAL & HISTORIC AREAS

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The Town has identified concerns regarding recurrent failures, 'brown outs' or other power reductions to National Grid in effort to address these concerns to assure continuous pumping operations. National Grid has replaced utility power equipment components in the vicinity of some of the Town's stations, which apparently has reduced the occurrence of power reductions or failures that result in interruption of pumping operations. The Town has found that the utility service / pumping operation interruptions may be associated with operations and maintenance activities performed periodically by National Grid. In effort to coordinate these activities so that appropriate measures can be implemented in advance in order to maintain continuous pumping operations, the Town has requested that National Grid notify the Sewer Department when the activities that have been associated with pumping operation interuptions are scheduled to occur.

3.2.6.7 Related Projects

Related projects that are ongoing or anticipated to occur in the near future include:

- NBC Interceptor Sewers Capacity Analysis
- NBC Washington Highway Pump Station Improvements
- NBC Bucklin Point WWTF Improvements
- NBC Interceptor Cleaning, Inspection, Repairs
- RIDOT Route 146 / 116 Interchange Reconstruction
- RIDOT Berkeley and Martin Street Bridge Replacement
- RIDOT Smithfield Avenue Resurfacing (Woodland Street to Front Street)
- RIDOT Route 246 Resurfacing (Breakneck Hill Road to Route 116)
- RIDOT School Street Resurfacing (Main Street to Route 126)
- RIDOT Railroad Street Resurfacing (Main Street to Old River Road)
- RIDOT Blackstone River Bikeway Segment 7A
- RIDOT Blackstone River Bikeway Segment 4A

The NBC Interceptor Sewer Capacity Analysis project includes collecting flow metering data at various locations of its interceptor system in order to evaluate existing sewage and

extraneous flows and quantify available capacity. Conditions assessment and evaluation of interceptor repair and replacement alternatives also are to be conducted. These studies could have significant impact upon the Town if NBC identifies substantial extraneous flows and determines the sources to be within Lincoln's sewers. Particular attention should be paid to the Louisquisset Interceptor evaluation to ensure that the Town's sewerage needs are addressed fully by the final recommendations. Other NBC projects involve maintenance, upkeep and improvements to existing facilities. Immediate impacts due to construction activities may be observed on projects occurring within the Town. These projects are expected to have a positive impact on Lincoln's wastewater facilities by establishing more accurate system data and providing for long-term reliability of the NBC facilities.

The RIDOT projects are not expected to have substantial impact upon this Facilities Plan. For the most part, the highway projects involve maintenance or improvement of existing roadways that should not result drastic traffic increases or changes in overall traffic patterns. The existing sewers in the segment of Smithfield Avenue to be reconstructed were installed during the major sewer system construction projects in the 1980s. These sewers should be in satisfactory condition to remain in service, but there are older sewers in some connecting streets. Summer 2006 construction is anticipated for this project, therefore assessing the sewer system conditions and coordinating any necessary replacement to occur coincide with the roadway construction may not be possible.

Much of the segment of Route 246 (Old Louisquisset Pike) to be resurfaced has sewers that were installed during the major sewer system construction projects that also are expected to be in satisfactory condition. However, there are no sewers in Old Louisquissett Pike extending approximately 1,800 feet north from Breakneck Hill Road. If sewers are to be extended to this area in the future, the possibility of coordinating the work with the roadway resurfacing project should be investigated and implemented to the extent practical. Similarly, any necessary repair or replacement of sewers in Railroad Avenue and School Street should be coordinated with these respective RIDOT projects.

The non-highway projects associated with bike and walking paths serve to enhance recreational accessibility and should have no impact on this study. However, the Town should monitor all individual projects, whether highway or non-highway, with respect to existing sewer systems in the vicinity of construction activities for potential impacts. Of particular importance and concern is protection of existing manholes, frames and covers so that these remain fully functional and are not buried or paved over. Start of construction for Bikeway Segments 7A and 4A are scheduled for Spring 2006 and Summer 2006 respectively.

3.2.6.8 Rare and Endangered Species

Information on rare and endangered species habitats in Lincoln obtained from the Rhode Island Natural Heritage Program and RIDEM is presented in the 2003 Comprehensive Plan. RIDEM was contacted and confirmed that the information included in the Comprehensive Plan remained valid. The Limerock Quarry area is identified as the only significant limestone outcropping in Rhode Island and provides habitat for various rare plant species. The Lonsdale Marshes are identified as one of the largest freshwater marshes in Rhode Island and provide habitat to several species of rare birds. The following list of rare species found in Lincoln are identified in the Comprehensive Plan:

Agalinis Acuta	Sandplain Gerardia
Adlumia Fungosa	Climbing Fumitory
Aralia Racemosa	Spikenard
Asplenium Rhizophyllum	Walking Fern
Galearis Spectabilis	Showy Orchis
Pellaea Atropurpurea	Purple Cliff-Brake
Hirundo Pyrrhonota	Cliff Swallow
Asclepias Quadrifolia	Four-Leaved Milkweed
Coeloglossum Virde Var Virescens	Long-Bracted Green Orchis
Corallorhiza Odontorhiza	Autumn Coralroot
Coreopsis Rosea	Pink Tickseed
Cypripedium Pubescens	Large Yellow Lady's-Slipper
Desmodium Ciliare	Small-Leaved Tick-Trefoil

Gentianopsis Crinita	Fringed Gentian
Liparis Liliifolia	Lily-Leaved Twayblade
Liparis Loeselii	Yellow Twayblade
Platanthera Hyperborea	Northern Green Orchid
Triosteum Aurantiacum	Wild Coffee
Anas Crecca	Green-Winged Teal
Cistothorus Palustris	Marsh Wren
Ixobrychus Exilis	Least Bittern
Porzana Carolina	Sora
Actaea Rubra	Red Baneberry
Anemone Cylindrica	Long-Fruited Anemone
Botrychium Lasnceolatum Var Angustisegmentum	Triangle Grape-Fern
Botrychium Matricariifolium	Daiseyleaf Grape-Fern
Botrychium Simplex	Dwarf Grape-Fern
Corallorhiza Maculata	Large Coralroot
Cornus Rugosa	Round-Leaved Dogwood
Hedeoma Pulegioides	American Pennyroyal
Hottonia Inflata	Featherfoil
Juncus Debilis	Weak Rush
Ulmus Rubra	Slippery Elm
Asplenium Trichomanes	Maidenhair Spleenwort
Equisetum Sylvaticum	Woodland Horsetail
Hepatica Nobilis Var Obtusa	Hepatica
Matteuccia Struthiopteris	Ostrich Fern
Platanthera Psycodes	Small Purple Fringed Orchid
Sanguinaria Canadensis	Bloodroot
Saxifraga Virginiensis	Early Saxifrage
Sorghastrum Nutans	Indian Grass
Zizia Aurea	Golden Alexanders
Agrimonia Pubescens	Hairy Agrimony
Castilleja Coccinea	Painted Cup
Eupatorium Aromatucum	Snakeroot
Geum Laciniatum Var Trichocarpum	Hairy Herb-Bennet
Linnaea Borealis Ssp Americana	Twinflower
Parnassia Glauca	Grass-Of-Parnassus
Spiranthes Lucida	Shining Ladies'-Tresses
Southern New England Rich Mesic Forest	Southern New England Rich Mesic Forest

Protection of these rare or endangered species and their habitat should be included when considering and evaluating potential future development.

3.3 Wastewater Systems

The Comprehensive Plan reports that municipal sewers are available to approximately 99% of the geographic area of the Town and Town personnel estimate that approximately 95% of the Town is connected to the public sewer system. Areas isolated from the municipal sewer systems are served by individual sewage disposal systems (ISDS). There also are properties that remain served by ISDS scattered within sewered areas. Town ordinance requires properties where existing ISDS systems have failed to connect to the sewer system where public sewers are available. Existing sewers include: sewers constructed prior to 1900, normally found in older mill village center areas; sewers constructed in the 1960s to serve industries in the area of Wellington and Powder Hill Roads; sewers constructed by the Blackstone Valley Sewer District Commission (BVSDC) during regionalization projects in the 1970s, which now are owned and operated by NBC; and sewers constructed since 1985 that have extended service to nearly the entire Town. The existing collection system is segregated into numerous smaller tributary sub-systems and there are thirty-one pumping stations owned and operated by the Town. The Town is divided into 23 drainage sub-areas based upon property information from Tax Assessor's plat map, the extent of existing sewers, and the limits of existing pump station service areas as indicated on Figure 3-7.

The older village systems originally discharged to the Blackstone River, and the industrial park area originally was connected to a septic system and leach field, and subsequently to a packaged wastewater treatment plant, before these systems were connected to the regional sewers. Previously constructed sewers were replaced to a varying extent during construction of the Town and regional systems, but some older sewers do remain in service in the village centers. All sewers in the Town now discharge to the NBC system, either by direct connection or through municipal sewers in Pawtucket and North Providence. Approximately 20 properties are tributary to Pawtucket sewers and 64 to

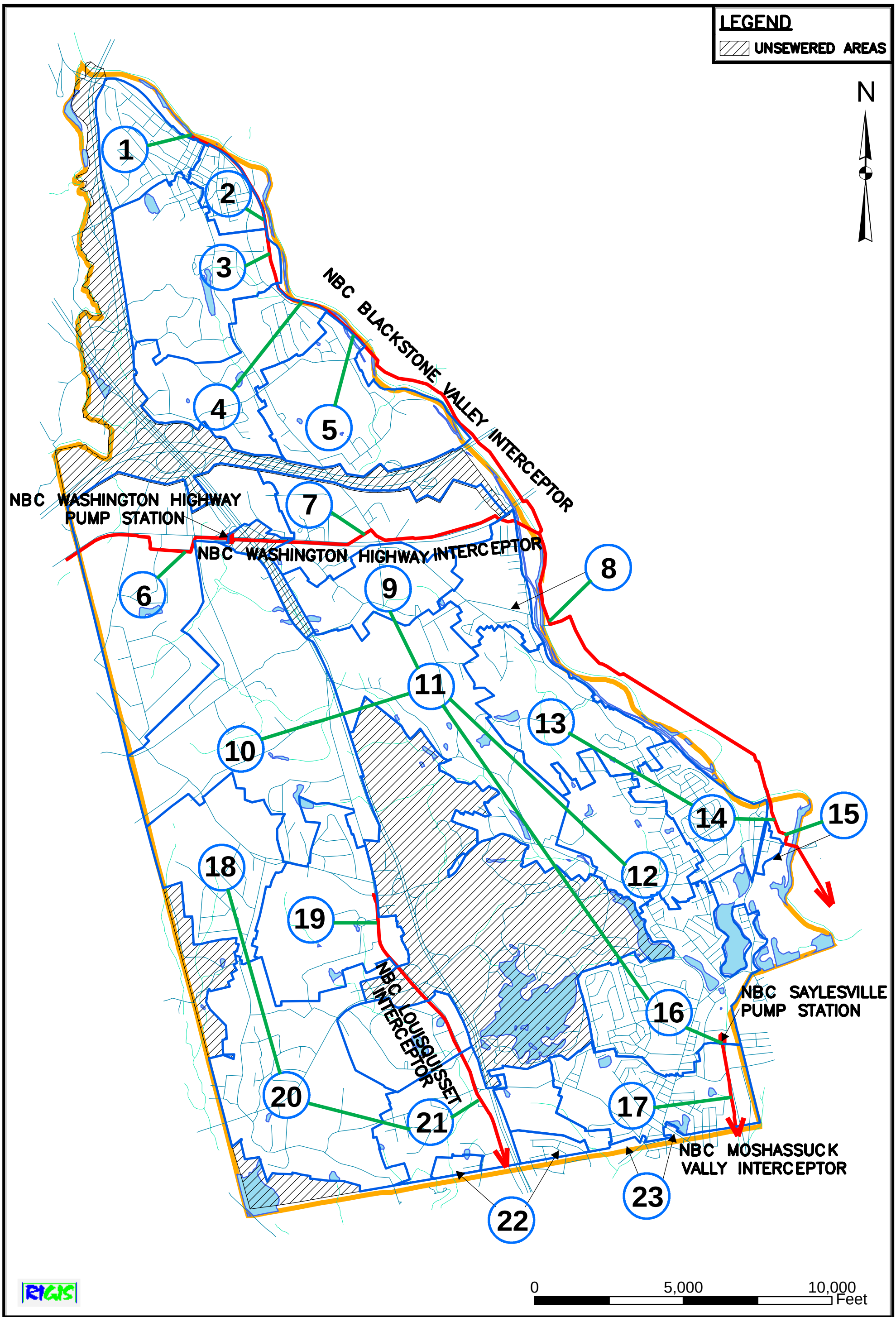

FIGURE NO.
3–7

TOWN OF LINCOLN
Incorporated 1871

WASTEWATER FACILITIES PLAN
CONTRIBUTORY AREA PLAN

Civil & Environmental Engineering Partners, Inc.
342 Park Avenue, Woonsocket, RI 02895

North Providence sewers. All flows from the Town's sewers ultimately are conveyed to NBC for treatment and disposal, either to the Bucklin Point Wastewater Treatment Facility in East Providence or to the Field's Point Wastewater Treatment Facility in Providence.

3.3.1 Collection System

There are approximately 97 miles of gravity sewers and 6 miles of forcemain within the Town's collection system. These sewers were constructed during various periods, and the existing system ranges from sewers dating prior to 1900 that remain in service in some sections of the Town to sewers installed during recent development and subdivision projects. Many of the sewers were installed under the Town's major sewer system projects constructed between 1985 and 1992. The prevalent pipe material found in the Town's system is PVC. Most sewers installed since 1985 are of PVC construction, with ductile iron utilized where necessitated by installation constraints, such as shallow depth of cover. Other pipe materials include vitrified clay, asbestos cement, and reinforced concrete. Mapping of existing sewers is provided in Figure 3-8 and Appendix A. An inventory of sewer pipe lines by size is presented in Table 3-6.

The 1971 "Report on Proposed Sewerage System" prepared by Whitman & Howard, Inc. indicates that all existing sewer systems at that time were separate sanitary type sewers with the exception of combined storm and sanitary sewers in the Manville section. Additional sewers had been constructed and these storm sewers were separated from the sanitary sewers by 1984 as indicated in the "Report on Proposed System of Sanitary Sewers" prepared by Siegmund & Wilkins, Inc. Based upon this information, all sanitary sewers in Lincoln are considered to be separate sanitary type designed to convey only sanitary wastes. However, the Town has observed isolated areas where stormwater connections are suspected. Standard procedures for sewer system maintenance include provisions for smoke testing and dye testing to determine sources of infiltration and inflow so that stormwater sources can be identified for separation from the sanitary sewer system where illegal connections are suspected.

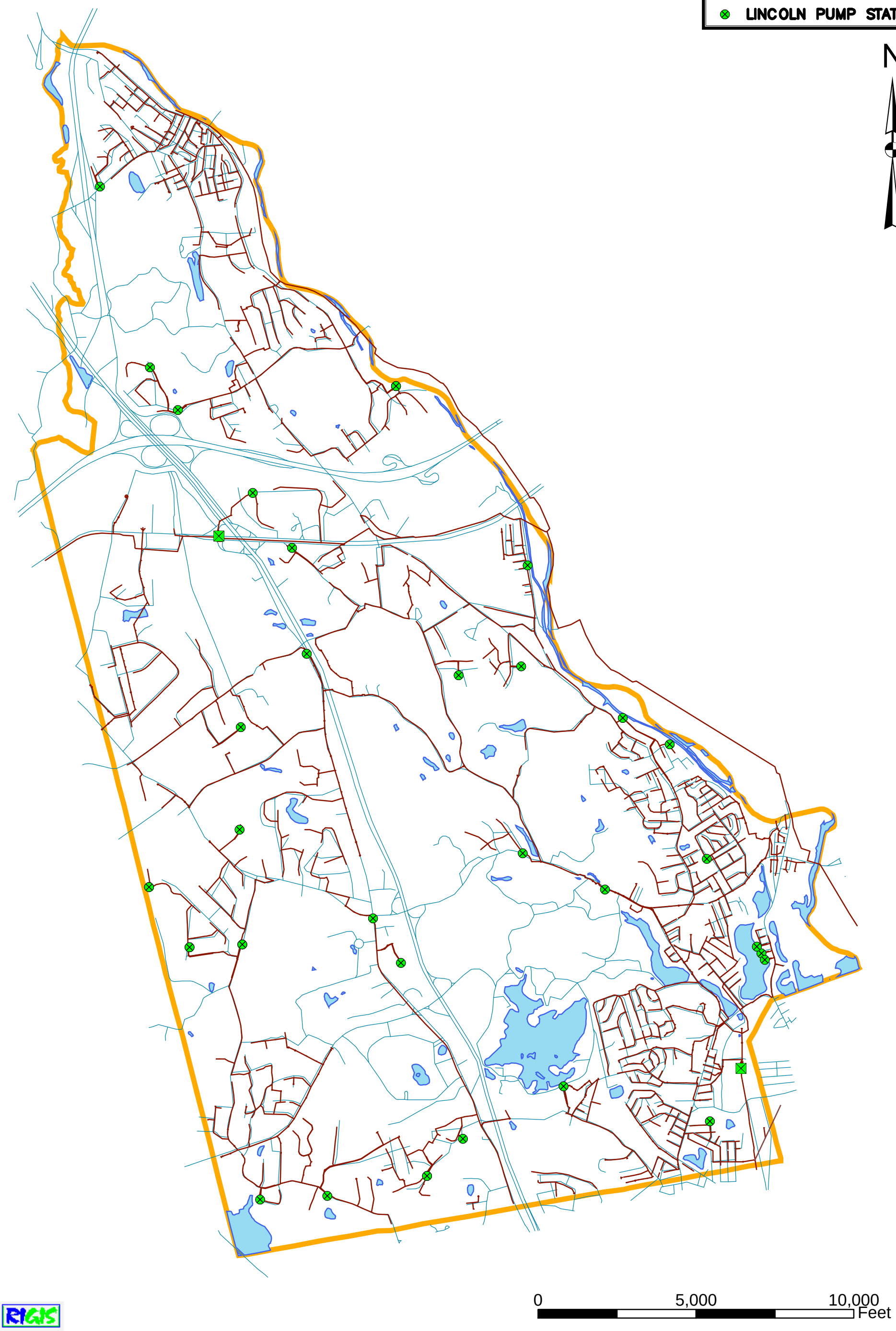

FIGURE NO.
3-8

TOWN OF LINCOLN
Incorporated 1871

WASTEWATER FACILITIES PLAN
EXISTING SEWERS

Civil & Environmental Engineering Partners, Inc.
342 Park Avenue, Woonsocket, RI 02895

Table 3-6

Sewer Pipeline Inventory

Pipe Diameter (Inches)	*Approximate Linear Feet*	*Miles*
8	421,000	79.7
10	26,100	4.9
12	30,000	5.7
14	1,200	0.2
15	15,100	2.9
16	1,900	0.4
18	8,800	1.7
20	500	0.1
21	1,800	0.3
24	4,200	0.8
Total	510,600	96.7

Construction of the Town-wide sewer system was proposed in the 1971 and 1984 planning documents listed above, and the existing system was constructed generally in accordance with the proposed plans. However, construction of several reaches of gravity sewers apparently were deemed infeasible due to environmental constraints, including wetlands and river crossings. While the originally proposed systems envisioned at least ten pumping stations due to the rolling topography of the Town, four of the Town's five larger pump stations became necessary. Subsequent development employed sewage pumping as needed to accommodate topographic constraints in order to connect to existing sewers. As such, the Town's sewer system includes thirty-one Town owned pumping stations.

The 1984 report indicates the design of the Town sewers is based upon flows projected to the year 2040. The flow projections assume development to saturation by the design year, which resulted in a projected population of 46,870. This projection is nearly twice the

current population projection to the end of the planning period. The 1984 report indicates the following per unit flow rates were used to develop the design flow for the sewer system: Residential – 1,000 gallons per capita per day, Business - 2,000 gallons per acre per day, Industrial - 3,000 gallons per acre per day.

Based upon these generation rates, the an average daily design flow of 10.889 MGD and a peak day design flow of 19.600 MGD were projected. As the 1984 design areas and population served exceed current projections to the end of the planning period and per unit figures exceed current estimates of projected wastewater flow based upon existing water use data, the overall design capacity of the existing sewers is significantly greater than the flows projected currently. As such, the existing sewer system capacity is considered to be adequate to beyond the end of the current planning period. The Town has identified the specific areas of concern within the existing system based upon operational history, which are identified in Table 3-7.

Table 3-7

Existing Sewer Pipeline Areas of Concern

Location	Description
AP 6 Lots 196, 197 from Seventh Day Adventists' Church	Old clay pipe runs in private property back yards; building connection and line experience blockages
AP 7 Lots 70- 76 south of Ballou Street	Old clay pipe runs in private property back yards; line blocks up occasionally
AP 4 Lot 70 and AP 5 Lots 17, 19, 20 21 Lonsdale	Old clay pipe runs in private property back yards, pipe runs flat, SMH in poor condition, occasional blockage
School Street in Albion from Kennedy Blvd. To NBC interceptor	Old clay pipe in poor condition, suspected inflow / stormwater connections
AP 3 Lot 34 to Industrial Drive	Old clay pipe, runs flat, in poor condition, occasional blockage
AP 37 Lots 90,91,92,113,114,115 Post Office parking lot and Spring Street properties	Old clay pipe runs in parking lot and in private property back yards, pipe in poor condition, occasional blockage
AP 35 Lots 7, 9, 10 Manville	Old clay pipe in poor condition, runs in private property back yards, occasional blockage
Woodland Court	Suspected inflow / stormwater connections

As part of the Plan preparation the Narragansett Bay Commission (NBC) was contacted to establish the capacities of the treatment and conveyance facilities that currently and will continue to serve the Town of Lincoln through the planning period. NBC stated that sufficient capacity exists at these facilities, even with the projected increase of flows of the planning period.

3.3.2 Pump Stations

The Town's thirty-one (31) existing wastewater pumping stations can be segregated into three (3) general types: Submersible Grinder Pump station, Wet Well / Dry Well Pump station, and Screw Pump station. Twenty-five (25) of the Town's pump stations are Submersible Grinder Pump type stations, five (5) stations are Wet Well / Dry Well type stations, and one (1) station is a Screw Pump type station. A limited physical conditions assessment was conducted for each of the Town's pump stations during the preparation of this Facilities Plan, reports of the conditions observed are provided in Appendix B.

Odor control is a concern common to all wastewater pump stations. Town personnel indicated that odor complaints have occurred generally due to the proximity of adjacent residential areas to the existing pump station locations. Excessive complaints or recurrent concerns for odors were not identified for any specific location, therefore no provisions for odor controls are deemed to be necessary at this time for any pump station. However, odor control considerations should be re-evaluated if an increase in the frequency of complaints or other change in conditions is observed to suggest excessive odor emissions may be occurring.

3.3.2.1 Submersible Grinder Pump Stations

As noted above, 25 of the Town's 31 wastewater pump stations are of the Submersible Grinder Pump type. The 1998 Edition of the Guidelines for the Design of Wastewater Treatment Works Technical Report #16 (TR-16) as prepared by the New England Interstate Water Pollution Control Commission recommends wet well / dry well type

stations as preferable but allows for other types of stations under certain circumstances. TR-16 requires a minimum of two pumps, with each pump being capable of handling the peak design flows. Two pumps are provided for all Submersible Grinder pump stations and record documents provided by the Town indicate that each pump is capable of discharging the full design load. As such, the existing station design and capacities generally conform to the current TR-16 capacity guidelines. As the pump stations are in serviceable condition and each conveys a relatively small flow volume, station replacement at each location for the sole purpose of providing a Wet Well / Dry Well type station would not be recommended. A summary listing of the Submersible Grinder type pump stations is provided in Table 3-8.

The wet well for each station is constructed of precast concrete manhole ring and base sections and a flat slab top section with a cast-in aluminum access hatch. An aluminum ladder is provided to allow access to the base level of the wet well chamber. A vent pipe through the top slab provides passive ventilation of the wet well chamber. Influent flow enters the wet well via gravity sewer connection(s) constructed primarily of PVC pipe, with concrete materials apparently utilized at a few stations. The Birchwood station receives flow from an individual residential pressure sewer connection in addition to gravity flow.

At grade construction consists of the wet well and valve chamber (where provided) top slabs and the main electrical cabinet enclosure. Access hatches and the main electrical cabinet are secured by padlock, and chain link security fencing with padlocked gate is provided at some stations. Based on their proximity to adjacent streets, most stations appear to be located within public right of way. Paved bituminous access / parking drives occur at some stations.

Electrical and control equipment is housed in a pad mounted enclosure cabinet. The electric service meter socket and receptacle for connecting a portable emergency generator

Table 3-8

Submersible Grinder Pump Stations

Station Name	Pump Size (HP)	Approximate Age	Projected Rehabilitation
Applewoood	3	18	2007
Arlington	3	19	2006
Ashley	3	16	2009
Belmont	3	7	2018
Birchwood	5	16	2009
Butterfly	5	14	2011
Cider Mill	3	16	2009
Davies	5	12	2013
Eagle Nest	5	16	2009
Edgehill	3	19	2006
Great Road (116)	3	18	2007
Heidi	3	14	2011
Hillside	3	19	2006
Jason	5	17	2008
Lincoln Center	3	15	2010
Lori Ellen	5	16	2009
Middle	3	19	2006
Mount	3	19	2006
Newland	3	19	2006
Oak Hill	5	16	2009
Old Pike	5	14	2011
Paddock	5	17	2008
Rollingwood	5	15	2010
Whitney	3	10	2015
Woodridge	3	15	2010

are mounted on the exterior of the cabinet. Only the Davies station is provided with a permanent emergency diesel generator installation on-site. No utility meter is provided at the Lincoln Center station as this station reportedly is fed by the local (Amica) electrical power distribution system. The electric service panelboard, switches / breakers for transfer between emergency and utility power supply, pump controls and motor starters, and alarm dialer with a battery backup power supply are located in the main enclosure. Provisions for transfer between utility and emergency power vary from station to station.

Some stations are provided with a manual transfer switch in a separate enclosure. Other stations have the Utility and Emergency power main breakers mounted side by side with a slide bolt guard to prevent both breakers from being set to the "On" position at the same time; the slide bolt guard is configured with a set screw to maintain its position over the selected breaker. An automatic transfer switch is provided for the permanent emergency generator at the Davies station.

The pump control system is based on changing level in the wet well. All but one station is equipped with a compressed air bubbler level sensing system and an "electro-gage" mercury level gauge / switch controls. A microprocessor based pump controller and submersible pressure transducer that responds to changing water level in the wet well are provided at the Belmont station, which is not equipped with a bubbler level system and mercury level gauge controls. Replacement of the mercury level gauge based control systems should be considered due to the potential for environmental impacts should a release of mercury occur.

Pump controls are segregated behind a separate inner door inside the main enclosure cabinet. The pump level gauge, status and alarm lights, pump run time meters, and pump H-O-A switches are mounted on the face of the inner door, as are the side by side Emergency and Utility power main breakers for stations without a separate enclosed manual transfer switch. Pump controller module, relays, motor starters and bubbler system equipment is mounted behind the pump control panel door.

The pump stations originally were equipped with a computer based monitoring system within a separate panel inside the main enclosure. Town personnel indicate that the use of this system was discontinued due to malfunction and unsatisfactory performance. The Town subsequently has installed autodialers, replacing the computer based system, to transmit selected alarms to the Sewer Department (weekday working hours) and Police Department (nights / weekends). Abandoned hardware from the original computer system remains in the enclosure at some stations. An uninterruptible power supply (UPS) battery

backup unit is provided for the autodialers in the main enclosure. The possibility of implementing a new computer based monitoring system can be evaluated if replacement of the existing controls systems is considered.

Record documentation provided by the Town indicates that the mechanical systems are designed for a 20 to 25 year service life and that the pipelines and pump stations at the following stations are designed to accommodate a future flow projected to the year 2035: Hillside, Edgehill, Newland, Arlington, Mount, Middle, Applewood, and Great Road (116). The future flow design year is beyond the end of the 20-year planning period for the current Plan and, as such, it is expected that the buried pipelines and pump station wet wells will be serviceable and capable of accommodating flows to the end of the planning period. Documentation was not available for review to determine the design capacity for other Submersible Grinder pump stations. Based upon the consistency with the above listed stations similar design considerations are assumed, and the capacities of the pipelines and wet wells for the remaining stations are considered to be capable of accommodating flows from their contributory areas to the end of the planning period. However, many of these Submersible Grinder pump stations appear to be associated with specific areas and developments, therefore detailed capacity evaluations should be conducted before any future developments or sewer extensions are approved to convey flows to individual pump stations.

Construction of the Submersible Grinder Pump stations occurred between 1986 and 1998, with the majority of stations constructed prior to 1992 and three stations (Belmont, Davies, and Whitney) constructed in 1993 or later. This information indicates that the mechanical systems at the many of these facilities are approaching the end of their intended service life and may require replacement in the near future. The age and anticipated equipment rehabilitation schedule for the Submersible Grinder Pump stations are listed in Table 3-8. The structural components of these stations are expected to be serviceable to beyond the end of the planning period. Pumps, discharge piping and valves are anticipated to require replacement at all stations. Electrical installations in the wet well chambers may also

require repairs or replacement. Controls systems are expected to be serviceable to the end of the planning period, with replacement the small air compressors, however replacement should be evaluated with respect to continued use of the mercury filled level gauge / controllers.

3.3.2.2 Wet Well / Dry Well Pump Stations

The Town's five Wet Well / Dry Well type wastewater pump stations are: Angell Road North, Angell Road South, Great Road, Maria Street, and Kirkbrae. TR-16 recommends wet well / dry well type stations as preferable and requires a minimum of two pumps for all stations, with each pump being capable of handling the peak design flows. Two pumps are provided at four of the five Wet Well / Dry Well pump stations and record documents provided by the Town indicate that each pump is capable of discharging the full design load at these stations. Three pumps are provided at the Great Road pump station. For stations with three (or more pumps), TR-16 requires that peak flows be handled with any one pump out of service. Record documents indicate that the capacity of the Great Road station with two pumps running exceeds the peak design flow. Based on this information, the existing station design and capacities generally conform to the current TR-16 capacity guidelines. A summary listing of the Wet Well / Drywell type pump stations is provided in Table 3-9 later in this section.

The Wet Well / Dry Well stations are constructed of precast concrete rectangular structures with the wet well and dry well chambers cast separately. The upper sections of the wet well and dry well chambers are exposed above grade, with the top slab general a few feet above the surrounding ground surface. Aluminum access hatches are provided in the top / roof slabs to provide entry to the chambers. Aluminum ladders are provided to allow access to the wet well operator platform and to the control level and pump level in the dry well. The Town has constructed wood framed building structures above the precast concrete chambers at the Great Road, Maria and Kirkbrae stations. The pump station structures are expected to be serviceable to beyond the end of the current planning period.

Influent flow enters the stations via gravity sewer connection and flows through a manually cleaned bar rack as it enters the wet well. The Great Road station has a divided wet well with slide gates to isolate the two sections, the other four stations have a single undivided wet well. All stations are equipped with centrifugal pumps with close-coupled vertically mounted 3-phase electric drive motors. Seal water systems are provided at the Great Road and Angell Road South stations. The pumps do not required seal water at the other stations. There are no odor control systems at the stations. Each pump is connected to the wet well by individual suction piping with isolation gate valve. Each individual pump discharge is provided with a check valve and isolation gate valve prior to joining at a common force main and exiting the station. The pump suction and discharge piping is constructed of flanged ductile iron. The pumps and piping systems are located in the lower (pump) level of the dry well chamber. There are no provisions for connecting temporary bypass pumping equipment to the existing discharge forcemain.

The pump control system is based on changing level in the wet well. Similar to the Submersible Grinder Pump stations, all Wet Well / Dry Well stations are equipped with a compressed air bubbler level sensing system and an “electro-gage” mercury level gauge / switch controls. Pump controls are segregated from other electrical equipment in a separate control panel enclosure(s) in the dry well upper level. Variable Frequency Drive equipment that changes the pump speed in response to changing wet well water level conditions in effort to match pumping rates to station influent is provided at the Great Road pump station. The pumps operate at constant speed, in response to pump “On” and “Off” wet well level controls at the other four stations. As recommended for the Submersible Grinder pump stations, replacement of the mercury level gauge based control systems should be considered due to the potential for environmental impacts should a release of mercury occur.

The wet well / dry well pump stations also were equipped originally with a computer based monitoring system. This equipment was housed within a separate enclosure in the upper control level. As was the case with the submersible grinder pump stations, the

performance of the computer based monitoring system was unsatisfactory and its has been discontinued. An autodialer has been installed, replacing the computer based system, to transmit selected alarms to the Sewer Department (weekdays, working hours) and Police Department (nights / weekends). Abandoned computer system hardware remains in the enclosure at some stations. An uninterruptible power supply (UPS) battery backup unit is provided for the autodialer.

Wet wells and dry wells are provided with separate mechanical ventilation systems, however, most of the ventilation equipment was not functional and requires repair or replacement in order to be fully operational. Electric unit heaters are provided in the dry wells, no heating is provided to the wet wells. Dehumidifiers are provided at four stations; the Town has found that dehumidification is not necessary at the Great Road station. A sump pump is provided in the pump level of each station dry well. Sump pump discharge piping is provided with two check valves and an isolation gate valve prior to penetrating through the structure to discharge back into the wet well.

Electrical and control equipment generally is located in the upper (control) level of the dry well chamber. The seal water control panel at the Great Road and Angell Road South stations is located in the lower pump level. Main electrical disconnects, distribution panels, automatic transfer switch, and pump controls are located in the upper level. Phase conversion equipment is provided at the Angell Road North and Kirkbrae stations because only single-phase utility power service is available at those locations. The electric service meter socket is located on the exterior of the stations. A stationary emergency diesel generator unit is provided at each station mounted on the top slab of the precast concrete chambers. The emergency generators are inside the building at stations where wood structures have been added. Town personnel have indicated that the electrical systems in the wet wells are either partially or fully inoperable. These systems need to be replaced or restored to proper functional status. Dry well electrical systems at four of the stations appear to be functional and Town personnel did not identify specific operational concerns or problems. The Angell Road South station experienced flooding conditions that partially

submerged the lower dry well. All or portions of the dry well electrical system installation at that station may require replacement.

Table 3-9

Wet Well / Dry Well Pump Stations

Station Name	Number of Pumps	Pump Size (HP)	Approximate Age	Projected Rehabilitation
Angell Road North	2	15	15	2010
Angell Road South	2	60	16	2007*
Great Road	3	60	16	2009
Kirkbrae	2	20	16	2009
Maria Street	2	40	17	2008

*- Expedited rehabilitation schedule due dry well flood impacts.

Record documentation provided by the Town indicates that the pipelines and pump stations are designed to accommodate a future flow projected to the year 2035 and mechanical systems are designed for a 20 to 25 year service life. Construction of the Wet Well / Dry Well Pump stations occurred between 1986 and 1990. This information indicates that the mechanical systems at these facilities are approaching the end of their intended service life and may require replacement in the near future. The age and anticipated rehabilitation schedule for the wet well / dry well pump stations is listed in Table 3-9. Rehabilitation of the Angell Road South should be expedited because the station has experienced flooding conditions that partially submerged the lower dry well. The pumps currently are operational, but the seal water system is not functional.

There no provisions for combustible and hazardous gas detection at any pump station station. TR-16 requires combustible and hazardous gas detection systems for medium to large pumping stations. Provisions for combustible and hazardous gas monitoring and alarm system to be installed should be included as part of the mechanical and / or control systems replacements for the Wet Well / Dry Well stations.

There are no provisions for direct flow metering or totalizing at any station. TR-16 recommends that a flow measuring device be provided at large pump stations. Wet Well / Dry Well pump station rehabilitation and major equipment replacement projects should include provisions for flow metering equipment to be installed. The Town does not need to measure flow for billing purposes and metered flow information generally would be utilized for operations and maintenance purposes, such as determining equipment maintenance intervals and identifying abnormal flow conditions.

The estimated existing average daily flow to each station is approximately 75% to 85% below station design capacity, based upon 2004 NBC billing information for tributary connections. As the estimated existing flow is substantially less than the design capacity for each station and the future flow design year is beyond the end of the 20-year planning period for the current Plan, it is expected that the buried pipelines and pump station wet wells will serviceable and capable of accommodating flows to the end of the planning period and that no increase in pumping capacity is needed.

3.3.2.3 Screw Pump Station

The Lower River Road pump station is the Town's Screw Pump type wastewater pump station. As previously noted, TR-16 recommends wet well / dry well type stations as preferable but allows for other types of stations under certain circumstances. TR-16 requires a minimum of two pumps, with each pump being capable of handling the peak design flow. Two screw pumps are provided at the Lower River Road station and record documents provided by the Town indicate that each pump is capable of discharging the full design load. As such, the existing station design and capacity generally conforms to the current TR-16 capacity guidelines. Record documents indicate each pump is rated for a peak design flow of 300 gallons per minute at 12 feet total dynamic head. Each pump is powered by a 1.5 HP electric motor.

Screw pumps are well suited to low lift pumping applications and have the advantage of providing variable output from constant speed pumps. Pump output matches station

influent and varies based upon the wet well sump level. As a result, simple controls systems are inherent in the design of screw pumps. Because there essentially is only one component that requires maintenance (pump / motor) and the simplicity of the controls, screw pump stations are relatively easy to operate and maintain. However, screw pumps require an open system that operates at atmospheric pressure and can be the source of odor complaints due to turbulent and / or septic conditions. Town personnel identified that odor complaints have occurred generally due to the close proximity of adjacent residential areas but specific concerns for odors or excessive complaints were not indicated for this station.

The pumps are constant speed and operate continuously without any level sensing input. The control panel includes a Hand-Off-Auto switch and run time meter for each pump and a pump alternating timer. With each pump in the Auto position, the timer selects and alternates operation between the two pumps. One pump is operating at all times. If one pump is down for service or otherwise, the other pump can be operated continuously in the Hand mode. Sewer Department personnel indicated the pump controls were operational. Based upon this information, continued satisfactory service is expected for the Planning period. However, replacement of the controls could be necessary in conjunction with related electrical and mechanical equipment replacements.

Similar to the other stations, an alarms autodialer has been installed in the telemetry panel inside the main electrical enclosure replacing the original computer based system. The autodialer transmits alarms to the Sewer Department (weekdays, working hours) and Police Department (nights / weekends). An uninterruptible power supply (UPS) battery backup unit is provided for the autodialer. The only alarm condition monitored is wet well flood level. Sewer Department personnel indicated that the controls and alarms were operational. Based upon this information, continued satisfactory service is expected for the Planning period.

No major repairs to or replacement of the existing pump station structure is expected to be necessary during the Planning period. Electrical systems inside the station wet well

structure are expected to require replacement during the planning period. Electrical code and TR-16 compliance should be incorporated into any major renovations. Replacing the existing enclosure cabinets could be considered if the majority of the components housed in the enclosure are being replaced.

Ventilation equipment is not operational at this station. Portable ventilation equipment reportedly is connected to the vent piping outside the wet well to provide ventilation during maintenance personnel access. Permanent ventilation equipment should be included in the rehabilitation of this station.

Record documentation provided by the Town indicates that the pipelines and pump stations are designed to accommodate a future flow projected to the year 2035 and mechanical systems are designed for a 20 to 25 year service life. The fabrication date inside the control panel indicates that this station was constructed in 1988, so the approximate age of the station is 17 years and the mechanical systems are approaching the end of their intended service life. Satisfactory continued performance is expected based upon the conditions observed and reported for this station, but the electrical and mechanical equipment will require replacement in the near future. Based upon the age of this station, rehabilitation / replacement is projected to be necessary in 2008.

There are no provisions for combustible and hazardous gas detection at the pump station. TR-16 requires combustible and hazardous gas detection systems for medium to large pumping stations. Provisions for combustible and hazardous gas monitoring and alarm system to be installed should be included as part of the mechanical and / or control systems replacements for this station.

There are no provisions for direct flow metering or totalizing at this station. The Town does not need to measure flow for billing purposes and metered flow information generally would be utilized for operations and maintenance purposes, such as determining equipment maintenance intervals and identifying abnormal flow conditions. Although TR-16 recommends that a flow measuring device be provided at large pump stations, run time

meters effectively can provide operational information to determine required maintenance milestones for screw pumps because the pump(s) run continuously regardless of flow conditions. Metered flow information is not essential to the effective operation of the Screw Pump station and incorporating a gravity flow measuring device into the existing station influent chamber or on the effluent sewer line would present significant additional construction costs, therefore provisions for flow metering are not recommended for the Lower River Road Screw Pump station.

The estimated existing average daily flow to this station is approximately 90% below station design capacity, based upon 2004 NBC billing information for tributary connections. The future flow design year is beyond the end of the 20-year planning period for the current Plan. As such, it is expected that the buried pipelines and station influent and effluent channels will be serviceable and capable of accommodating flows to the end of the planning period and that no increase in pumping capacity is needed.

3.3.3 ISDS

Although public sewers serve a majority of the Town, there are a few areas generally isolated from the public system where sewers have not been extended and on-site Individual Sewage Disposal Systems (ISDS) are required for wastewater treatment. These areas occur in the following general locations:

- Breakneck Hill Road at Old Louisquisset Pike and Route 146
- Twin River Road at Old Louisquisset Pike and Route 146
- Whipple Road, Lantern Road and East Lantern Road area
- North of Wilbur Road along Old Louisquisset Pike and Route 146
- Old Great Road at Route 146, Sayles Hill Road at Route 99
- Woodward Road

In addition to these isolated areas, ISDS systems remain in use in scattered locations throughout the sewered areas of the Town. Septage generated in Town is privately hauled

for disposal. NBC owns and operates a regional septage receiving station in Lincoln located on Route 116.

Historically, ISDS systems consisted of cesspools and septic systems with leach fields. Regulation and enforcement of design standards was limited prior to 1979 when the State adopted new design standards and began stricter enforcement. Current regulations were adopted in January 2002. RIDEM allows installation of conventional septic systems and innovative / alternative systems that do not conform to location, design or construction requirements of a conventional system, but have documented evidence of satisfactory performance.

Detailed records were not available to document the actual number of existing ISDS currently in use in Lincoln. Based upon a review of Town sewer billing records there are approximately 1,400 existing ISDS systems. This estimate assumes that properties with a specific mailing address (street and number) where no billing cycle or sewer connection information is provided are developed lots with on-site treatment and that no "dry sewers" were provided for recent development that currently has sewer access (i.e. all recent developments constructed with sewers were immediately connected and no ISDS systems built where sewers are available). Assuming the ratio of residential to commercial (business) ISDS is equal to 3.6, the existing ratio of residential to business land use identified in the Comprehensive Plan, there are approximately 1,100 residential and 300 commercial ISDS existing systems. Of the 1,400 total estimated ISDS units, only 170 occur in locations currently without access to the public sewer system.

Based upon the 2004 population of 22,188 and density of 2.54 persons per unit, and 265 unoccupied units as reported for the 2000 Census, there are approximately 9,000 total housing units in Lincoln. The estimated residential ISDS units represent approximately 12% of this estimated total of existing housing units, which exceeds 5% assumed unsewered units based upon the Town's assessment 95% connected units, however, the estimated ISDS quantity is considered to be conservative. As indicated above, the

estimated ISDS units are based upon the Town's sewer billing list assuming properties identified with a street number address are developed lots and require wastewater disposal. Many properties listed with a street address may actually be undeveloped and without on-site ISDS units. In addition, NBC acknowledges that there may be gaps in their billing data that was partially inherited from the Blackstone Valley District Commission (BVDC). The Town should work with NBC to address any billing data deficiencies.

As public sewers are widely available and the quantity of estimated ISDS units without access to public sewers should be minimal, further analyses and evaluation to refine this estimate generally is not warranted. Any discrepancy in the estimated quantity of ISDS units will impact only the estimated existing septage generated in the Town. No impact to existing wastewater flow estimates will occur because these estimates are based upon serving 95% of the Town population. A decrease in septage production is anticipated in the future as ISDS systems in sewered areas are abandoned and replaced by connections to the public sewer system. In discussion with NBC, who runs the existing septage receiving facility that services the Town of Lincoln, it was made clear that adequate capacity exists to continue to serve the residences with ISDS in Town throughout the planning period.

A review of RIDEM ISDS permit histories indicates that 21 repair or alteration applications have been submitted from Lincoln since 1980. Repair and alteration applications can be indicative of ISDS system inadequacy. Failures can occur due to such conditions as unsuitable soils, high groundwater, shallow depth to bedrock, improper maintenance practices, incorrect sizing, overloading and incorrect construction and installation. Alteration applications can be associated with a proposed change in use or increase in applied loading to an ISDS treatment system and may not necessarily represent failure. For the purposes of evaluation for this Plan, all repair and alteration applications will be considered due to ISDS failure. Based upon this interpretation of the repair and alteration applications, the average rate of ISDS failure in Lincoln since 1980 is less than one per year.

Two of the 21 repair applications were in locations with access to public sewers, and one has since connected to the Town system. Although the several repair locations and times appear to be grouped together, there does not appear to be a specific pattern of failures due to unfavorable conditions or site constraints. Groupings of repairs and alterations are attributed to the fact that ISDS use generally is isolated to the specific areas listed above and the likelihood that development in these areas occurred such that these systems would be expected to need replacement at approximately the same time due similar age and system construction. The repair rate for existing ISDS systems in Lincoln does not suggest an urgent need to provide public sewers to these unsewered areas. However, it should be noted that several ISDS permit applications included either a request for variance and / or use of innovative and alternative technologies, which suggests that public sewers might be preferable due to area constraints. The Town should monitor ISDS failures and repair applications for comparison to past occurrences in order to identify if an increased rate of failures, repairs or implementation of alternative technologies suggests unsuitable site conditions.

3.3.4 Wastewater Flows

Limited flow metering information is available on existing wastewater flows for the Town of Lincoln. NBC operates flow meters at various locations of its interceptor system and the flow computation for the Town of Lincoln involves addition and subtraction of data from eight individual metering locations. According to NBC, the flow meters have not been operational for several years at two metering locations; the flow computation for Lincoln would require using data from temporary metering equipment that NBC recently installed near these locations. Temporary metering equipment installed within a manhole structure generally is expected to be less accurate that permanent facilities due to space and flow channel limitations. Additionally, NBC does not calibrate its meters on a regular basis and in many cases the recorded data is intermittent. Initial computations utilizing raw meter data resulted in negative flows for portions of the Town. Due to these conditions, the accuracy of the data from these meters is not considered to be fully reliable and the available flow metering data should only be use for general reference. Existing

wastewater flows for this Facilities Plan have been based upon metered water use data as described below.

Table 3-10 presents existing wastewater flow figures estimated for the Town of Lincoln based upon average water use for the 5-year period from 2000 to 2004 inclusive and assuming 85% of the total water use is directed to the sewer system. NBC bills individual customers for sewage treatment and disposal based upon metered water use records and the billing rate formula is based upon 85% of meter water use entering the sewer system.

Table 3-10

Estimated Existing Wastewater Flow
Based Upon Metered Water Use

Category	Flow (MGD)
Commercial	0.29
Industrial	0.19
Residential	1.33
I / I Allowance	0.43
Average Day	2.24
Peak Day	3.77

Water use data provided by the Lincoln Water Commission identifies Commercial water usage but does not provide a breakdown between Industrial and Commercial use categories. Utilizing billing information provided by NBC for 2004, Industrial use represents approximately 40% and Commercial use represents approximately 60% of the total non-residential water use. Wastewater flow estimated for Industrial and Commerical categories is based upon applying these percentages to the Commercial (i.e. non-residential) Lincoln Water Commission water use data. Using the Residential wastewater estimated in Table 3-10 and assuming the sewered population is 95% of the total population results in an average generated Residential wastewater of 65 gallons per person per day, which is a reasonable per capita flow figure. Peak day flow is calculated by applying a peaking factor of 2.15 to the average daily Residential flow quantity. This

peaking factor is derived from TR-16 Figure 2-1 Ratio of Extreme to Average Daily Flow based on the average estimated Residential flow of 1.33 MGD.

To determine an approximate infiltration/inflow (I / I) contribution, a "high-end" factor of 500 gal/in. dia./ mile of sewer was applied to the approximate length of Town sewers as determined from the sewer system map. This figure represents a maximum allowance for a normal I / I amount as recommended in TR-16. NBC currently is conducting I / I analyses of the interceptor systems that receive flow from Lincoln. These analyses are ongoing and no final reports of findings or conclusions have been issued. Further discussion of I / I is presented later in this chapter.

NBC billing information identifies 20 services as Industrial customers. Seven of the Industrial customers use in excess of 10,000 gallons of water per day based upon the NBC billing information. These larger customers and their approximate daily wastewater flow generated based upon 85% of 2004 metered water use is provided in Table 3-11.

Table 3-11

Approximate Daily Wastewater Flow
High Volume Industrial Sources

Name	Address	Flow (GPD)
General Cable Industries LLC	3 Carol Drive	23,500
Stern-Leach Company	4 Carol Drive	10,800
Richard E Beaupre	11 New England Way	11,600
Tanury Industries Inc	6 New England Way	32,700
A T Cross Co	1 Albion Road	22,900
Arcrivis Ltd	1 Crownmark Drive	12,200
Technical Materials Inc.	5 Wellington Road	54,900

These approximate flow figures are based upon the assumption that the production operations are continuous for 7-day per week without weekend shutdowns. These seven customers account for approximately 93% of the flow from Industrial customers identified in the 2004 NBC billing information.

3.3.5 Infiltration / Inflow Preliminary Assessment

A preliminary assessment of existing I / I conditions was performed utilizing available wastewater flow meter data. NBC provided preliminary flow monitoring data for several temporary flow monitoring stations located in Lincoln that are collecting data for its I / I investigations and also for its permanent meter stations that receive flows from Lincoln. As noted above, the accuracy of the NBC meter data is not considered to be fully reliable and should only be used for general reference and broad comparison.

The flow meter data provided by NBC collected during 2004 and 2005 from its permanent and temporary metering stations was compiled to allow for a comparison with the estimated wastewater flow figures based on water use and the "high end" I / I allowance. This compilation included a limited review of average daily flow data figures in effort to eliminate data that appeared to be erroneous, such as negative flows or figures substantially lower than the overall averages. Table 3-12 presents the flows compiled from NBC metering data alongside the estimated flow for the drainage areas tributary to each metering location.

Table 3-12

Comparison of Estimated Existing Wastewater Flow
to Available Metered Flow Data

Tributary Areas	Estimated Flow (MGD)	I/I Allowance (MGD)	Total Estimated Flow (MGD)	NBC Metered Flow (MGD)	Difference (MGD)
1 – 5	0.35	0.083	0.433	0.60	0.167
6 – 8	0.37	0.034	0.404	0.44	0.036
9 – 12, 16, 17	0.61	0.185	0.795	1.81	1.015
18 - 21	0.19	0.067	0.257	0.48	0.223

Comparison of the flow meter data against the estimated flow figures indicates the probable entry of extraneous flows into the sewer systems upstream of the NBC metering locations and suggests that investigations to identify sources of excessive I / I are warranted. However, two items must be noted with respect to the information presented in Table 3-12. First, wastewater flows from sources outside of Lincoln occur in the flow

metered at some locations. Second, the I / I allowance is based on the approximate length of Lincoln sewers in the tributary sewer drainage area only and no accounting of the NBC interceptors, or adjacent tributary municipal sewers, is included in the estimated figures. Once completed, the ongoing NBC studies likely will provide some refinement as to separation of identifiable source locations, but additional investigations of the Town's sewer system will be required to identify specific sources of excessive I / I in Lincoln.

While areas 9 through 12, 16 and 17 encompass a substantial portion of the existing sewer system and proportionately higher I/I is expected due to the longer length of tributary sewers, area 16 covers most of Saylesville, including areas of older sewers that were not replaced under the major sewers system construction program. Similarly, areas 1 through 5 include Manville and Albion where portions of the older sewer systems remain in service. Excessive I/I occurring sewers over 100-years is not unexpected, especially where sewers were installed in close proximity to the river by necessity to service the mills. Areas 18 through 21 cover the southwesterly portion of the Town and generally the sewers in this area were installed under the major sewer construction program. These areas are tributary to the Louisquisset Interceptor, which is included in the current NBC interceptor sewer investigations projects due to concerns regarding potentially deteriorated conditions. Areas 6 through 8 include the Industrial park, Route 116 corridor and Quinnville.

Chapter 4 – Future/Planning Conditions

4.1 Demographic Projections

To determine the projected domestic wastewater flow to be generated within the Town of Lincoln, it is necessary to estimate the population that will be served. Treatment facilities are generally designed to handle the needs within a particular planning area for a 20 year period. Therefore, the population that will have sewer service available by the year 2025 will provide the most accurate estimate of wastewater flow generation. Buildout conditions must also be evaluated in order to develop a basis for the proper sizing of interceptor sewers and other appurtenances that have useful lives far in excess of the 20 year planning period. As established in Chapter 3, the design year flow for the existing pump stations and conveyance facilities is beyond the end of the current planning period and these facilities generally have sufficient capacity to accommodate future flows.

Total population projections for the Town were based on data obtained from the Town's Comprehensive Plan and from the Office of Statewide Planning. From this information, the total residential population in the year 2025 is projected at 24,019. Projections are shown in Table 4-1.

Table 4-1

Population Projections

Year	Population
2000	20,898
2005	21,449
2010	21,098
2015	22,596
2020	23,363
2025	24,019

Source: Statewide Planning Program Technical Paper 154

The US Census estimated the 2004 population of Lincoln at 22,188, which exceeds the projected 2005 population listed in Table 4-1. The Statewide Planning Program projected

change in population between 2005 and 2025 is 2,570. Adding this projected change to the current (2004) population provides a projected population figure of 24,758, which will be utilized as the maximum service population for this Facilities Plan. The estimated sewered population is dependent upon the extent to which sewers are extended to currently unsewered areas. Evaluation and discussion on future sewered population is presented the Wastewater Projections section later in this Chapter.

4.2 Land Use Projections

The premise for future land use projections in the Town is based on the following assumptions:

1. The same proportions of land uses now in existence will continue for future development.
2. Residential density will remain at the present level of 2.54 persons per household.

Based on the population projections presented previously, the Town's population is expected to increase by 2,570 by 2026. Using the current population density of 2.54 persons/household, approximately 1,010 additional dwelling units will be required to accommodate the projected growth. Adding this quantity to the 9,000 estimated existing housing units results in a total of 10,010 housing units at the end of the planning period. The buildout analysis included in the Comprehensive Plan indicated the Town could accommodate a total of 13,206 dwelling units based upon 2001 zoning. Based upon the buildout projection the Town sufficient area to accommodate the year 2026 housing demand based upon 2001 zoning conditions.

Recommendations of the Comprehensive Plan call for the Town to maintain current zoning practices with respect to commercial development and to protect the residential character within village center areas. An estimate of 957 acres currently is used for commercial (business) purposed as described previously in this Facilities Plan. Based upon the existing residential to business use ratio of 3.6 there is approximately 3,446 acres

of current residential land use. Utilizing this figure and the 2004 population of 22,188 results in a population density of 6.4 persons per developed acre, and applying this ratio to

Table 4-2

Land Use by Business and Residential Categories

Land Use Category	1995 Land Use Acreage	Future Land Use Acreage
Business	919	1,727
Residential	3,298	7,200
Total	4,217	8,927
Ratio Residential to Business Use	3.6	4.2

Source: 2003 Town of Lincoln Comprehensive Plan

the projected 2026 population results in a future residential land use of approximately 3,870 acres. Based on this residential use acreage the business use acreage for 2026 will be 1,075 acres, assuming the ratio of residential to business land use will remain at 3.6 until saturation of commercial and industrial zoned areas, or an additional 118 acres of developed business land use. The Comprehensive Plan indicates an available future business land use of 1,727 acres for the Town based upon the buildout study, therefore the Town should be able to accommodate the estimated 2026 business land use demand of 1,075 acres. Existing and future land use data provided in the Comprehensive Plan is listed in Table 4-2.

4.3 Economic Projections

Increases in residential housing figures and changes in the rate of increase often are used as an indicator of economic conditions. Census data presented in the Comprehensive Plan, indicates that the average increase in housing was 94 new units per year from 1980 to 1990 and 123 units per year from 1990 to 2000 was unit. Changes in the rates of new housing units are attributed to cyclical economic conditions. The Comprehensive Plan notes that the housing growth in Lincoln between 1950 and 2000 consistently averaged about 100 units per year.

A review of Town certificate of use and occupancy data indicates that 237 of the 397 certificates issued by the Town Building Official's office during the period of 2001 through 2005 were residential use (i.e. at least one bed room). Based on this information, the average annual housing increase was approximately 47 units per year. While this figure is less than the demonstrated history of housing increases, a reduction in the rate of increase is not unexpected due to a corresponding reduction in available land through development. As such, the slower pace of recent housing increases is not attributed to a negative trend in overall economic conditions.

For the most part, local business enterprises are permanent in nature and require a stable work force. There currently are no significant single occurrence or finite projects (i.e. large scale construction project or manufacturing plant closing / relocation) that would result in substantial job losses at conclusion due to specialized employment needs that would give cause to anticipate associated adverse economic impacts. These conditions also suggest a healthy economic status and warrant a positive future outlook. Based upon these conditions and the consistent history of housing increases over extended periods and varying economic conditions, it is expected that the Town will experience similar economic stability in the future. Given the current economic strength and the reduced demand for expansion in comparison to historic development, it is expected that future economic conditions will be favorable and will be suitable to support the projected growth.

4.4 Wastewater Projections

4.4.1 Wastewater

Present development data was used to determine a base wastewater flow. Future flows from an increase in population and development are addressed separately. Average daily residential flows are based on the total number of housing units with 2.54 persons per unit and a daily per capita wastewater contribution of 68 gallons. This wastewater flow is based upon 85% of the 80 gallon per person per day water use projection. This figure exceeds the estimated existing per person water use derived from actual water consumption data as presented in Chapter 3. To estimate average non-residential flows, a

wastewater generation rate of 1,500 gallons per developed acre per day was applied to the projected 118 acres of new business land use. This figure exceeds the 767 gpd / acre rate identified in Chapter 3, in order to provide a conservative projection. The proportions of the projected non-residential flow are assumed to be 60% Commercial and 40% Industrial based upon the existing water use information. Estimated average daily flows projected to 2026 are presented in Table 4-3. For planning purposes, the increased flow volumes assume that all future development will be connected to the public sewer system.

Table 4-3

Projected 2026 Wastewater Flow

Category	Existing Flow MGD	Increased Flow MGD	Projected Flow MGD
Commercial	0.29	0.11	0.40
Industrial	0.19	0.07	0.26
Residential	1.33	0.18	1.51
I / I	0.43	0.02	0.45
Average Day	2.24	0.38	2.62
Peak Day	3.77	-	4.28

To determine the approximate infiltration/inflow contribution, the existing length of lateral and interceptor sewers was determined from the sewer system map and a “high-end” factor of 500 gal/in. dia./ mile of sewer was applied. Additional infiltration / inflow is projected based upon the several assumptions. As described previously, 1,010 new residential units will be needed to accommodate projected population growth during the planning period. According to the Comprehensive Plan, the majority of new residential development is anticipated to occur in the Limerock area as single family homes. Assuming that all new development to be single family units and that 35% of lots will be on new subdivision roads, as utilized in the Comprehensive Plan, and applying a 150 frontage width results in approximately 5 miles of new subdivision roads. The additional infiltration / inflow was projected for 5 miles of new 8-inch diameter lateral sewers at 500 gal/in. dia./ mile is 0.02

MGD. New commercial and industrial development generally will occur within existing developed areas and is not expected to require extensive new lateral sewer construction.

Peak day flow is calculated by applying a peaking factor of 2.1 to the average daily Residential flow quantity based upon Figure 2-1 of TR-16. As described in Chapter 3, the existing sewer system design capacity accommodates a peak day flow of 19.600 MGD. The projected 2026 flows do not exceed this design capacity and based upon this information the existing system capacity is adequate for the planning period.

4.4.2 Septage

There are estimated to be approximately 1,400 lots with active ISDS system in Lincoln as developed in Chapter 3. Based on this quantity of existing systems and assuming an average tank capacity of 1,500 gallons the total ISDS holding volume is 2.1 MG. Under a three year pump out interval the annual septage production will be 700,000 gallons. NBC currently accepts waste at its Lincoln Septage Receiving Station for five days per week, and the daily septage generation for Lincoln will be approximately 2,700 gallons per day when applying this mode of operation to the estimated annual septage production. The NBC Lincoln Septage Facility can receive approximately 118,000 gallons per day of septage waste and there currently are no reported concerns with respect to septage disposal volume for the Town.

As described in Chapter 3, the majority of the existing estimated ISDS systems are located in sewered areas, leaving approximately 170 systems without access to public sewers. It is presumed that lots with access to the public sewer system that are served currently by ISDS will be required to connect to the public system if the ISDS system fails. In this manner, an increase in the total number ISDS served lots is not expected and the quantity of active ISDS systems will be reduced over time by attrition. Based upon this assessment no new or expanded septage receiving facilities will be necessary during the planning period.

Chapter 5 – Wastewater Management Alternatives

5.1 Operation of Existing Facilities

The Town will need to continue operation of existing wastewater facilities in order effectively to manage and convey wastewater for treatment and disposal. Due to the extent of the existing system and areas served connected areas, it is anticipated that all of the existing pumping stations will need to remain in service. As identified in Chapter 3, the existing pump stations are approaching the end of their expected useful service life and replacement of major equipment components and systems during the planning period will be necessary. The estimated existing wastewater flows through the six (6) larger Town pump stations are substantially less than the design capacity for these stations and no increase in pump station capacity is necessary to accommodate increased flow during the planning period. The existing capacities of the Submersible Grinder pump stations also are expected to be adequate for the planning period. However, specific capacity analyses should be conducted when development beyond the current service area is proposed for connection to a particular station or stations.

Pump station rehabilitation generally will be limited to mechanical, control and electrical systems and components. Re-establishing a computerized monitoring system or upgrading to a computerized monitoring and control system should be investigated during detailed pump station rehabilitation evaluations. Major structural renovations are not envisioned based upon the age and existing conditions of structural components.

Review of planning documentation associated with design of the collection system reveals that many more pump station than originally were envisioned were constructed due to environmental constraints associated with installing utilities in regulated areas and associated buffers. In the evaluations for rehabilitation of the pump stations, some considerations should be given to the possibility that some of these pump stations could be replaced with gravity sewers through alternative routing scenarios. While pump station elimination may be possible conceptually, in the 15 to 20 years since these facilities have been constructed environmental regulations have been reinforced and made stricter.

Therefore, it is doubtful that any environmental limitations to the installation of gravity sewers, as opposed to pump stations, that were identified in the 1980's most likely are still in existence and probably would be more difficult to overcome under the current regulatory environment. In addition, mechanical / electrical rehabilitation of pump stations typically are much less costly than sewer rerouting (especially the smaller stations that are prevalent in Lincoln) even when considering life cycle costs of multiple upgrades of a single station.

As described in Chapters 3 and 4, the existing sewer system design capacity and intended service life extend beyond the end of the 20-year planning period. New construction to replace existing gravity facilities to accommodate increased flows due to development during the planning period is not anticipated to be necessary. However, existing collection facilities with a documented history of operation problems and deteriorated conditions should be repaired or replaced to correct deficiencies. The following projects should be considered:

- Identify sewers constructed prior to 1900 and / or with suspected deteriorated conditions and conduct I / I analyses and Sewer System Evaluation Surveys (SSES), and initiate Rehabilitation / Replacement program.
- Evaluate feasibility of replacing existing sewer systems located on private properties with new sewers constructed in public right-of-way or establishing easement rights, legal ownership, and maintenance responsibility. (Note: Town currently pursuing such investigations for replacement of the existing "Lonsdale Village Sewers".)
- Evaluate Rehabilitation / Replacement alternatives for approximately 1,500 LF of existing 8-inch sewer in School Street from NBC interceptor connection to Berkshire Drive to repair deficient conditions.
- Identify areas of suspected stormwater intrusion, perform investigations to confirm inflow locations, and eliminate identified illegal connections to sanitary sewers.
- Review and update Town Sewer Ordinance.
- Perform Sewer Rate Study and reset sewer use fees as necessary.

5.2 Regional Solutions

All flows from the Town of Lincoln's sewers are conveyed to the NBC regional system for treatment and disposal. Areas tributary to the NBC Blackstone Valley Interceptor and Moshassuck Valley Interceptor, either directly or via the Saylesville Pumping Station, ultimately are conveyed to the Bucklin Point Wastewater Treatment Facility in East Providence. Areas that flow to the City of Pawtucket public sewer system also are conveyed to Bucklin Point. Areas tributary to the NBC Louisquisset Interceptor and the Town of North Providence public sewers ultimately are conveyed to the Field's Point Wastewater Treatment Facility in Providence. As such, the Town is fully integrated into the NBC regional system. Regional alternatives for currently unsewered areas include the possibility of coordinating conveyance facilities with adjacent communities. The Town should continue to participate in regional discussions with NBC and neighboring communities concerning matters relating to proper wastewater management.

The May 1993 Facilities Plan for Wastewater Management in the Town of North Smithfield indicates that extension of sanitary sewers to serve the Sayles Area properties along Route 146, Sayles Hill Road and Old Great (Old Smithfield) Road. The abutting areas of Lincoln along along Route 146 north of Route 99 and at the intersection of Sayles Hill Road and Route 99 currently are served by ISDS treatment. As noted previously, Lincoln has not experienced excessive ISDS failures, and extending sewers to these areas is not a priority. Should future conditions warrant abandonment of ISDS treatment, the possibility of providing coordinated service with the Town of North Smithfield should be investigated.

The area of Lincoln along Route 146 north of Route 99 is separated from other areas of the Town sewer system physically by Route 99 and topographically. The area of Lincoln at Sayles Hill Road and Route 99 is physically accessible to the existing sewer system in Sayles Hill Road, but additional gravity sewers and an additional pump station or relocation of the Birchwood station would be required to extend service there. As existing

Lincoln sewers can be accessible from portions of the existing unsewered areas, the possibility of directing some of the North Smithfield wastewater flow to the Lincoln system also exists. Approval by both North Smithfield and Woonsocket would be necessary for Lincoln to connect to the proposed North Smithfield system because North Smithfield directs its wastewater to Woonsocket for treatment via intermunicipal agreement. NBC also would need to approve additional flows that would be introduced from North Smithfield, and any proposed interconnections or coordinated systems would need to be accepted by RIDEM.

The September 2002 Town of Smithfield Wastewater Facilities Plan indicates that public sewers are proposed to provide service to the area surrounding Whipple Road west of Route 7 (Douglas Pike). The area of Lincoln at Whipple Road, Lantern Road and East Lantern Road currently is served by ISDS treatment system. The proposed Town of Smithfield sewers are approximately 4,500 feet away from the town boundary with Lincoln at Whipple Road. However, the existing Lincoln sewers in Angell Road are in the immediate vicinity of Whipple Road. Pumping would be necessary to convey wastewater from the unsewered area either to the proposed Smithfield sewers or to the existing Lincoln sewers. As the existing Lincoln sewers are more accessible and no intermunicipal negotiations or agreements would be necessary to connect to the existing sewers in Angell Road, pursuing an interconnection with the Town of Smithfield is not considered feasible. Should future conditions warrant abandonment of ISDS treatment for this area of Lincoln, connection to the existing sewer sytsem in Angell Road would be recommended.

5.3 Unsewered Areas

Alternatives to address future wastewater needs for currently unsewered areas include continued use of ISDS systems, extending public sewers to provide for centralized treatment, and the use of innovative and alternative collection and treatment technologies in certain districts. The existing Lincoln sewer system is connected to regional NBC facilities and centralized treatment is the primary existing wastewater management means in use. Excessive ISDS failure rates were not identified in the evaluation of repair

histories conducted in Chapter 3 and continued use of ISDS treatment in developed areas where public sewers do not exist is recommended. As noted in Chapter 3, the Town should continue to monitor ISDS failures and repair histories for acceptable performance. Based upon the excess capacity evident in the existing sewer system design, sufficient capacity is available to accommodate the additional flows should future conditions warrant abandonment of ISDS treatment in the limited areas currently not accessible to the public sewer system.

Given the widespread availability and accessibility of public sewers coupled with the generally acceptable performance and limited total area using individual on-lot systems, implementing innovative and alternative systems to treat wastewater on districtwide basis is considered to be less viable than either public sewers or ISDS. The capitol cost to construct sewers to convey flows to a treatment site within unsewered districts would be comparable to the cost to construct sewers to convey sewage to the existing public system. Capital and operations and maintenance costs for any innovative and alternative treatment system for a small district would exceed greatly the cost of sewer maintenance fees. For this reason, district-wide innovative and alternative treatment alternatives will not be considered further.

5.3.1 Individual Sewage Disposal Systems

A conventional system is a traditional ISDS with a septic tank, pump chamber with pump or siphon (if needed), distribution box and a standard leach field with gravity distribution. An Innovative/Alternative (I/A) System or Technology is an ISDS system that does not meet the location, design or construction requirements of a conventional system, but has been demonstrated through field testing, calculations and other engineering evaluations to provide the same degree (or better) of environmental and public health protection. RIDEM's Individual Sewage Disposal Systems Rules and Regulations provide the basis for approval of I/A Technologies in Rhode Island. I/A systems are designed as alternatives to conventional ISDS systems or parts of a conventional system. Evaluation of I/A systems must consider the specific conditions and constraints of the particular site for

individual on-lot systems. Accordingly, these evaluations are performed case by case on a site specific basis. Information on available I/A technologies is readily available from RIDEM. Further description of specific I/A technologies with respect to ISDS treatment is considered to be beyond the level of detail necessary for this Town-wide Facilities Plan.

5.3.1.1 ISDS and Septage Management

Like most municipalities, the Town of Lincoln relies on individual property owners/managers to maintain their private on-lot wastewater disposal systems. Unfortunately, negligence or improper operation on the part of the property owner, along with unsatisfactory site conditions, can lead to early failure of the system. Failed septic systems present potential threats to the health of residents and can adversely impact the environment. Failure of a system can be attributed to one or more of the following factors:

- Improper siting
- Inadequate sizing
- Hydraulic overloading
- Introduction of large quantities of non biodegradable solids
- Failure to pump the system regularly
- Improper installation or substandard construction materials
- Adverse activities around the leaching field (i.e. planting trees)

Although State legislation allows municipalities to establish wastewater management districts for the purpose of preventing contamination of state waters due to malfunctioning disposal systems, based on the limited extent of areas where the use of on - site wastewater disposal systems will continue, establishing a wastewater management district in the Town of Lincoln is not recommended. There are several options available to insure the proper performance of ISDS and individual on-lot I/A systems in the Town, which are described further below.

Community Operated Maintenance Program - The basis for this alternative establishes a program, financed through user fees assessed to individual property owners, whereby the Town would require that subsurface disposal systems be pumped out on a regular schedule and allow the Town to conduct periodic inspections of all systems. The service would be provided by the Town either directly or through private firms under contract to the Town. Legislation would be necessary to issue orders to the property owners requiring participation in the program. Bonds would also have to be issued to cover capital expenditures, should the Town provide pumpout services directly.

This alternative carries several negative aspects. Additional operating cost, predominantly in the form of additional Town personnel required to implement and administer the program, will be incurred. By taking this approach, the Town also assumes significant amounts of liability. Difficult legislation requiring owner participation is also necessary.

Conversely, by the Town assuming responsibility for ISDS pumping schedules and periodic ISDS inspection, proper system maintenance and operation would be assured. This would have a tremendous environmental benefit on the community by protecting groundwater and surface water resources form contamination associated with ISDS failure. This type of program would serve to remove the general complacent attitudes of the public toward ISDS system function.

Community Required Maintenance - Under this alternative, the Town would require homeowners to provide proof of periodic maintenance to their subsurface disposal systems, but would not provide the service directly. A notice would be sent every three years to system owners to remind them that it is time to pump out their system. A return receipt attached to the notice could then be returned to the Town by the pumping contractor as confirmation. Local legislation requiring periodic maintenance by property owners would need to be established. The Town also should have the authority to randomly inspect systems to ensure their proper operation. This alternative has a fairly low cost since the Town will not provide any services directly and few, if any, additional

personnel would be necessary to cover additional administrative duties. However, the effectiveness of this program is contingent upon owner participation and the Town's ability to enforce such an ordinance; the potential exists for a high degree of delinquency which could create overbearing enforcement problems.

Educational Program - This type of management program would involve the mailing of reminders and educational material describing the need for system maintenance. In this manner, the Town would have no enforcement authority over the property owner. This is a low cost alternative that will likely be ineffective if implemented on its own, but should serve as the base level of the selected program.

The recommended management program for Lincoln should consist of a combination of features from the Community Required Maintenance program alternative and the areawide Educational Program. It can be assumed that the greater the scope of responsibility given to the Town, the greater will be the costs incurred in implementing the plan. To accomplish the goals of a management program, several basic management functions need to be defined. These include:

- Public education
- Site evaluation
- System design
- Installation/Construction supervision
- Operation monitoring
- Financing
- System rehabilitation

A discussion of each of the key elements of the management program and recommendations for the level of participation to be provided by the Town is presented below.

Public Education - An active education program can prevent system problems by making the public aware of proper maintenance and operating procedures, proper design and installation techniques, and the required licenses for system construction. It can also make the public cognizant of the environmental benefits of properly functioning systems and aware of the negative impacts from failing systems. Public education is capable of providing positive results in preventing system failure. Instructional and informational pamphlets, describing potential system problems and solutions should be mailed and/or made available at the public library or authority office. This effort should result in a low cost and effective means of establishing a baseline for managing on - site systems, regardless of the level of control the Town takes.

Site Evaluation - A potential site for an ISDS system is evaluated for its soil, geology, groundwater, topographic characteristics and its proximity to surface water bodies. Unfavorable conditions may be alleviated by proper design. Site evaluation is foremost in implementing a management program. To receive a permit from the RIDEM Division of ISDS to construct an on - site system, certain evaluation procedures, such as a test pit, a percolation test, and the compilation of a topographic map, must have been completed. These services are offered by a large number of professional engineers and land surveyors. In addition, the RIDEM has regulations and procedures in place to assure that site evaluations are conducted properly. Therefore, the Town should not become involved in this management function.

System Design - A design review will insure that site constraints revealed in a site evaluation have been incorporated into a design and that design is completed in accordance with all applicable regulations. The RIDEM publishes design criteria and engineering standards that are reviewed and enforced by their technical staff. Due to the availability of private sector professionals and existing state regulations, it is recommended that the Town not become involved with this management function. The Town should maintain a local file to document septic system designs for reference.

Installation/Construction Supervision - Improper construction methods or materials can nullify the most prudent site evaluations or designs. Substandard materials are subject to breakage, premature decomposition or poor conveyance of wastewater. Field changes by a contractor, made without the knowledge or approval of the designer, can hinder the design's original intent. An inspector can assure adherence to the design and authorize changes in the field that maintain design criteria. Inspection service can range from certification of design to a complete construction management program. The RIDEM Division of ISDS provides spot inspection services during construction only. Licensed ISDS designers are responsible for system inspections at key points during construction to assure proper installation. The Town's construction supervision should be limited to receiving notification of completion from the responsible designer, which should be routed to both the Sewer Department and Building Official for record purposes.

Operation Monitoring - Monitoring the performance of an on-site wastewater disposal system is aimed at assuring proper mechanical operation and proper treatment, which will preclude the potential for groundwater contamination. Although groundwater is a limited source of potable water for the Town of Lincoln and the areas overlying groundwater reservoirs and recharge areas generally have been provided with public sewers, proper performance of on-site disposal systems remains extremely important in protecting groundwater resources for private wells utilized in remote areas not serviced by the public water supply system, as well as environmentally sensitive areas.

In addition to verifying proper and necessary system maintenance, the inspection process should insure that the system does not represent a health threat by exhibiting conditions such as ponding in the yard or basement and back-up of wastewater in toilets and sinks. An evaluation of system performance during rain events and spring run-off should be made to assess the threat of surface water contamination.

The Town should establish the current status for individual systems through a community survey process. Based upon the maintenance history documented by the survey, the future

pumpout and owner notification schedule can be established. A pumpout frequency of three to four years generally is acceptable for most domestic septic tank. Systems requiring more frequent pumping cycles will be determined from on-site inspections. Proper ISDS maintenance is to be documented to the Town by the return of receipts from private contractors for pumpout services performed.

Financing - A wastewater management authority must have the ability to finance activities through such means as establishing and collecting user fees, issuing bonds, and levying assessments or taxes. The main expenditure of funds by the management authority should be for construction assistance for ISDS system rehabilitation. Construction expenses are the single largest obstacle to the homeowner considering system rehabilitation. The Rhode Island Clean Water Financing Agency has developed a Community Septic System Loan Program that makes low interest loans available to fund ISDS upgrades. Property owners within areas designated for or with existing sewer service should be excluded from rehabilitation funding. Funds should also be made available only for systems approved by RIDEM. Administrative procedures must be developed by the Town for loan applications and fund disbursal.

System Rehabilitation - The Town must have the staff and materials that will enable it to assist the homeowner in solving ISDS problems either by directly instructing the homeowner or by referring the homeowner to a qualified professional. The authority also must have the legislative backing that will provide a recourse to insure that a problem will be corrected once identified.

Administration - A new committee can be formed to administer the ISDS management or this program can be administered through the Department of Public Works by the Town Engineer and or Sewer Division. Given the limited extent of continued ISDS treatment in the Town, formation of a new department to administer the ISDS management program is not warranted and it is recommended that these duties be the responsibility of the Engineering and Sewer Departments.

5.4 Sewer Extensions

Viable collection system alternatives include grinder pumps with pressure sewers, septic tank effluent pumps with pressure sewers, and gravity sewers. Each of these systems is described further below. Vacuum sewers are not considered to be viable due to limited lift, inefficient operation resulting in high operation costs, and because system failures will usually result in backflow and accumulation of waste in the connected buildings.

Grinder Pump/Pressure Sewer - The grinder pump/pressure sewer alternative includes a small pump at each home that discharges to a pressurized sewer in the street. The grinder pump, typically a 1 to 2 horsepower, is used to grind solids in the wastewater to form a slurry. The slurry is discharged through a service main to a small diameter (2 to 4-inch) polyvinyl chloride pipe, shallowly buried below the frost line, following the ground profile. A check valve is provided on the service main to prevent backflow. A septic tank is not required for this alternative. Pressure sewers are typically economically attractive over conventional sewers in less sparsely populated areas because less excavation is required (particularly in areas where there is shallow rock and/or high groundwater). They also have the advantage that they can be placed in area where existing ISDS influent pipes can be easily intercepted and pumped out into the pressure sewer located in the streets as apposed to gravity sewers that sometimes require rerouting of domestic plumbing to drain homes by gravity to collection pipes in the street.

Disadvantages are that grinder pump systems can cost between $10,000 and $15,000 per installation installed and capital costs escalate rapidly as the number of buildings served increases. Due to expense, emergency power usually is not provided at each home and when experiencing a prolonged service outage, these systems will be left without sewer service. In addition, these systems require maintenance, which usually is beyond the capabilities of the typical homeowner, requiring a service contract with a service vendor. There is limited use of low-pressure sewers in Lincoln and, although the Town is not responsible for these private systems, the Town has noted that homeowners have contacted the Sewer Department when maintenance is necessary or operational problems have

occurred. The Town does not have the equipment necessary to service private systems and responding to such requests places additional burdens on Sewer Department personnel and resources. Disagreeable situations can result when the Town must advise homeowners of their responsibilities in regard to ownership and operation of these private systems.

Septic Tank Effluent Pump/Pressure Sewer - The septic tank effluent pump (STEP) / pressure sewer alternative includes an open impeller pump which is used to pump wastewater from a septic tank to a pressurized sewer in the street. This is similar to a grinder pump installation except that instead of grinding solids, they are settled out in a septic tank similar to a conventional ISDS. The septic tank is used to remove solids including grit, grease, sludge and floatables and to reduce pollutant strength. The septic tank in a STEP system is commonly made of fiberglass reinforced polyester or low density polyethylene. The STEP pump can be located in a vault external or internal to the septic tank. This vault is typically made of fiberglass reinforced polyester. The pump discharges through a service main to a pressure sewer as described above.

Disadvantages of STEP systems are similar to the grinder pump. The open impeller pumps are somewhat less costly than the grinder pumps, requiring less horse power but the added need for a septic tank offsets the savings for the lower cost pumps. In addition, solids will need to be removed periodically from the septic tank similar to an ISDS (every 3 to 5 years). Failure to do so can result in solids accumulating in the pump chamber and clogging or damaging the pumps. Like grinder pumps, these systems are usually installed without emergency power. The potential for additional burden upon Town resources and for homeowner misunderstanding regarding ownership and maintenance responsibilities described above also are associated with low-pressure STEP systems.

Gravity Sewers - Gravity sewers are the preferable alternative for wastewater collection and conveyance systems because these systems typically are the less expensive to operate and require the less maintenance than other systems. Gravity collection sewers can be installed where a minimum pipe slope of 4 vertical feet per 1,000 horizontal feet can be

achieved to convey wastewater to the desired location. Manholes are installed with spacing 400 feet apart or less, and at changes in direction and grade. Local topographic considerations generally are the limiting factor in the feasibility of gravity sewers for specific areas. Pumping is necessary within systems where topography does not accommodate gravity sewers to the required point of discharge. Pumping may also be employed to avoid construction of sewers to unreasonable depths. Initial construction costs for gravity sewers with manholes are higher than pressure sewers but they do not require mechanical pumping equipment at each individual home, which is a great savings.

Combination Systems (Gravity Sewers plus Grinder or Effluent Pumps in Select Areas) - The final alternative for collection of wastewater from unsewered areas consists of a combination of one or more of the technologies described above. In some cases, remote areas of the service territory may be at grades or distances that would require installing the gravity sewer at greater depths to achieve the required slopes thereby lowering the system as a whole and increasing costs due to the greater depths of excavation and encountering groundwater or rock. In such cases, a cost benefit analysis would typically be conducted to see where the installation of grinder or effluent pumps with limited pressure sewers or force mains would be better served to convey flows from these remote areas to the gravity sewers. This would allow the most cost efficient installation of the gravity sewer system (i.e. shallow as possible) and minimize the number of onsite pumping systems needed.

5.4.1 Summary of Sewer Extension Alternatives

As the Town sewer system is well established and sewers occur throughout a majority of the Town, large scale sewer extension projects are not envisioned. Topographic constraints generally prevent the extension of gravity sewers from existing developed areas of Lincoln that are without public sewers and currently are served by ISDS treatment. Had gravity sewers been feasible for these areas, sewers likely would have been provided under the major sewer system construction program. It is presumed that some form of pressure sewers, or gravity sewers and additional pump stations, would be necessary to extend sewers to these developed areas. Detailed investigations and

evaluations of the available alternatives would need to be conducted for specific areas should future conditions (i.e. increased failure rates) warrant abandonment of ISDS in areas without public sewers.

New sewers necessarily will be associated with new development in order to convey wastewater flows. These new systems will likely be financed and installed by the developers and new sewer connection assessments charged in accordance with Town ordinance. As indicated above, gravity sewers are the preferred alternative for collection sewer systems. As the Town will assume ownership, and maintenance responsibilities, for most of these systems upon completion, extensive use of pump stations and pressure sewers is undesirable. However, because new development must connect to the existing sewer system, the depth of the existing sewers where connection will occur restricts the new systems and may necessitate pressure sewers or additional pump stations. The Town has established the order of acceptability for new sewer systems in Table 5-1 listed in order of most favorable to least favorable.

Table 5-1

Sewer System Order of Acceptability

1	Gravity sewer
2	Gravity sewer/existing pump station combination
3	Grinder pumps/gravity sewer combination
4	New pump station to replace one or more existing pump stations.
5	Additional pump stations

Sewer extensions for new development should be evaluated and implemented with the goal of providing the most favorable system. ISDS systems are to be implemented in areas that are to remain inaccessible to public sewers. Should the Town consider extending sewers to existing development in unsewered ISDS areas in the future, the detailed evaluations for specific locations should rate alternative systems based on the above order of acceptability.

Chapter 6 – Recommended Plan and Evaluation of Alternatives

6.1 Recommended Plan

The recommended plan for the Town of Lincoln wastewater facilities is established based upon the information, evaluations and assessments presented in the previous Chapters of this Facilities Plan. In general, new facilities or expanded facilities are not needed to address the existing or future wastewater disposal capacity needs of the Town and the recommended plan involves anticipated maintenance of existing facilities and investigations to identify deficient conditions in order to establish a rehabilitation and replacement program. The following evaluations and administrative activities should be conducted.

- Review and update Town Sewer Ordinance.
- Perform Sewer Rate Study and reset sewer use fees as necessary.

6.1.1 Collection System

As described in Chapters 3 and 4, the existing sewer system design capacity and intended service life extend beyond the end of the 20-year planning period, assuming a proper program of system maintenance (i.e. cleaning and flushing). Extensive construction to replace existing gravity facilities to accommodate increased flows due to development during the planning period is not anticipated to be necessary. New gravity conveyance facilities possibly may be constructed as replacements to existing pumping stations as discussed later in this Section. Existing facilities with a documented history of operation problems and deteriorated conditions should be repaired or replaced to correct deficiencies. The following recommendations are made with respect to the existing gravity collection facilities.

- Prepare / complete detailed information database of all Town pipe lines and manholes to identify location, size, age, materials of construction, slope, etc.

- Target sewers constructed prior to 1900 and sewers with suspected deteriorated conditions to conduct I / I analyses (this activity should be coordinated with the findings of the current NBC studies being conducted).
- Perform Sewer System Evaluation Surveys (SSES) where excessive extraneous flow is indicated by the I / I analyses.
- Initiate Rehabilitation / Replacement program for sewers with confirmed sources of excessive I / I identified under the SSES.
- Continue to evaluate alternatives for rehabilitating / replacing existing sewer systems located on private properties. Generally, new sewers constructed in public right-of-way are preferable to establishing Town easement rights, legal ownership, and maintenance responsibility, but specific recommendations must be based upon detailed studies for individual areas.
- Continue to target and conduct I / I, SSES and Rehabilitation / Replacement evaluations for remaining pipelines based on age (i.e. older than 1950s, older than 1980s, etc.) and areas of suspected stormwater intrusion until entire system has been evaluated and deficient conditions corrected as necessary.
- Perform detailed analyses based upon data compiled in the sewer system database to confirm that existing pipe line and facilities capacities are consistent with the original planning and design documents and identify areas of concern should actual capacities vary substantial from that required or originally proposed.

Investigations, evaluations, rehabilitation / replacement analyses for areas of known or persistent problems should be expedited where necessary. One such area is the existing sewer in School Street from NBC interceptor connection to Berkshire Drive. The RIDOT School Street resurfacing project is proposed to occur in 2008 and the sewer study and corrective measures for this area should be coordinated with this RIDOT project to the extent practical. Completion of activities that require excavation or other pavement disturbance prior to or in conjunction with the final roadway resurfacing should factor into the rehabilitation alternatives analyses and enable the Town to realize some cost savings or

implement a technically superior alternative by sharing costs (i.e. pavement restoration) with RIDOT.

6.1.2 Pump Stations

Staged rehabilitation based upon age and existing conditions is recommended for the Town's wastewater pump stations. The projected rehabilitation schedule presented in Chapter 3 is based upon the age of each pump station and the minimum intended service life of 20 years unless specific deficiencies or deteriorate conditions are apparent that indicate earlier rehabilitation is necessary.

6.1.2.1 Submersible Grinder Pump Stations

Based upon the age and general conditions, the staged rehabilitation the Submersible Grinder Pump Stations will be spread over several years with three to five stations rehabilitated per year. Rehabilitation of the Submersible Grinder Pump Stations is recommended to include complete replacement of the pumps and discharge piping systems (including valves and gauges) in the wet well chambers, repairs to the electrical system installation where necessary, and replacement of control system bubbler air compressors. Stainless steel guide rails and lifting chains, and PVC discharge piping is recommended for corrosion resistance. Additionally, access ladder safety extensions should be installed at stations without extensions.

Sewer Division personnel are most familiar with the physical and mechanical conditions of these stations and, due to the similarity of the basic design, detailed assessment of each Submersible Grinder Pump Station likely would not identify any information the Town is not aware of already. Town personnel can prioritize these stations annually and develop a specific rehabilitation schedule based upon operations and maintenance histories and occurrences. Once the priority schedule is established each year, the Town would then arrange for construction plans and specifications to be prepared based upon detailed assessment of the existing conditions at the specific stations to be rehabilitated. The detailed assessment and design recommendations also should investigate the feasibility

and cost effectiveness of eliminating existing pump stations by construction of alternate routing gravity sewers. Refer to the Wet Well / Dry Well Pump Station section below for further discussion on this topic. The Heidi pump station may have been constructed in lieu of gravity sewers through wetlands areas.

As noted in Chapter 3 the control systems for all but one of these pump stations utilize a mercury filled "electro-gage" controller. Although these control systems are generally in serviceable condition, the rehabilitation of these stations should consider replacing these systems to eliminate the possibility of accidental release and potential environmental impacts associated with this hazardous material. Microprocessor based control systems with level sensing pressure transducers and backup float systems are recommended. Depending on the sophistication desired, the microprocessors can be used to collect more detailed data, such as specific timing of pump operations and cycling, which cannot be obtained from elapsed run time meters that can be of use in documenting system operating conditions and identifying if changes in system use as they may occur. Additionally, these control system could be incorporated into the operations monitoring system recommended below for the Wet Well / Dry Well Pump Stations if desired.

6.1.2.2 Wet Well / Dry Well Pump Stations

Rehabilitation of the Wet Well / Dry Well Pump Stations should include a detailed assessment of the existing structural, mechanical, electrical, and instrumentation and control systems to verify the existing conditions and establish specific preliminary design recommendations for rehabilitation of each station. Detailed final design of construction plans and specifications for the rehabilitation of each station would follow the report of detailed assessment and design recommendations. The assessment and preliminary design recommendations portion of the rehabilitation tasks should be conducted under as a single project for all Wet Well / Dry Well stations, rather than individually, so as to provide consistency in the evaluation as well as the recommended design for all stations. Lower River Road Screw Pump pump station also should be included in the assessment and preliminary design project with these stations to promote consistency and minimize to

cost of the preliminary engineering phase to the Town. TR-16 recommends that fully valved connections be provided to allow the use of portable pumps in the event of equipment malfunction. The pump station rehabilitation evaluations should include consideration of providing bypass connections for the Wet Well / Dry Well stations.

As noted in Chapter 5 Lincoln has more pump stations than were envisioned in the original planning documentation for the original system design due to environmental constraints associated with installing utilities in regulated areas and associated buffers. Specifically, the Kirkbrae and Maria stations were constructed in lieu of river crossings to connect to the NBC interceptor on the opposite side of the Blackstone River; the Great Road station was constructed in lieu of gravity interceptor along the Moshassuck River and Barney Pond; and the Angell Road North was constructed in lieu of gravity sewers along the utility easement south to Twin River Road. The evaluations for rehabilitation of the pump stations should include investigations into the feasibility and cost effectiveness of replacing pump stations with gravity sewers through alternative (original) routing scenarios. The assessment project should include a detailed comparison of design, construction, and operations and maintenance costs in order to determine if elimination of specific pump stations can be recommended.

The pump station assessment project should also include evaluation of supervisory control and data acquisition (SCADA) system alternatives for the Wet Well / Dry Well. Computerized SCADA systems have a proven history of reliability in the period since the now abandoned pump station monitoring system was constructed and data obtained by continuous monitoring can be valuable tool in evaluating wastewater facilities operations and planning effective maintenance programs. SCADA system is recommended for the Wet Well / Dry Well stations and should include provisions for flow metering equipment to be installed for these stations. The SCADA system base station likely would be located at the Sewer Department or Engineering office and should be included in the initial pump station rehabilitation project. Later projects would need to be compatible with and provide appropriate modifications to add the subsequent projects to the system.

Similarly to the Submersible Grinder Pump Stations, the Wet Well / Dry Well Pump Stations also utilize a mercury filled "electro-gage" controller that are generally in serviceable condition. As recommended for the Submersible Grinder Pump Stations, the rehabilitation of these stations should consider replacing these systems to eliminate the possibility of accidental release and potential environmental impacts associated with this hazardous material. It is recommended that each Wet Well / Dry Well Pump Station rehabilitation include replacement of the existing control system. Eliminating the potential environmental impact liability is considered to be well worth the additional incremental cost of new control systems.

6.1.2.3 Screw Pump Stations

As indicated above, Lower River Road Screw Pump pump station is recommended to be included in the assessment and preliminary design project with the Wet Well / Dry Well stations. Complete rehabilitation of the mechanical and electrical systems for this pump station is recommended. The control system is expected to be serviceable for continued operation, but may require replacement for compatibility with the replacement mechanical pumping equipment. Additional equipment will be necessary to provide input data and communications with the above recommended SCADA system. The rehabilitation should include a new control system that is compatible with the proposed SCADA system accordingly.

6.1.3 ISDS

Continued use of ISDS treatment is recommended for the areas that currently are inaccessible to the existing public sewer system. These areas generally occur in the locations identified in Table 6-1 below, however, other scattered properties and areas occur elsewhere that do not have convenient access to existing sewers.

Properties with existing ISDS treatment that occur in sewered areas and have connection access to the existing sewer system should not be allowed repair, replace or otherwise

modify on-lot systems and should be required to connect to the existing available sewer system upon ISDS failure, proposed change of use, or proposed increased loading.

Table 6-1

ISDS Treatment Areas Generally
Inaccessible to Existing Public Sewers

- Breakneck Hill Road at Old Louisquisset Pike and Route 146
- Twin River Road at Old Louisquisset Pike and Route 146
- Whipple Road, Lantern Road and East Lantern Road area
- North of Wilbur Road along Old Louisquisset Pike and Route 146
- Old Great Road at Route 146, Sayles Hill Road at Route 99
- Woodward Road north / east of King Phillip Road

It is recommended that Lincoln implement a management program that consists of combination of features from the Community Required Maintenance program and the areawide Educational Program detailed in Chapter 5 in order to promote the proper operation, maintenance and use of ISDS treatment systems in areas that are to remain unsewered.

6.2 Evaluation of Alternatives

The extent of the existing service area and general suitability of the existing sewer system to accommodate future needs limits the available alternatives to be evaluated. New developments should be evaluated based upon the acceptability criteria listed in Chapter 5 based on specific projects, locations, and proposed point of connection to the existing sewer system with the goal of no net increase in pumping stations. Isolated development in areas inaccessible to the existing sewers will require ISDS treatment for wastewater disposal. New development in these areas is anticipated to be low-density and limited to individual property sites. Evaluation of extending sewers should be considered if any significant subdivision or extensive development projects are proposed for currently isolated areas.

6.2.1 Collection System

As established previously in this Plan, construction of new collection facilities to accommodate future increased flows is not envisioned to be necessary. As such, the alternatives for the future management of the collection system generally are limited to the No Action alternative and the system investigations and evaluations discussed above. Under the No Action alternative, existing deficient conditions would remain in areas and would continue to present intermittent operational problems. These areas require special attention and a disproportional level of effort in order maintain satisfactory operations. It can be expected that conditions will at best remain as exist at this time without programs to identify and correct deficiencies, but it is likely that system operations will degrade further over time if deficiencies are not corrected. Further degradation would necessitate that additional maintenance resources be applied, increasing the disproportional effort to maintain these areas. Additionally, the level of service could degrade to the point that unacceptable performance would require construction of emergency replacement facilities without being afforded time to develop and evaluate alternative designs.

Under the recommended program of system evaluation and rehabilitation, deficient conditions would be identified and corrected in a logical fashion. Under this approach, the system operations and reliability would be improved, thereby reducing the anticipated maintenance required of historically problematic areas and allowing these resources to be applied more evenly throughout the system. This scenario will lead to the overall improvement of the entire system and for this reason is recommended over the No Action alternative.

Without completing specific investigations, analyses, and evaluations of the existing system conditions, detailed comparison of individual sewer repair, replacement and rehabilitation technologies is not possible. The merits and drawbacks of the various viable alternatives for collection sewer system rehabilitation are provided below. It should be noted that in all cases by-pass pumping of sewage around facilities under repair will be necessary.

Excavation and Replacement – Excavation and replacement is the most disruptive means of correcting deficient conditions in existing sewers. This method is employed when the structural integrity of the pipeline is degraded to the point where in-place repair methods are not possible. Examples where replacement would be necessary include pipe that is crushed, missing sections, is excessively cracked, or is misaligned. The extent of replacement can vary from individual lengths of damaged pipe to entire runs of pipe and manhole structures. Advantages of pipe replacement are improvements associated with current construction materials and methods that will provide an increased service life for the pipe. Replacement typically will require disturbance and restoration of existing pavement and may encounter buried utility or other unforeseen interferences. Replacement pipe bedding materials generally will be required and additional select backfill materials often may be needed because existing materials do not conform to current pipe installation requirements. These aspects of excavation and replacement lead to higher installation costs than other rehabilitation alternatives.

Chemical Grouting – Internal grouting is the most commonly used method for sealing leaking joints in structurally sound sewer pipes. Small holes and cracks can also be sealed with chemical grouts. Chemical grouts are applied inside the pipe using specialized equipment that force the grout through the leaking joint or crack and into the surrounding soil, which is stabilized by the grout. Repair of small to medium sized pipes employ a "packer" that can seal off pipe segments, air test the isolated segment, and injecting grout where air testing indicates leaks occur. The primary advantage of this rehabilitation method is that repairs are effected in-place without requiring costly excavation and surface restoration, or potentially disturbing other underground utilities. Chemical grouting is not a structural repair and does not result in increased pipe strength. Changes in groundwater conditions and the moisture content of the surrounding soil can reduce the effectiveness of grout. Additionally, leaks can be difficult or impossible to seal if large voids exist outside the pipe. Chemical grouting is not suitable for repair of misaligned or offset joints or longitudinal cracks.

Pipe Lining – There are several methods of in-place pipe rehabilitation that fall under the general category of pipe lining. These methods include slip lining, deformed pipe, cured-in-place pipe (CIPP).

- *Slip Lining* – In the slip lining rehabilitation process whereby a replacement pipe is inserted inside the existing pipe. The lining pipe must be slightly smaller in diameter than the existing pipe and is installed by either pushing or pulling. Slip lining requires an excavation pit to access the existing pipe and begin the insertion process at one end of the pipe segment to be repaired. Winching equipment usually can fit into standard manholes, which allows the slip lining installation to terminate at a manhole structure. Slip lining can be accomplished with continuous (fusion butt welded) or segmental lengths of piping. Spiral wound piping where the strips of liner material are wound into the existing pipe and the spiral joint is sealed by interlocking, gaskets or adhesive. Spiral would lining sometimes can be installed through manholes without excavation. Service connections must be reconnected by excavating or remote control cutter after slip lining pipe installation. Although an insertion pit is necessary for each repair segment, slip lining requires substantially less excavation in comparison to complete pipe replacement. Disadvantages of are associated with the necessary reduction in size from the original pipe diameter. Where the existing pipe has offset joints or excessive service lateral taps, the liner pipe may need to substantially smaller than the original pipe. These conditions may result in a reduction in carrying capacity such that the slip lining method becomes unsuitable for the application.

- *Deformed pipe* – The deformed pipe lining method is similar to slip lining in that the liner pipe is inserted into the existing host pipe. The flexible liner pipe is deformed, commonly by folding into a “U” shape, to reduce the cross section temporarily so that it can be pulled through the existing pipe. The liner pipe then is heated and pressurized to expand to the existing pipe to complete the installation. Service laterals are identified by a dimple in the liner pipe and reconnected by remote cutting device.

Deformed pipe linings usually can be installed via standard manhole structure without requiring excavation, which provides for reduced installation costs. Disadvantages include reduced pipe diameter and the possibility that the liner pipe can shrink or deform after expansion.

- *Cured-in-Place Pipe* – This method pipe rehabilitation utilizes a flexible fabric tube impregnated with a thermosetting resin to reline the existing pipe by inversion. Inversion is the process of turning the resin impregnated tube inside out by the use of water or air pressure. Heated water or steam is applied to cure the liner and bond it to the existing carrier pipe to complete the installation. The CIPP method uses existing manholes as access points for inverting and curing the liner tube. Service lateral connections are identified by dimples in the cured liner and reconnected by remote cutting device. The advantages of CIPP are that excavation usually is not required, the liner material forms a tighter bond and seal with the existing pipe, and the liner / resin materials with distinct resistance to specific wastewater characteristics can be provided. As with other lining methods, the pipe diameter is reduced for the original pipe. The curing time required for CIPP generally requires that repair segments be out of service for longer periods that other lining methods, and curing of long segments can be difficult. Resin materials can collect in the pipe invert and improper or deficient installations can be problematic to correct.

Pipe Bursting – New piping can be installed by the pipe bursting method to replaced damage existing piping. Under this repair method, an expansion head is used to force the existing pipe outward until it breaks. Expansion heads can be static with no moving parts, or dynamic applying additional force on the existing pipe by pneumatic pulsation or hydraulic expansion. A bursting device is pulled behind the expansion head to break up the existing pipe and the new pipe is pulled through behind the bursting device. Pipe bursting normally requires an access pit to be excavated to accommodate inserting the bursting equipment and installing new pipe segments. Service laterals are reconnected by excavation or remote control device. This in-place rehabilitation method has the distinct

advantage of replacing the existing pipe without requiring a reduction in size, and sometimes can be used to installed larger size pipe to increase capacity. Pipe bursting may not be a suitable based upon the existing pipe materials, and the potential exists for surface and underground disturbance to occur with this method.

6.2.2 Pump Stations

New construction to increase the capacity of the existing pump stations to accommodate future increased flows is not envisioned to be necessary. Similar to the collection facilities discussion presented above, the alternatives for the future management pump stations generally are limited to the No Action alternative and the equipment replacement and station rehabilitation programs recommended above, which include evaluation of new gravity sewers to replace existing pump stations.

Basic arguments against the No Action alternative for pump stations are the same as for collection facilities, whereby existing deficiencies would continue to place undue demand on maintenance resources reducing the efficiency of overall system operations and continued deterioration would serve to compound the situation. Immediate response to major equipment failure likely would require transportation of wastewater by tanker truck because no provisions exist for temporary bypass pump connections to the existing discharge forcemain piping. This concern generally is associated with the Wet Well / Dry Well stations, as an inventory of spare pumps maintained for the Submersible Grinder stations that allows for prompt equipment replacement, and portable pumps with short runs of discharge hose could be implemented at the Screw Pump station without difficulty if needed. Without a planned program for rehabilitation, system reliability would not be assured and all stations eventually would experience equipment malfunction or failure that would require emergency replacement activities. The No Action alternative is deemed to be infeasible for this reason.

Under the recommended program of staged rehabilitation, the actions and projects necessary to maintain satisfactory operating conditions at the pump stations would be

identified, sequenced, and implemented in a logical fashion. Station operations and reliability would be assured and emergency response maintenance activities would be reduced correspondingly. Reliable pump station operations are essential to the overall satisfactory service of the Town's wastewater facilities, and rehabilitation of the existing pump stations is recommended over the No Action alternative accordingly.

6.2.2.1 Gravity Sewer Pump Station Replacement

The possibility of replacing pump stations replacing pump stations with gravity sewers through alternative (original) routing scenarios may exists for some stations. As indicated earlier in this Section, the detailed pump station rehabilitation assessments to be performed should include a comparison of design, construction, and operations and maintenance costs in order to determine if elimination of specific pump stations can be recommended. These detailed evaluations would include investigation of the specific environmental constraints and mitigation requirements associated with the gravity routing alternatives. Final recommendations as to the viability of station replacement over rehabilitation until these investigations are performed that anticipated costs to address the specific constraints associated with the alternative routing can be established.

For the purposes of comparison in this Plan, the projected cost for pump station rehabilitation projects includes replacement of pumps, controls, heating and ventilation equipment, and wet well electrical systems. The proposed facilities identified in the 1971 Phase I Sewers Proposed Sewerage System plan will be used as the basis for gravity routing alternatives and projected costs will be based upon conventional design and construction utilizing ductile iron pipe, with a 20% increase in expense assumed due to environmental constraints. Cost to abandon or demolish existing pump stations is not included. The projected costs, including engineering, construction and contingencies, for the stations identified earlier in this Chapter where replacement may be possible are provided in Table 6-2 below.

Table 6-2

Pump Station Rehabilitation and Gravity Sewer Replacement Estimated Costs

Location	Pump Station Rehabilitation	Gravity Sewer Replacement
Great Road	$380,000	$1,060,000
Maria	$165,000	$360,000
Kirkbrae	$185,000	$280,000
Angell Road North	$160,000	$805,000
Heidi	$35,000	$70,000

Based only upon these estimated costs, gravity sewers would not be recommended as to replace any of these stations. However, as noted previously, the gravity sewer replacement alternative costs are based upon the broad assumption that project costs will be increased by 20% due to environmental factors, under certain conditions where severe constraints must be overcome actual costs may be much higher. These factors can include activities such as wetlands permitting and restoration, additional dewatering, and special pipe bedding requirements. Additionally, the above listed estimated costs represent initial project capital costs without anticipated lifetime operation and maintenance cost considerations. As such this information is presented here for general reference only. Formal comparison of station rehabilitation against replacement must be deferred until further investigation of specific alternative routing scenarios has been conducted and additional detailed information is available for evaluation.

6.2.3 ISDS

The alternatives evaluated for areas without access to the existing sewer system where ISDS treatment is in use, and thus required for any future development are continued use of ISDS treatment (with education and community required maintenance), and extending public sewers. Various topographic and physical barriers occur that isolate these areas and limit the practicality of sewer extension. Given the extent of the existing sewer system, it is reasonable to expect that the major sewer system expansion projects would have

included construction of sewers to service these areas if such construction was reasonably feasible or if a specific need (i.e. excessive ISDS failure) was evident.

Various sewer system alternatives are discussed in Chapter 5, and a combination of individual grinder or effluent pump with pressure sewers, gravity sewers, and small pump station methods typically would be necessary in order extend sewers to most of the existing unsewered. For general comparison, extending sewers to service approximately 20 lots along Old Louisquisset Pike north of Wilbur Road would entail construction of 3,400 feet of new 8-inch gravity sewer, 1,400 feet of new 3-inch forcemain, and relocation of the existing Old Pike pump station. The estimated construction cost for these facilities is approximately $615,000, or approximately $31,000 per lot, and assumes that no environmental constraints exist that would necessitate extensive mitigation or special construction methods.

Projects to extend sewers to the Town's other unsewered areas would require individual grinder or effluent pumps and pressure sewers, with an approximate cost of $15,000 per service, in addition to comparable gravity sewers construction. Assuming and extension with the same length of gravity sewer and number of services, with half of the services requiring grinder pumps, and no further centralized pump station is necessary, the estimated cost per service would increase to approximate $35,000 due to the expense of individual pumping systems and pressure sewers. If one new centralized pump station were required, the cost per service would increase to approximately $37,500. Additionally, relocation of the Old Pike pump station includes only the cost of a new pump station wet well chamber structure and not the complete cost of a new centralized pump station. The Town will incur equipment costs to rehabilitate this station regardless of its possible relocation and therefore equipment costs are not included in the estimated sewer extension costs.

This estimated cost to extend sewers along Old Louisquisset Pike north of Wilbur Road is considered to be generally optimistic due to the specific conditions associated providing

service to this area and higher per unit cost would be anticipated for sewer extensions to other unsewered areas. Additionally, the limited evaluations above do not consider potential additional cost to address environmental impacts or special construction methods to clear other physical barriers, such as pipe jacking to cross state highways. As the cost of conventional on-site wastewater disposal systems can range from $12,500 to $19,000 and advanced I / A systems from $23,000 to $41,000, the continued use of ISDS treatment is the financially more attractive alternative unless specific local conditions necessitate implementation of advanced I / A systems with increasing frequency. There is no emergent evidence of excessive ISDS failure or unsuitability based upon existing repair histories, therefore continued use of ISDS treatment is recommended for areas without access to the existing sewer system. However, the Town should monitor ISDS operating conditions, failures, and repairs in order to identify if any of the conditions that form the basis of this recommended have changed in the future whereby re-evaluation of the need to extend sewers would be warranted.

6.3 Environmental Impacts of the Recommended Plan

The purpose of an environmental evaluation is to identify the project alternatives selected in the Facilities Plan and determine the impacts these alternatives have on the environment. The recommended plan for the Town of Lincoln was presented in the preceding sections of this chapter and is briefly outlined as follows:

- Investigation, evaluation, rehabilitation / replacement of collection facilities
- Staged rehabilitation of pump stations
- Continued ISDS treatment in selected areas inaccessible to the sewer system

6.3.1 Future Environmental Environment without the Project

By adopting the No Action alternative, the existing system conditions discussed in this and previous chapters will prevail and continued degradation of performance of portions of the existing sewer system would be anticipated. Environmental impacts associated with the No Action alternative include the potential for release of sewage to the environment due to

pipeline blockages, failures, and failed pumping systems. Such releases could necessitate notification of public safety and health officials, or other emergency responses.

6.3.2 Water Quality and Aquatic Life

The proposed activities and improvements to the Town of Lincoln sewer systems are those required to maintain and provide for the proper operation of these facilities throughout the planning period. There are no discharges to surface waters existing or proposed from the Town system and no appreciable change or impact to local water quality or aquatic life is anticipated to result from implementation of the recommended plan.

6.3.3 Wetlands and Floodplains

In general, the above discussion of water quality impacts associated with areas of continued ISDS treatment apply equally to the anticipated impact upon wetlands and floodplains. No projects are proposed at this time that would require new or extensive construction activities in regulated areas. Should the future evaluation of pump stations and potential rerouting alternatives conclude that pump stations replacement is to be recommended, these evaluations necessarily will need to provide detailed assessment of the expected impacts and required mitigation measures associated with the proposed construction activities. Similarly, any sewer rehabilitation or replacement projects resultant from the recommended studies and evaluations of the existing collection system would include specific detail of the environment impacts and necessary mitigation requirements for the proposed work. Significant impacts are not envisioned, as the rehabilitation projects would involve existing systems in developed areas. Where existing piping in wetlands or floodplains must be rehabilitated, impacts associated with the temporary disturbance would be expected based upon the extent of work necessary and a requirement to completely restore all disturbance would be anticipated for any project.

Potential construction impacts to wetlands and floodplains are primarily in the form of erosion and sedimentation. The washout of soil excavated from trenches could severely affect local storm drainage structures and private property, increasing maintenance costs,

reducing water quality, and possibly causing localized flooding problems. These impacts are regulated by RIDEM and permits would be required for work within jurisdictional wetlands. Potential need for permits should be identified and permits should be sought as early as practical in evaluation and planning phases of the collection system and pump station rehabilitation projects. No significant permanent effects to any floodplain such as storage, aesthetics, habitat, human health, and welfare are being compromised by adoption of the selected plan.

6.3.4 Traffic and Noise

Disruption of traffic is a direct impact associated with most sewer construction and rehabilitation projects. Public safety and traffic flow concerns can post a variety of lifestyle problems during construction. Interference with normal access to commercial and residential facilities generally can be anticipated. In cases where troublesome traffic flow patterns exist, congestion could become more severe during construction projects.

Traffic impacts during sewer system investigation activities are associated with accessing existing manhole structures to install metering or observational equipment and perform conditions assessments. These impacts usually are confined to a single manhole location or reach between two manholes and will occur only when access is required. Traffic impacts from sewer pipe rehabilitation activities will be dependent upon the extent of excavation required under the specific method of pipe rehabilitation to be implemented as determined through the SSES program, with anticipated traffic impacts increasing with increased excavation. The greatest amount of excavation is required with the excavation and replacement method, lesser excavation is needed for slip lining and pipe bursting methods, and the least excavation is necessary for CIPP and deformed pipe methods. Temporary controls during investigation and construction activities, including warning signage, flagmen, lane closures, detours, or police details, usually are necessary to mitigate impacts and maintain acceptable traffic flow.

The pump station rehabilitation projects will impact traffic in the immediate vicinity of each station during the work. Many of the Submersible Grinder stations are located in primarily residential areas encroachment of activities into the roadway, which typically will be necessary due to the location and small size of each site, the anticipated impacts to traffic are expected to be minimal because these streets mostly are lightly traveled and many stations are located at a dead end or cul-de-sac. One exceptions to this generality are the Davies stations located on Route 246 / Old Louisquisset Pike at the intersection with Route 123 / Breakneck Hill Road. This intersection is heavily traveled due to its proximity to both the Davies Vocational School and Community College of Rhode Island, and also because Route 123 serves as a direct route towards Route 146 south to Providence and Route 95 from the industrial park. However, this site is larger than most other Submersible Grinder pump station sites, with area available on site to accommodate some construction vehicle parking, and no significant traffic impacts are expected to occur due to the proposed station rehabilitation project.

Lower River Road is a narrow street and there is no off street accessibility at the Lower River Road pump station. Lower River Road is not a heavily traveled street, but moderate traffic impacts to residents of Quinnville could occur during construction. The Wet Well / Dry Well stations each occur on larger sites that generally provide for off street parking of construction vehicles similar to the Davies station and only the Great Road station is located on a road that sees a substantial traffic load. Substantial traffic impacts during construction of the pump station rehabilitation projects are not anticipated and no long-term traffic impacts are expected to result from these projects.

Noise impacts are predominately short term, and derived from construction vehicles involved with pavement breaking, trench excavation, backfilling, and repaving existing streets. As with traffic impacts, the impact of noise from these activities will be dependent upon and increase as the extent of excavation required increases based upon the specific method of pipe rehabilitation to be implemented. The effect of these impacts will be less in densely developed areas, where background noise is relatively high, than in quieter

residential areas where increased background noise levels would occur during normal working hours. Rehabilitation of the existing pump stations is not expected to have a permanent effect on noise levels. Temporary impacts are expected to be minor, as little or no excavation is expected to be necessary. However, permanent reduction in noise levels would be expected in the immediate vicinity of any stations eliminated or relocated

6.3.5 Air Quality

One of the factors affecting air quality during construction is increased emissions of carbon monoxide and hydrocarbons from heavy duty vehicles and gasoline driven pumps and generators. These effects will be more pronounced in residential neighborhoods than in the high traffic commercial district. A second factor affecting air quality is dust which will be generated during trench excavation, backfilling and vehicular transport. Air quality impacts from construction are temporary in nature and will be localized at the point of disturbance.

Odors are a typical concern, especially in residential areas, for wastewater pump stations, where raw wastewater is subjected to turbulent conditions causing the release of hydrogen sulfide and other potentially odorous compounds. As noted previously in this Plan, while odor complaints do occur, the frequency of these complaints does not suggest a particular air quality problem is associated with pump station odors. As no substantive changes for any pump stations are proposed, air quality conditions with respect to odors are expected to remain the same. However, changes such as increased loading over time and new occupants in adjacent dwellings may occur and odor control may become a future issue.

6.3.6 Hydrology and Drainage

No appreciable effect on hydrologic conditions is anticipated from the proposed plan. The impact of reduced flow to groundwaters as ISDS treatment is abandoned and replaced by sewer connections will be minimal because these occurrences will be scattered throughout the Town and groundwater is utilized as a drinking water supply in limited practice.

Water quality conditions in areas of continued ISDS treatment should only benefit from the proposed plan. Through the education and required maintenance program, public awareness of the importance in properly servicing these systems will be raised and the performance of these systems generally would be expected to improve accordingly. Improved ISDS performance would result in reducing the pollutant loading to local groundwater. Further, the Town's continued monitoring of ISDS conditions and repair histories will enable problems to be identified and addressed promptly so that necessary measures are taken to assure water quality is maintained.

There will be no effect on topography as a result of the proposed plan. Drainage may be affected by the potential increase in base flow to streams and storm drains resulting from elimination of extraneous I / I sources from the sewer system. The overall effect will be most evident during wet weather, but should be minimal if noticeable at all.

6.3.7 Economic Impact

There are numerous benefits associated with the proposed plan. The most obvious benefit arises from the potential of construction projects to provide short term jobs for local contractors and their work force. The projects will also create a need for materials and may produce an influx of business to local entities to address worker needs. Secondly, sewers will continue to address the need for wastewater disposal for many of the commercial establishments in Lincoln, enabling large water consumers such as restaurants, and laundromats to remain in Town without concerns that inadequate ISDS systems might hinder the operations and allowing new commercial establishments to consider locating in Lincoln with similar confidence. The third and most important economic benefit will result improved water quality by reducing polluting effects of failing subsurface disposal systems. Improved water quality will serve to enhance the existing conditions and features of the Town that promote its attractiveness to potential residents and commercial enterprises.

6.3.8 Cultural, Historical and Archeological Impacts

Numerous locations were identified within the Town that are included in the Federal Historic Register. Since most of the work is proposed in existing streets or easements, impacts to historic and archaeological resources is expected to be minimal.

6.3.9 Wild and Scenic Rivers

Sections of rivers registered in Rhode Island as wild and scenic are located in southern Rhode Island. The Blackstone Valley National Heritage Corridor was established by U.S. Congressional act acknowledging the historical and aesthetic importance of this region. None of these will be affected by the proposed wastewater facilities rehabilitation or continued proper use ISDS treatment technologies.

6.3.10 Secondary Impacts

The presence of sewers in an expanding residential community is virtually certain to increase land use pressures, particularly where soil conditions have previously limited the use of on site sewage disposal systems. These pressures can result in less stringent zoning regulations and increases in population unless the Town takes the necessary measures to protect against this. In turn, increased urbanization leads to additional air and noise pollution, energy demands, and impairment of aesthetic qualities. However, it is anticipated that the Town will abide by current zoning regulations in keeping with the goal of maintaining the Towns rural and village character. Since majority of the Town is provided with public sewers, strict enforcement of zoning regulations will serve to keep growth to a minimum. The wastewater generation rates projected for the sewered areas was based on the premise that future development will proceed in accordance with existing zoning.

6.3.11 Mitigation Measures for the Proposed Alternative

The majority of the negative environmental impacts are related to construction activities. Important elements necessary to mitigate impacts include a detailed erosion and sediment

control plan, a dust control plan, traffic control, and construction phasing to avoid excessive traffic conflicts and to reduce noise.

Erosion and sediment control is designed to protect hydraulic structures such as culverts, inlet structures and catch basins and to protect water courses particularly at planned river crossings. Protective measure such as hay bale sediment traps and siltation fences will be installed as needed during construction operations to minimize short - term erosion and to prevent sedimentation in surface waters. In the event that dust becomes a problem during construction, water and/or calcium chloride will be sprayed on critical areas to minimize disturbances. After construction is complete, all disturbed areas will be graded and revegetated.

The traffic control plan should address normal vehicular traffic as well as construction traffic within an area to be disturbed. To the extent possible, main traffic arteries will be kept open, which will likely lead to alternating one - way traffic lanes and subsequent vehicle slowdowns. In some cases, particularly on narrow streets, complete detouring may be necessary. Pedestrian safety also is an important consideration in residential areas and adjacent to schools, churches, and other public buildings where a large number of street crossings are anticipated. As part of the erosion control plan, the contractor will be required to backfill all sewer trenches at the end of each working day to minimize public safety concerns.

Appropriate security measures will be taken to prevent vandalism and to protect the public from entry to excavations. Construction phasing to avoid annoying times of day and weekends in residential areas will minimize noise impacts and interference with regular neighborhood activities. The potential for encountering undocumented cultural of historical resources, particularly those involving indian artifacts or indian burial sites exists. The Rhode Island Historic Preservation Commission will be consulted and archaeological surveys conducted, if deemed necessary.

6.4 Summary of Costs

A summary of the costs for the proposed activities is presented in Table 6-3 below.

Table 6-3

Estimate of Probable Construction Cost

Description	Cost
Collection Sewer Rehabilitation	$4,175,000
Angell Road North PS Rehabilitation	$160,000
Angell Road South PS Rehabilitation	$200,000
Great Road PS Rehabilitation	$380,000
Kirkbrae PS Rehabilitation	$185,000
Maria PS Rehabilitation	$165,000
Lower River Road PS Rehabilitation	$250,000
Submersible /Grinder PS Rehabilitation	$875,000
Total	$6,390,000
Amortized Cost	$639,000

Development of these costs is based upon the following assumptions:

- Rehabilitation will be required for approximately 5% of collection sewer total length, all repairs by excavation and replacement, and 8-inch diameter average pipe size.
- Screw Pump and Wet Well / Dry Well pump station costs include replacement of pumps, controls, ventilation systems, and electrical systems in wet wells.
- Submersible / Grinder pump station cost include replacement of pumps, guide rails and all wet well discharge piping, controls, and electrical systems in wet wells for 25 stations.
- Amortized cost based on factor of 0.10.

Chapter 7 – Recommended Plan Implementation

7.1 Institutional Responsibilities

As identified in prior chapters, the Town of Lincoln directs all of its wastewater flow to the Narragansett Bay Commission for treatment at either the Bucklin Point WWTF or Field's Point WWTF. Neither the Town nor NBC was able to provide a copy of any inter-jurisdictional agreement that describes the terms of services and uses between these two entities. Similarly, the Town does not have records of any inter-jurisdictional agreements with the Town of North Providence or the City of Pawtucket in regard to Lincoln wastewater flows that are directed to the local sewer systems of these municipalities prior to reaching downstream regional NBC facilities. When inquired regarding this matter, public works personnel in North Providence and Pawtucket indicated they were not aware of any agreements with the Town of Lincoln for local sewer use.

The Town should coordinate with adjacent municipalities to determine if there is justification to establish a formal agreement for continued use of their local sewers. The Town also should coordinate with NBC to verify if an agreement exists between these two entities, to document its terms and conditions, and determine if any renegotiation is necessary or, if no agreement exists or can be documented, to negotiate the terms and conditions of a new agreement in order to accommodate future Town wastewater disposal needs. In either case, the terms of the agreement should address the following issues:

- *Flow Rates* – The agreement should identify permitted flow rates and approved tie-in locations to the NBC system.
- *Flow Metering* – The agreement should identify locations where NBC flow metering occurs and the formula utilized to calculate wastewater flows attributable to Lincoln. The agreement should afford Lincoln the opportunity to review and be provided with meter data as well as calibration and maintenance information, including on-line electronic data accessibility if available.

- *Characteristics of Waste* – Waste delivered by Lincoln must conform to the NBC requirements established to in order to maintain the integrity of the treatment processes.
- *NBC Responsibilities* – NBC must agree that as long as Lincoln conforms to the terms of the agreement that it will accept, receive, treat and dispose of waste delivered to the treatment facilities to the best of its ability. Language should also be included regarding damages resulting from the failure or inadequacy of the NBC facilities. Lincoln should be held harmless for damages due to negligence on the part of NBC.
- *Right to Inspect* – Lincoln should maintain the right to inspect any and all records concerning construction, expansion, modifications, operation and maintenance of the NBC facilities to which it directs wastewater flows, including: Bucklin Point WWTF, Fields Point WWTF, Sayleville Pump Station, Washington Highway Pump Station, Ernest Street Pump Station, Blackstone Valley Interceptor, Washington Highway Interceptor, Moshassuck Valley Interceptor, and Louisquisset Interceptor.
- *Operating Charges and Future Expansion Costs* – NBC is a regulated public utility and, as such, its rates are subject to Rhode Island Public Utilities Commission approval. The Town should maintain awareness of the NBC rate structure and participate in the public hearing and approval process for proposed changes as deemed necessary to assure that the future interests and needs of the Town and its sewer system users are properly protected and addressed.

The Town's duties, authority, rights and responsibilities with respect to providing wastewater services are established in the Town of Lincoln Sewer Ordinance as legislated by the Town Council. This Ordinance enables the Town to control the planning, financing, construction and operation of all major wastewater facilities and establishes the Town's authority to issue notes and borrow money, establish and collect sewer connection and sewer use charges, and levy taxes for the purposes of providing wastewater facilities within the Town. The Town will need to pass legislation to amend the Town's duties, rights and responsibilities with respect to the area wide Education and Community Required Maintenance program for privately owned ISDS treatment units, as well as

authorizing new bonds or assessments to fund the future activities of the recommended Plan.

Money must be raised to finance the recommended plans. The Town will be obligated to secure financing and distribute costs equitable among those benefiting from the services and improvements. The Town therefore should have reliable sources of capital and income. Such sources are general obligation and revenue bonds, taxes, and user charges. Financing for capital improvements and related projects for wastewater facilities also can be obtained in the form of low interest loans via the State Revolving Fund (SRF) financing program. Normally major improvements that benefit the entire community are financed through long-term general obligation bonds issued against the entire community, while capital improvements that benefit a limited area become the obligation of that area. Administrative, operation and maintenance costs should be distributed over the area sewered and financed by user fees.

7.2 Implementation Schedule

In order to implement the recommended plan, appropriate funds must be made available. RIDEM approval of this Facilities Plan is prerequisite to eligibility for SRF financing and it is anticipated that any financing program requiring public approval would be presented to voters in November 2006. As such, funding for the major portions of the proposed projects is not expected to be available until early to mid-2007. However, many portions of the proposed activities fall within the criteria of system maintenance and could be funded through the existing maintenance budget if sufficient monies are available. The Town might be able to secure additional funding via the Community Development Block Grant program, to finance projects similar to the “Lonsdale Village Sewers” project. If available funding is identified from these or other sources the Town might be able to initiate certain aspects of the recommended plan prior to securing financing for the entire program. The proposed implementation schedule with approximate dates for engineering and construction of the various projects is presented in Table 7-1.

Note that this projected implementation schedule is based only upon pump station age unless existing conditions are evident to suggest that earlier equipment replacement may

Table 7-1

Project Implementation Schedule

Description	Anticipated Start
Collection Sewer I / I Studies	March 2007
Collection Sewer SSES	June 2007
Collection Sewer Rehabilitation	September 2007
Wet Well / Dry Well and Screw Pump Stations Assessment and Design	January 2007
Angell Road South PS Rehabilitation	June 2007
Maria PS Rehabilitation	June 2008/2013
Lower River Road PS Rehabilitation	June 2008/2013
Great Road PS Rehabilitation	June 2009/2014
Kirkbrae PS Rehabilitation	June 2009/2014
Angell Road North PS Rehabilitation	June 2010/2015
Submersible /Grinder Pump Stations Assessment and Design	January 2007
Submersible /Grinder PS Rehabilitation	
Arlington, Edgehill, Hillside, Middle, Mount, Newland	June 2007/2012
Applewoood, Great Road (116), Jason, Paddock	June 2008/2013
Ashley, Eagle Nest, Birchwood, Cider Mill, Lori Ellen, Oak Hill	June 2009/2014
Lincoln Center, Rollingwood, Woodridge	June 2010/2015
Butterfly, Heidi, Old Pike	June 2011/2016
Davies, Whitney, Belmont	June 2013/2018

be necessary. Where a range is listed range, the dates identified generally represent 20 and 25 years in service. Additionally, it is assumed that the collection system investigations and rehabilitation will be an ongoing program. Findings and conclusions of detailed investigations, assessments, and evaluations to be performed should be used to amend and refine this schedule as necessary.

7.3 Operation and Maintenance

Administration, operation and maintenance of Town's wastewater facilities the fall under the responsibility of the Department of Public Works and are delegated to the Sewer Department and Engineering Department. The Sewer Department is responsible for the operation and maintenance of the Town gravity sewers and wastewater pumping facilities. The Sewer Department Supervisor manages the department's staff of operations and maintenance personnel under the supervision of the Director of Public Works. The Engineering Department provides technical support to all Town departments, reviews and approves development plans, maintains engineering records and maps, and provides for the design of Town infrastructure and facilities. The Town Engineer manages the Engineering Department staff to perform these duties under the supervision of the Director of Public Works. The additional duties associated with oversight of the recommended ISDS programs should be incorporated into the responsibilities of the Engineering and Sewer Departments.

Sewer inspections and preventative maintenance measures are conducted on a daily basis by Sewer Department staff. Inspections and preventative maintenance are on-going tasks that performed at a rate that results in the complete inspection of the entire Town sewer system over a ten (10) year period. Maintenance inspections are to be performed on a weekly or more frequent basis for all pump stations. Pump station alarms, sewer blockages and other emergency conditions are addressed as they are identified and occur. The Town's Sanitary Sewer Management Program included in Appendix C details the plan of operations to be followed to maintain the proper performance of the sewer system.

7.3.1 Staffing Plan

The Sewer Department consists of a full time staff of one supervisor and four operators who are responsible for routine operations, maintenance and emergency response. Significant expansion of the wastewater facilities is not proposed and the current staffing levels are expected to sufficiently address the operation and maintenance requirements of the recommended plan.

7.4 Financial Impact Analysis

The estimated total capital cost for the proposed projects is $6,390,000 as presented in Table 6-3. Based upon projected budget revenues and the current $75 base user fee, there are 7,400 current sewer users. Assuming SRF loan program financing over a 30-year term with an average interest rate of 4%, a total capital cost $6,390,000 equates to an annual debt service of $365,767, and the average user share of the debt service would be $49.43 based upon 7,400 users. Utilizing the current base rate user fees, approximately 66% of user fees would be required to cover the annual debt service cost. For comparison, the current median residential home valuation assessment is $325,000 and the current tax rate is $19.18 per $1,000 of assessed value, which translates to an annual average residential property tax of $6,233.50. If additional sewer assessment taxes were levied to cover the debt service, the tax burden upon the average residential sewer user would increase approximately 0.8% to $6,282.93.

Chapter 8 – Public Participation

8.1 General

Due to the nature of this project and its impact on the community from both an economic and environmental perspective, a public participation program was instituted. The intent of the public participation program is to solicit input from the local governing body and the community at large, as well as from other governmental agencies. Goals of the public participation program are summarized as follows:

- Identify public perceived concerns regarding wastewater management.
- Quantify past and current problems in regard to wastewater disposal in the Town.
- Gain public input regarding the desirability of various wastewater management alternatives.
- Evaluate and gather community support for implementation of the recommended plan of action.
- Meet regulatory requirements.

8.2 Public Presentations

To achieve the goals of the public participation program, a public meeting and formal public hearing are to be conducted. Newspaper advertisement of these activities will be published in effort to provide notification so that interested parties may be in attendance to provide public input. The formal public hearing will be conducted when both the Town and RIDEM are prepared to approve the completed Wastewater Facilities Plan. Copies of information relating to these public presentations such as newspaper advertisements, meeting minutes, attendance sign in sheets, public hearing transcript, will be included as an addendum to Appendix D of this report.

8.3 Intergovernmental Reviews

The draft Facilities Plan was submitted to the institutions and agencies listed below in order to solicit comments and provide for intergovernmental review of the proposed plan.

- Rhode Island Statewide Planning Program
- Rhode Island Historical Preservation and Heritage Commission
- Rhode Island Department of Transportation
- The Narragansett Indian Tribe
- RIDEM Natural Heritage Program

Copies of related correspondence are provided in Appendix D.

The Town of Lincoln conducted a hearing for public consideration of the proposed Wastewater Facilities Plan on October 31, 2006. Minutes of this hearing were documented via an audiotape recording of the proceedings. A cassette copy of the recorded minutes is forwarded to RIDEM with the Final Wastewater Facilities Plan for record purposes. Written copies of the presentation notes prepared for the Public Hearing are included herein.

The Town of Lincoln conducted a hearing for public consideration of the proposed Wastewater Facilities Plan on October 31, 2006. Minutes of this hearing were documented via an audiotape recording of the proceedings. A cassette copy of the recorded minutes is forwarded to RIDEM with the Final Wastewater Facilities Plan for record purposes. Written copies of the presentation notes prepared for the Public Hearing are included herein.

REVISIONS:

APPROVED:

TOWN OF LINCOLN DEPARTMENT OF PUBLIC WORKS
LINCOLN, RHODE ISLAND

DESIGNED BY: DATE:
CHECKED BY: DATE:
DRAWN BY: DATE: 03/2006
CHECKED BY: DATE:

Civil & Environmental Engineering Partners, Inc.
342 Park Avenue Woonsocket, RI 02895 401.762.1711
Fax: 401.235.9088

WASTEWATER FACILITIES PLAN

SEWER SYSTEM MAP
SCALE 1"=800'

PROJ. NO. J0506

DWG. NO.
C-1
SHEET 1 OF 2

REVISIONS:

APPROVED:

TOWN OF LINCOLN DEPARTMENT OF PUBLIC WORKS
LINCOLN, RHODE ISLAND

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WASTEWATER FACILITIES PLAN

SEWER SYSTEM MAP
SCALE 1"=800'

PROJ. NO. J0506

DWG. NO.
C-2
SHEET 2 OF 2

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Civil & Environmental Engineering Partners, Inc.

Technical Memorandum #1

Town of Lincoln Wastewater Facilities Plan
C&E Project No. J0506

Date: August 26, 2005
To: N. Kim Wiegand, P.E., Town Engineer

Subject: Existing Pump Stations Evaluation
Submersible Grinder Pump Stations

Introduction

C&E Engineering Partners, Inc. (C&E) has completed an evaluation of the Town's thirty-one (31) existing wastewater pumping stations as described under Task 2 of Exhibit A to the Agreement dated June 16, 2005. The Town's existing pumping stations can be segregated into three (3) general types: Submersible Grinder Pump station, Wet Well / Dry Well Pump station, and Screw Pump station. Twenty-five (25) of the Town's pump stations are Submersible Grinder Pump type stations, five (5) stations are Wet Well / Dry Well type stations, and one (1) station is a Screw Pump type station.

C&E personnel conducted site visits to observe station conditions on July 13, 14, 27, and 28, 2005. Observations were limited to visual inspection of the facilities to establish the anticipated remaining useful service life for the pump stations so that this information can be incorporated into the wastewater facilities planning process. Detailed evaluation of the facilities and specific performance testing were not conducted. A Technical Memorandum prepared for each station type presents the conditions observed at the stations, and conditions reported by Sewer Department personnel, so that the requirements for maintaining these facilities for the 20-year planning period can be established and incorporated into the Wastewater Facilities Plan. The reference standard utilized as the basis for evaluating the pump stations is the 1998 Edition of the Guidelines for the Design of Wastewater Treatment Works Technical Report #16 (TR-16) as prepared by the New England Interstate Water Pollution Control Commission.

This Technical Memorandum #1 describes the general conditions observed at the Submersible Grinder Pump stations. Specific conditions identified for individual stations are provided in the Submersible Grinder Pump Station Survey Summary Table appended to this Technical Memorandum. Conditions observed at the Wet Well / Dry Well and Screw Pump type stations are presented in Technical Memorandum #2 and #3, respectively.

General Description

As noted above, 25 of the Town's 31 wastewater pump stations are of the Submersible Grinder Pump type. TR-16 recommends wet well / dry well type stations as preferable but allows for other types of stations under certain circumstances. TR-16 requires a minimum of two pumps,

with each pump being capable of handling the peak design flows. Two pumps are provided for all Submersible Grinder pump stations and record documents provided by the Town indicate that each pump is capable of discharging the full design load. As such, the existing station design and capacities generally conform to the current TR-16 capacity guidelines. As the pump stations are in serviceable condition and each conveys a relatively small flow volume, station replacement at each location for the sole purpose of providing a Wet Well / Dry Well type station would not be recommended.

The wet well for each station is constructed of precast concrete manhole ring and base sections and a flat slab top section with a cast-in aluminum access hatch. An aluminum ladder is provided to allow access to the base level of the wet well chamber. Influent flow enters the wet well via gravity sewer connection(s) constructed primarily of PVC pipe, with concrete materials apparently utilized at a few stations. One station receives flow from an individual residential pressure sewer connection in addition to gravity flow. A vent pipe through the top slab provides passive ventilation of the wet well chamber.

All of these stations employ duplex pumping systems with two (2) submersible grinder pumps. The individual discharge from each pump is piped to a common station effluent force main. The individual discharge and effluent force main piping is constructed of galvanized steel. The individual pump discharges are fitted with a check valve and isolation gate valve prior to joining at the common force main. Pumps are removed and installed via a galvanized steel guide rail system. While the isolation valves and connections to the common effluent force main are located within the wet well structure at the majority of stations, some locations have a separate precast concrete chamber in which the isolation valves and connection to the common force main are located. The valve chamber has a flat top slab with cast-in access hatch at these locations and is provided with a drain pipe with an isolation gate valve and check valve to prevent backflow from the wet well allow the valve chamber to be drained to the wet well as may be needed. There are no odor control systems at the submersible grinder stations.

At grade construction consists of the wet well and valve chamber (as applicable) top slabs and the main electrical cabinet enclosure. Access hatches and the main electrical cabinet are secured by padlock, and chain link security fencing with padlocked gate is provided at some stations. Based on their proximity to adjacent streets, most stations appear to be located within public right of way. Paved bituminous access / parking drives occur at some stations.

Electrical and control equipment is housed in a pad mounted enclosure cabinet. The electric service meter socket and receptacle for connecting a portable emergency generator are mounted on the exterior of the cabinet. However, one station is provided with a permanent emergency generator installation on-site and one station did not have a utility meter on the enclosure. The electric service panelboard, switches / breakers for transfer between emergency and utility power supply, pump controls and motor starters, and alarm dialer with a battery backup power supply are located in the main enclosure. Provisions for transfer between utility and emergency power vary from station to station. Some stations are provided with a manual transfer switch in a separate enclosure. Other stations have the Utility and Emergency power main breakers mounted side by side with a slide bolt guard to prevent both breakers from being set to the "On" position at the same time; the slide bolt guard is configured with a set screw to maintain its

position over the selected breaker. An automatic transfer switch is provided where a permanent emergency generator is on site.

The pump control system is based on changing level in the wet well. All but one station is equipped with a compressed air bubbler level sensing system and a mercury level gauge / switch controls. A microprocessor based pump controller and submersible pressure transducer that responds to changing water level in the wet well are provided at the one station that is not equipped with a bubbler level system and mercury level gauge controls. Pump controls are segregated behind a separate inner door inside the main enclosure cabinet. The pump level gauge, status and alarm lights, pump run time meters, and pump H-O-A switches are mounted on the face of the inner door, as are the side by side Emergency and Utility power main breakers for stations without a separate enclosed manual transfer switch. Pump controller module, relays, motor starters and bubbler system equipment is mounted behind the pump control panel door.

The pump stations originally were equipped with a computer based monitoring system within a separate panel inside the main enclosure. An autodialer has been installed in the separate enclosure, replacing the computer based system, to transmit selected alarms to the Sewer Department (weekday working hours) and Police Department (nights / weekends). Abandoned computer system hardware remains in the enclosure at some stations. An uninterruptible power supply (UPS) battery backup unit is provided for the autodialers in the main enclosure.

Record documentation provided by the Town indicates that the pipelines and pump stations are designed to accommodate a future flow projected to the year 2035 and mechanical systems are designed for a 20 to 25 year service life. Construction of the Submersible Grinder Pump stations occurred between 1986 and 1998, with the majority of stations constructed prior to 1992 and three stations constructed in 1993 or later. This information indicates that the mechanical systems at the many of these facilities are approaching the end of their intended service life and may require replacement in the near future. The future flow design year is coincident with the end of the 20-year planning period for the current Plan and, as such, it is expected that the buried pipelines and pump station wet wells will serviceable and capable of accommodating flows to the end of the planning period.

Observations and Evaluation

C&E personnel visited each station, accompanied by Town Sewer Department personnel, to perform on-site observations. Observations and considerations to be incorporated into the Wastewater Facilities Plan are provided in the following narrative. Additional detail on specific items observed and conditions identified are provided for individual locations in the Station Survey Summary Table appended hereto. The summary table is itemized into categories corresponding to the headings listed below. The following narrative also provides detailed description of the conditions and annotations that appear in the summary table.

Site (Land Use / Access)

Site conditions generally are provided for informative purposes and are not significant wastewater management planning considerations unless specifically noted. The wet well, valve chamber (where occurring), and electrical enclosure cabinet were accessible at all locations. The

Summary Table provides the general land use in the vicinity surrounding the station under the Land Use heading and provisions for accessing the site under the Access heading as follows:

Land Use	
R	Residential
I	Industrial
C	Commerical

Access	
S	Street access, no site drive
D	Access drive access provided from street to station

Most of the stations are located in predominantly Residential areas with access from the adjacent public street.

Building / Structure

Interior conditions of station wet wells were observed from grade level through the access hatch opening. Station wet wells were not entered to perform the observations. The precast concrete structures appear to be in generally sound condition at all stations and no substantial deteriorated conditions were observed. Several stations accumulate a grease ring at the upper / lead pump on water level and the extent of accumulation varies from station to station. The Town reportedly has implemented the use of prepackaged biological treatment products, which has reduced the accumulation of grease in its facilities. Hydraulic integrity of the stations appears to be satisfactory however, evidence of possible infiltration through ring section joints and / or pipe penetrations was observed at some locations. No active evidence of infiltration into the wet wells was observed, but it should be noted that groundwater conditions are assumed to be at seasonal (summer) low levels at the time the observations were conducted. Satisfactory service is expected for the pump station precast concrete structures for all locations for the 20-year planning period.

Access hatches were padlocked and functional at all stations and the covers and frames exposed to view in good condition. The spring / piston assembly and its cover exhibit signs of corrosion to varying extents and the covers have rusted through at some locations. Aluminum ladders for accessing the wet well chambers appeared to be in functional condition at all stations with minor surface corrosion observed. Some stations are equipped with ladder extensions to facilitate entering and exiting. Satisfactory service is expected from the access hatches and ladders for the planning period. However, the spring / piston assemblies should be replaced as needed to maintain proper operation and anchors securing ladders to the wet well should be monitored for signs of deterioration and replaced if deficient conditions are observed. The Town should also consider installing ladder extension devices at all locations.

The exposed vent piping appears to be in satisfactory condition at all sites. The inlet to the vent piping inside the wet wells was not observed. Most sites have flanged ductile iron vent piping, but welded steel pipe construction occurred at a few locations and one station vent was PVC. Surface coatings and conditions varied from site to site and no significant deterioration was

observed. Vent piping should be cleaned and repainted to protect the piping where coating conditions are degraded. Bird / vermin screens were mostly in place, but repair or replacement is necessary at some locations. Surface coating and bird / vermin screen assessment and repairs should be included in routine maintenance activities for the stations. Satisfactory service is expected for all locations for the 20-year planning period provided that these routine maintenance activities are sustained.

The Building Structure column in the Summary Table identifies the station conditions as follows:

G	Good, no conditions observed or reported that are expected to impact performance
F	Fair, conditions of minor deterioration observed or reported that are not expected to impact performance
P	Poor, conditions of minor to significant deterioration observed that can be expected to impact performance

Mechanical / Process

Mechanical process systems for these stations include the submersible grinder pumps, piping, valves, and appurtenances. The pumps were not accessed for inspection and any specific operating conditions indicated are based on reported information from Sewer Department personnel unless noted otherwise.

Each station is equipped with two (2) ABS "Piranha" submersible grinder pumps with either 3HP or 5HP motors. Both pumps at each station are the same size and rating. Pump motors are single-phase at all but one station, which has three-phase motors. Both pumps were reportedly operational at most stations, but Sewer Department personnel indicated some stations had one pump out of service awaiting removal, troubleshooting, and repair. As indicated above, some stations have been in service for nearly twenty years, in which case the pumps are approaching the end of their expected service life. The Town maintains an inventory of spare pumps in case of need and Sewer Department personnel indicated that replacement pumps have been installed and remained in service on occasion.

Each pump is provided with a run time meter in the control panel. Sewer Department personnel indicated that these meters have not been reset; in which case current readings would be total run time for the pump position (Pump No. 1 and Pump No. 2) but may not represent the specific unit in service at this time if a replacement unit was installed. In general, the operation and performance of pumps approaching twenty years in service should be monitored on a frequent basis and replacement scheduled when satisfactory conditions are not provided. Based on our observations, the design life of the submersible grinder pumps, and the Town's description of the operation and performance of the various stations, the Wastewater Facilities Plan should include evaluating pumps for replacement upon reaching twenty years in service in effort to minimize the chance of service interruptions. Replacement decisions for specific units would be based

upon observations of individual performance as the scheduled replacement milestone is approached.

Pump Size, Approximate Age, and Projected Replacement are provided in the Summary Table. Pump size is the motor rating, either 3 or 5 HP. Approximate Age is based upon the fabrication date indicated in the control panel. Projected Replacement is based on 20 years of service and the Approximate Age listed for the pumps.

Each pump is provided with a guide rail for installation and removal. Configurations and conditions of the pump guide rails, upper guide brackets, and related supports observed varied from station to station. Mild to moderate surface corrosion was observed on most of the guide rails, which appear to be constructed of galvanized steel pipe. The heaviest corrosion generally was observed between the normal pump on and pump off operating levels where the guide rails are subjected to repeated submersion and exposure due to pump cycling.

The upper guide brackets appear to of cast iron or steel construction with moderate to heavy surface corrosion observed. The upper guide bracket is used to anchor the guide rail to the structure. At some installations the guide bracket is mounted directly to the precast concrete structure at the hatch opening, at others the guide bracket is secured to a structural steel angle beam that is mounted to the precast structure. Moderate to heavy surface corrosion of the structural steel angle was evident at locations where a steel beam is incorporated in the mounting configuration.

The guide rails, brackets and supports appear to be in functional condition at all locations at this time. Repairs and / or replacement should be considered when other mechanical replacement or repair work is scheduled or becomes necessary. Guide rails, brackets, and / or supports that are not degraded can remain in service where the existing installation is compatible with replacement mechanical systems. The condition of degraded items should be monitored and replacement performed before deterioration results in improper performance. Replacement will be necessary where the existing installation is incompatible with replacement mechanical systems regardless of condition.

Conditions identified in the Summary Table for the guide rail system include:

L	Limited surface corrosion observed, continued satisfactory performance expected
M	Moderate surface corrosion observed, continued satisfactory performance expected, conditions should be monitored for further deterioration
H	Heavy surface corrosion observed, continued satisfactory performance can not be expected for extended periods, conditions should be monitored and items replaced where improper performance occurs

The individual pump discharges and station effluent force main in the wet wells are constructed of galvanized steel piping. While this material is considered to be corrosion resistant, the harsh environment and conditions associated with raw wastewater and prevalent in the wet wells has resulted in moderate to aggressive corrosion of the process piping at the pump stations. Sewer Department personnel indicated that pipe failure was not uncommon and noted that the pump discharge piping at one station was scheduled for repairs due to pipe failure. Significant surface corrosion and / or evidence of prior repairs were observed at several stations and a failed discharge pipe was discovered at one station during the site visit.

Based upon the conditions observed and the operating history described by the Town, a twenty to twenty-five year service life appears to be an overly optimistic expectation and satisfactory performance of the pump discharge piping in the wet wells is not anticipated for any extended period. At this time, the Town should continue to monitor and observe the piping conditions and implement repairs as they become necessary to maintain acceptable station operations. The Wastewater Facilities Plan will include provisions for piping materials with better resistance to corrosion, such as stainless steel or PVC, in effort to provide a longer anticipated useful service life and a long-term solution for the discharge piping conditions experienced by the Town.

The individual discharge and force main piping appeared to be in good condition at locations where a separate valve chamber is provided and satisfactory service is expected for the 20-year planning period. Conditions for wet well piping are identified in the Summary Table and include:

G	Pipe appears to be in good condition with minor surface corrosion observed, continued satisfactory performance expected
F	Pipe appears to be in fair condition with moderate surface corrosion observed, continued satisfactory performance expected, conditions should be monitored for further deterioration
P	Pipe appears to be in poor condition, heavy surface corrosion observed, continued satisfactory performance can not be expected for extended periods, conditions should be monitored and items replaced where improper performance occurs
X	Pipe failure reported or observed, repairs / replacement required immediately
XR	Evidence of prior pipe repairs observed or reported

Each individual pump discharge includes a guide rail base and discharge elbow, a check valve to prevent backflow, and a gate valve to isolate the pump from the discharge force main. The guide rail base, discharge elbow, and check valve are located below the low water level operating range and remained submerged during the site observations. The gate valves are of PVC body

construction and appeared to be in generally satisfactory condition. Specific observations and / or operating conditions noted by Sewer Department personnel are provided in the Summary Table as applicable. Evaluation of these components should be performed when major mechanical / process equipment replacement is scheduled and degraded items replaced as needed.

The gravity influent piping observed at the stations appeared generally to be in satisfactory condition. Pipe materials are PVC at a majority of the stations, however the piping appeared to be concrete at some locations. Most of the exposed piping entering the wet well appeared to be cut clean more or less square to the pipe. Minor irregularities at the inlet stubs were observed at some locations, but no unusual discharge conditions were observed as flow entered the wet wells. Grease accumulates at the lead pump on / operating range high water level at many stations and the Town indicated that bagged biological treatment additives are utilized to reduce the impact due to grease buildup. The Summary Table does not provide conditions for influent piping due to the limited extent of observations. Based upon the information in record documents that the pipelines are designed to accommodate a future flow to the year 2035, the station influent sewers are expected to provide satisfactory service for the planning period.

Sewer Department personnel indicated that odor complaints have occurred at the stations generally due to their proximity to adjacent residential areas but did not identify any specific concerns for excessive odors or complaints. Provisions for odor controls at these stations are limited and could be impractical due to the size and configuration of the station and available space for additional equipment installation. Odor emissions for submersible grinder pump stations will be discussed coordinated further with the Town during planning process to determine if any odor controls appear to be needed and considerations for odor controls included in the Wastewater Facilities Plan as may be applicable.

Instrumentation & Control

The pump station control system operates the pumps automatically in response to changing wet well levels with the pump selector switch in the "Auto" position or manually with the switch in the "Hand" position. Lead / Lag pumps can be selected manually or to alternate between the two pumps at the pump controller. The lead pump is intended to handle station flows under normal operating conditions. The lag pump "On" level set point is above high wet well alarm level and the lag pump is not called to operate unless the high wet well alarm level is exceeded. High and low wet well levels also are monitored and alarms activated via the pump controller. Some stations are also equipped with a wet well flood level float switch to indicate wet well flood alarm conditions in addition to the pump control system alarms.

All but one station is equipped with a compressed air bubbler level sensing system and a mercury level gauge. The mercury gauge responds to back pressure on the bubbler system from the wet well level and provides a visual indication of the water level. Pump control and alarm wiring is connected to the level gauge and the changing mercury level opens and closes circuits to operate the pumps and activate alarms. Control and alarm set points are adjustable by through a series of wiring contact stud connections at the back of the level indicating gauge. A microprocessor based pump controller and submersible pressure transducer that responds to changing water level in the wet well are provided at the other station. The compressed air bubbler system and pump

controllers, including the microprocessor based controller, are proprietary systems by EG Pump Controls of Jacksonville, FL.

The compressed air bubbler systems consist of two small air compressors and an air system controller, there are no compressed air receiver tanks and the lead compressor operates continuously. According to Sewer Department personnel, fouling of components within the air compressor control systems has resulted in degraded performance of compressed air bubbler systems and station operations. Two of the stations constructed after 1993 utilize a later generation bubbler system controller (BAMS Bubbler Air Monitor System vs ATC-10 Air Transfer Chassis), the submersible pressure sensor and digital pump controller are provided at the most recently constructed station in place of the bubbler system and mercury level gauge controller.

Although the bubbler systems include a primary and backup compressor, these controls do not provide system redundancy as there is no backup in the event of an air system controller failure. Similarly, a single pressure transmitter with no backup level sensing is provided for the microprocessor based controller system. The pumps will not operate in the event of a failure of the air system controller or the pressure transducer. Any future control systems should include redundancy for improved reliability.

The air system controllers monitor pressure and the autodialer will transmit an alarm in the event of low air system pressure allowing for immediate response and action as necessary at the bubbler system stations. However, there are no apparent provisions to sense or transmit either level signal / transducer failure or high wet well level independently of the transducer the other station. Based upon these conditions, it appears that the station could become inoperable and no alarm condition reported to alert the Town that conditions exist that require response or action.

The pump controllers are functional at all stations and appear to be in serviceable condition. Sewer Department personnel indicated that various operational difficulties and malfunctions have occurred within the pump controllers that the Town attributes to utility power surges. Control relays, motor starters, wiring and other miscellaneous hardware have been replaced where necessary where such conditions have occurred and overall the pump controls are operating acceptably at all stations. As noted above, the Town has experienced reduced performance of the air compressor control systems as the stations remain in service for longer periods. Based these conditions, the pump controllers are expected to remain in serviceable condition for the twenty year planning period, but, replacement of the air compressor control systems apparently will be necessary by the time these systems approach twenty years in service. The Wastewater Facilities Plan should include provisions for evaluating bubbler system controllers for replacement upon reaching twenty years in service.

Although Sewer Department personnel indicate that the later generation (BAMS) bubbler system controllers exhibit improved performance, this improvement could be associated with the shorter period that these systems have been in service. Similar performance conditions also may be experienced as these units age, and the Wastewater Facilities Plan will include evaluation of these units for replacement on a similar schedule. The submersible pressure transducer and digital controller are considered to be state of the art systems and satisfactory performance is

expected for the planning period, but a pressure signal fail and / or wet well flood level alarm should be provided.

The alarms systems for the stations include local indicating lights, silence, and reset buttons, and remote transmission of selected alarm conditions by autodialer to the Sewer Department or Police Department (nights / weekends). All stations transmit the following alarms: high wet well level, low wet well level, power fail, and low air pressure (bubbler system). Some stations also transmit a wet well flooding alarm that is signaled by a float switch independent of the level sensing system. The alarms transmission autodialer systems have been recently installed by the Town at all stations and are reported to be operating in satisfactorily. The UPS unit at one station was found to be inoperable during the site visit conducted and reportedly will be replaced by the Town. As the alarm transmission equipment has recently been replaced and is reported to be in good operating condition, satisfactory performance is expected for the twenty year planning period.

Conditions identified in the Summary Table for Instrumentation & Controls include:

S	Satisfactory, control system reported to be in operating condition
M	Marginal, control system reported to be in operating condition with some malfunctioning or inoperable components
P	Poor, major components of control system reported as failed or inoperable, station operating on modified control system

Each station was constructed with provisions for sensing and indication of the station effluent force main discharge pressure. Most stations had the indicating dial gauge mounted on the force main piping in the wet well and reading the gauge required accessing the wet well chamber. As such, readings were not routinely recorded for these gauges according to Sewer Department personnel. The discharge gauge connection is located in the on the effluent force main inside the valve chamber at stations with a separate valve chamber. Some stations have the indicating dial gauge remotely mounted inside the electrical cabinet enclosure, which facilitates reading the gauge. Sewer Department personnel indicated that current operations and maintenance routines do not include taking pressure readings at any station.

Discharge pressure gauges are recommended by TR-16 for use in monitoring pump operation and performance and evaluating deficient or degraded operating conditions. TR-16 generally recommends that stations be designed so that routine access to wet wells is not required and that pressure gauges be mounted away from process pipe. Installing a submersible intrinsically safe pressure transmitter mounted to the effluent force main with remote readout to replace the existing (and previously removed) pressure gauges is recommended to be included in the Wastewater Facilities Plan.

Electrical

The electrical systems include conduit, wiring, enclosures, and devices. The descriptions presented here are based upon observations by C&E and are limited generally to the physical appearance of electrical system components and to conditions described by Sewer Department personnel. No observations or inspections were performed by an Electrical Engineer as such inspection is beyond the scope of this project. Explosion-proof equipment is required in sewage pump station wet wells. Record documents indicate the use of explosion proof equipment in the station wet wells, but detailed evaluation by an Electrical Engineer would be necessary to determine if the components are in proper operating condition.

A 230-volt three-phase service and permanent emergency generator with automatic transfer switch is provided at one location. All other stations have 115 / 230 volt single-phase electric utility service and a receptacle for connecting a portable generator for emergency power. Most station sites are in primarily residential locations, fed by the available (residential) power grid in the area and Sewer Department personnel indicated that deficient operating conditions experienced at several stations have been attributed by the Town to utility power inadequacies. No utility metering was observed at the station located in the Amica complex; Sewer Department personnel reported that the station is fed from the Amica complex power grid and not directly from utility power. Assessment of utility power requirements and / or potential deficiencies for the pump stations is beyond the scope of this evaluation.

A pad mounted, metallic enclosure cabinet that houses all electrical and control equipment is provided at each station. The enclosures were padlocked at all locations and are constructed of painted steel at older stations and stainless steel a newer installations. Utility service meter box and portable generator receptacle are mounted on the exterior of the enclosure. The stainless steel enclosures appear to be in good condition. The painted metal enclosures generally appear to be in serviceable condition with minor to moderate surface corrosion noted at some locations. Evidence of water infiltration into the enclosure was observed at some stations and Sewer Department personnel indicated that water has entered the cabinet through the electric and / or telephone service conduits that stub up into the bottom of the cabinet at certain locations. These conduits should be sealed against water infiltration. Satisfactory performance is expected for the planning period for the electrical enclosure cabinets at all but one station, which appears to need repairs or replacement to address corrosion at the base of the cabinet. Replacement enclosures could be necessary when control systems are being replaced in order to accommodate new control system components. Observations on the control equipment within the main enclosure are provided above under Instrumentation & Controls.

As indicated in the General Description above, the provisions to enable transfer from utility to emergency power varies from station to station. In general, the older stations are furnished with a self enclosed manual transfer switch within the main enclosure and newer stations have Utility and Emergency main breakers mounted at the pump control panel door with a thumb-screw lockable slide bolt to prevent energizing the station from both source at the same time.

The circuit breaker panel boards generally appeared to be in good condition. Dedicated receptacles for process systems, such as the alarm dialer, and a GFIC circuit receptacle for convenience and maintenance activities typically are provided. Each station is provided with a

single telephone line. The autodialer is connected permanently to the phone line, and a standard telephone jack also provided inside the main enclosure. The Town has installed a telephone handset at several locations, however, using the phone line to dial out temporarily interrupts the ability of the autodialer to transmit any alarms. The handset must be returned and properly cradled or disconnected from the from the phone jack following use so that the autodialer can transmit alarm conditions as necessary. Sewer Department personnel did not identify any particular operational issues for the basic electrical equipment. Satisfactory performance is expected for the planning period for these electrical components within the main enclosure.

The electrical system observed in the wet wells includes conduit, junction boxes, and receptacles for the submersible pumps. Moderate to heavy surface corrosion was observed on these items. The pump receptacles and boxes have been replaced at some locations with new corrosion resistant boxes and Sewer Department personnel indicated that replacements at all stations are proposed to occur as the need arises and as maintenance schedules permit. In general, the receptacle boxes in the wet wells are in fair to poor condition where not replaced and would not be expected to provide satisfactory service for an extended period. The replacement boxes appear to be in generally satisfactory condition and continued acceptable service is expected for these items. Explosion-proof equipment is required in sewage pump station wet wells, however, assessment of the existing systems with respect to explosion-proof conditions is beyond the scope of this evaluation.

Conditions identified in the Summary Table for Electrical items include:

A	Automatic transfer switch and permanent emergency generator
M	Manual transfer switch and receptacle for portable emergency generator connection
CB	Dual circuit breaker with thumb-screw mechanical interlock and receptacle for emergency generator
W	Water infiltration observed or reported at conduit entry stub up
R	Surface rusting observed inside enclosure
T	Telephone handset provided in enclosure
C	Moderate to heavy surface corrosion observed at pump receptacle boxes in wet well
FRP	Pump receptacle boxes in wet well replaced with FRP junction boxes.

While most of the electrical systems generally are expected to provide satisfactory service, certain components apparently will require replacement during the planning period due to the deteriorated conditions or because of integral association with other equipment that requires

replacement (pumps, controls). The electrical systems design should conform to TR-16 recommendations regarding accessibility of submersible pump wiring junction boxes and connectors from outside the wet well as well as applicable electrical code requirements where electrical system components are to be replaced.

Conclusions

No major repairs to or replacement of the existing pump station structures are expected to be necessary during the twenty year Wastewater Facilities Planning period. Normal maintenance and replacement of minor components as the need arises should provide for continued satisfactory operation for the foreseeable future. Replacement of structural components of the guide rail systems is to be coordinated with pump replacement as necessary.

The pumps, discharge and effluent force main piping, and piping supports at all stations are expected to require replacement within the 20-year planning period. The pump control systems are expected to be remain serviceable for the planning period, however, the replacement of the air compressor controls within the pump control system are expected to be necessary within the planning period. The control systems at the station are a proprietary system and most stations employ dated technology by current industry standards. Replacing only components that exhibit substandard performance or replacing entire station control systems should be considered in conjunction with pump replacement requirements to determine the best course of action to pursue.

In general, the electrical systems are expected to provide satisfactory service during the planning period. However, portions of the electrical installations associated specifically with the pumps and controls systems and would be replaced upon replacing those items. TR-16 and electrical code compliance should be incorporated into any major renovations. Replacing the existing enclosure cabinets also may be necessary when electrical and control systems are replaced.

Town of Lincoln Wastewater Facilities Plan
Submersible Grinder Pump Station Survey Summary Table
(Refer to Technical Memorandum #1 dated 8/26/05 for legend and descriptive information)

C&E Engineering Partners, Inc.
J0506

Station	Site		Building/Structure		Mechanical/Process					Instrumentation & Controls	Electrical		Comments
					Pumping System			Guide Rails	Piping				
	Land Use	Access	Concrete Chamber	Hatch & Ladder	HP	Age (Approx)	Projected Replacement				@Panel	@Wet Well	
Applewoood	R	S	G	P	3	18	2007	M	XR	S	M	C	Hatch spring housing rusted out
Arlington	R	S(1)	G(8)	F	3	19	2006	H	X	S	M	C	Patch above / chip below influent pipe
Ashley	R	S	G	P	3	16	2009	M	X(8)	S	M,R(8)	C	Hatch spring housing rusted out; Failed piping; Main enclosure rusting through
Belmont	R	S	G	G	3	7	2018(7)	L	G	S(8)	CB		Pressure transducer/DigiGage controller
Birchwood	R	S	G	F	5	16	2009	M	F	S	M,T	FRP,C	One gravity, one pressure sewer influent
Butterfly	R	S	G	F	5	14	2011	M	G	S	CB,T	C	Overflow MH provided
Cider Mill	R	S	G	F	3	16	2009	H	F	S	M,T	C	Station to be relocated/replaced by developer
Davies	R,C	S(1)	G(2,3,8)	F	5	12	2013	M	F	S(8)	A	C	BAMS air controller; Influent trash basket
Eagle Nest	R	S	G(6)	F	5	16	2009	H	F	S	M,R,T	FRP	
Edgehill	R	S	G(8)	F	3	19	2006	M	P	S	M,W,T	C	Limited spalling at precast ring joint
Great Road	R	S	G	F	3	18	2007	H	F	S	M	C	
Heidi	R	S	G	F	3	14	2011	M	F	S	CB	C	Two influent gravity sewer connections
Hillside	R	S	G	F	3	19	2006	M	X(8)	S	M,T	FRP	WW piping to be replaced
Jason	R	D	G	G	5	17	2008(7)	L	F	P(5)	M	C	
Lincoln Center	C	S	G(2,8)	F	3	15	2010	M	G	S	M(8),T	C	Chip/patch at ring joint; No utility meter
Lori Ellen	R	D	G	F	5	16	2009	L	F	M(4)	M,T	FRP	Two influent gravity sewer connections
Middle	R,C	S(1)	G	F	3	19	2006	M	P	S	M	C	
Mount	R	S	G	F	3	19	2006	M	P	S	M	C	Two influent gravity sewer connections
Newland	R	S	G	F	3	19	2006(7)	M	P	S	M,W,T	FRP	
Oak Hill	R	S	G(6,8)	F	5	16	2009	M	F	S(8)	M,R,T	C	Valve pit lock frozen; UPS unit not functioning
Old Pike	R,C,I	S	G	F	5	14	2011	L	F	S(8)	CB		Panel shorted out, wiring has been replaced
Paddock	R	S	G	F	5	17	2008	M	F	S	M	FRP	Two influent gravity sewer connections
Rollingwood	R	S	G	G	5	15	2010(7)	L	F	M(4)	CB,T	FRP	Pump 1 off line - capacitors/starter
Whitney	R	S	G	F	3	10	2015	M	G	S(8)	CB,T	FRP	BAMS air controller; Added heat for air line
Woodridge	R	S	G(6)	F	3	15	2010	M	F	M(4)	M	C	

Footnotes:
(1) - Chain link site fence provided
(2) - Staining evidence of apparent water infiltration at precast section ring joint
(3) - Staining evidence of apparent water infiltration at pipe penetration
(4) - Pump Controller malfunction
(5) - Air compressor controller malfunction
(6) - Separate discharge valve chamber
(7) - One pump out of service, repairs required
(8) - See Comments column

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Civil & Environmental Engineering Partners, Inc.

Technical Memorandum #2

Town of Lincoln Wastewater Facilities Plan
C&E Project No. J0506

Date: August 26, 2005
To: N. Kim Wiegand, P.E., Town Engineer

Subject: Existing Pump Stations Evaluation
Wet Well / Dry Well Pump Stations

Introduction

C&E Engineering Partners, Inc. (C&E) has completed an evaluation of the Town's thirty-one (31) existing wastewater pumping stations as described under Task 2 of Exhibit A to the Agreement dated June 16, 2005. The Town's existing pumping stations can be segregated into three (3) general types: Submersible Grinder Pump station, Wet Well / Dry Well Pump station, and Screw Pump station. Twenty-five (25) of the Town's pump stations are Submersible Grinder Pump type stations, five (5) stations are Wet Well / Dry Well type stations, and one (1) station is a Screw Pump type station.

C&E personnel conducted site visits to observe station conditions on July 13, 14, 27, and 28, 2005. Observations were limited to visual inspection of the facilities to establish the anticipated remaining useful service life for the pump stations so that this information can be incorporated into the wastewater facilities planning process. Detailed evaluation of the facilities and specific performance testing were not conducted. A Technical Memorandum prepared for each station type presents the conditions observed at the stations, and conditions reported by Sewer Department personnel, so that the requirements for maintaining these facilities for the 20-year planning period can be established and incorporated into the Wastewater Facilities Plan. The reference standard utilized as the basis for evaluating the pump stations is the 1998 Edition of the Guidelines for the Design of Wastewater Treatment Works Technical Report #16 (TR-16) as prepared by the New England Interstate Water Pollution Control Commission.

This Technical Memorandum #2 describes the general conditions observed at the Wet Well / Dry Well Pump stations. Specific conditions identified for individual stations are provided in the Wet Well / Dry Well Pump Station Condition Survey sheets prepared for each station and appended to the Technical Memorandum. Conditions observed at the Submersible Grinder Pump and Screw Pump stations are presented in Technical Memorandum #1 and #3, respectively.

General Description

As noted above, 5 of the Town's 31 wastewater pump stations are of the Wet Well / Dry Well type. These stations include: Angel Road North, Angel Road South, Great Road, Maria, and

Kirkbrae. TR-16 recommends wet well / dry well type stations as preferable and requires a minimum of two pumps for all stations, with each pump being capable of handling the peak design flows. Two pumps are provided at four of the five Wet Well / Dry Well pump stations and record documents provided by the Town indicate that each pump is capable of discharging the full design load at these stations. Three pumps are provided at the Great Road pump station. For stations with three (or more pumps), TR-16 requires that peak flows be handles with any one pump out of service. Record documents indicate that the capacity of the Great Road station with two pumps running exceeds the peak design flow. Based on this information, the existing station design and capacities generally conform to the current TR-16 capacity guidelines.

The Wet Well / Dry Well stations are constructed of precast concrete rectangular structures with the wet well and dry well chambers cast separately. The upper sections of the wet well and dry well chambers are exposed above grade, with the top slab general a few feet above the surrounding ground surface. Aluminum access hatches are provided in the top / roof slabs to provide entry to the chambers. Aluminum ladders are provided to allow access to the wet well operator platform and to the control level and pump level in the dry well. The Town has constructed wood framed building structures above the precast concrete chambers at three of the stations.

Influent flow enters the stations via gravity sewer connection and flows through a manually cleaned bar rack as it enters the wet well. The Great Road station has a divided wet well with slide gates to isolate the two sections, the other four stations have a single undivided wet well. All stations are equipped with centrifugal pumps with close-coupled vertically mounted 3-phase electric drive motors. Seal water systems are provided at two stations. There are no odor control systems at the stations. Each pump is connected to the wet well by individual suction piping with isolation gate valve. Each individual pump discharge is provided with a check valve and isolation gate valve prior to joining at a common force main and exiting the station. The pump suction and discharge piping is constructed of flanged ductile iron. The pumps and piping systems are located in the lower (pump) level of the dry well chamber. Wet wells were not accessed to observe suction piping / elbows and concrete surfaces below the water line because ventilation systems were inoperable.

The pump control system is based on changing level in the wet well. Similar to the Submersible Grinder Pump stations, all Wet Well / Dry Well stations are equipped with a compressed air bubbler level sensing system and a mercury level gauge / switch controls. Pump controls are segregated from other electrical equipment in a separate control panel enclosure(s) in the dry well upper level. Variable Frequency Drive equipment is provided at one station that changes the pump speed in response to changing wet well water level conditions in effort to match pumping rates to station influent. The pumps operate at constant speed, in response to pump "On" and "Off" wet well level controls at the other four stations.

The pump stations originally were equipped with a computer based monitoring system within a separate enclosure in the upper control level. An autodialer has been installed in the separate enclosure, replacing the computer based system, to transmit selected alarms to the Sewer Department (weekdays, working hours) and Police Department (nights / weekends). Abandoned

computer system hardware remains in the enclosure at some stations. An uninterruptible power supply (UPS) battery backup unit is provided for the autodialer.

Wet wells and dry wells are provided with separate mechanical ventilation systems, however, most of the ventilation equipment was not functional. Electric unit heaters are provided in the dry wells, no heating is provided to the wet wells. Dehumidifiers are provided at four stations. A sump pump is provided in the pump level of each station dry well. Sump pump discharge piping is provided with two check valves and an isolation gate valve prior to penetrating through the structure to discharge back into the wet well.

Electrical and control equipment generally is located in the upper (control) level of the dry well chamber. One notable exception to this generalization is the seal water control panel at the two stations equipped with such systems, where this panel is located in the lower pump level. Main electrical disconnects, distribution panels, automatic transfer switch, phase conversion equipment (where applicable), and pump controls are located in the upper level. The electric service meter socket is located on the exterior of the stations. A stationary emergency generator unit is provided at each station mounted on the top slab of the precast concrete chambers. The emergency generators are inside the building at stations where wood structures have been added.

Record documentation provided by the Town indicates that the pipelines and pump stations are designed to accommodate a future flow projected to the year 2035 and mechanical systems are designed for a 20 to 25 year service life. Construction of the Wet Well / Dry Well Pump stations occurred between 1986 and 1990. This information indicates that the mechanical systems at these facilities are approaching the end of their intended service life and may require replacement in the near future. The future flow design year is coincident with the end of the 20-year planning period for the current Plan and, as such, it is expected that the buried pipelines and pump station wet wells will serviceable and capable of accommodating flows to the end of the planning period.

Observations

C&E personnel visited each station, accompanied by Town Sewer Department personnel, to perform on-site observations. Observations and considerations to be incorporated into the Wastewater Facilities Plan are provided in the following narrative. Additional detail on specific items observed and conditions identified for individual locations are provided in the Wet Well / Dry Well Pump Station Condition Survey sheets prepared for each station and appended hereto. The individual station survey sheets are itemized into categories corresponding to the headings listed below.

Site

Site conditions generally are provided for informative purposes and are not significant wastewater management planning considerations unless specifically noted. Surrounding land use and site features observed at each station are noted. At grade construction consists of the precast Wet Well / Dry Well chambers, emergency generator unit, lighting fixtures, electric utility meter, site fencing, and wood framed building (at sites where constructed above the precast chambers). Gates were padlocked where site fencing encloses the entire station. Access

hatches are padlocked and buildings, where constructed, have locking doors. Paved bituminous access / parking drives occur at all stations. The Town has constructed an exterior sump at two stations so that ground water can be pumped away from the stations. The sites generally were clear of obstructions and stations accessible at all locations.

Building / Structure

As noted above, the station construction is comprised of precast concrete wet well and dry well chambers. The wet well and dry well chambers are completely separate, individual structures. Each chamber is comprised of several casting sections that are field assembled with the wet well and dry well chambers side by side. Exterior conditions were observed for above grade construction exposed to view. Dry well chambers were accessed to observe interior conditions of the upper control level and lower pump level. Wet well chambers were not accessed and interior conditions were observed through the wet well access hatch opening. Building additions were accessed and conditions observed where constructed.

Groundwater intrusion is a significant concern of the Town at several locations and evidence of prior leakage was observed at all locations. The joint between dry well upper and lower chambers at access and / or equipment openings between the upper and lower levels was a location of apparent leaking common to all stations. Groundwater apparently has penetrated between the upper chamber floor slab and lower chamber ceiling slab and has been able to enter into the stations at the cast openings in the slabs provided for access and piping between the upper and lower levels. Evidence of apparent prior groundwater intrusion also was observed at various pipe penetrations through the structures. Sewer Department personnel indicated that the station flooding had been experienced at the Angel Road South station, temporarily submerging various mechanical and electrical system components.

As noted above, the Town has constructed an exterior sump at two of the stations so that ground water can be pumped away from the station. These efforts are intended to reduce groundwater intrusion impacts on the stations and conditions reportedly have improved at Angel Road North where the sump is completed and pump operating. No active evidence of water intrusion was observed at the stations, but it should be noted that groundwater conditions are assumed to be at seasonal (summer) low levels at the time the observations were conducted.

A 90° conduit fitting was observed with a cracked body at the Angel Road North Station. Sewer Department personnel indicated that this condition is attributed to floatation. Investigation of station buoyancy and possible flotation is beyond the scope of this evaluation, however, record documentation includes a buoyancy analysis for this station that indicates groundwater levels to four feet below the top slab will not result in flotation. If actual groundwater conditions have exceeded this level, buoyancy and partial flotation may have resulted.

The precast concrete structures appear to be in generally sound condition at all stations and no substantial deteriorated conditions were observed. Satisfactory service is expected for all locations for the 20-year planning period. However, impacts due to groundwater should be monitored and corrective measures implemented if acceptable station operation is interrupted or jeopardized. Corrective measures also should be considered and included to the extent practical in projects where major mechanical equipment and systems are to be repaired or replaced.

Access hatches were functional at all stations and the covers and frames exposed to view in good condition. Little or no surface corrosion was observed at the interior side of dry well access hatches. The spring / piston assembly and its cover on the interior side of wet well hatches exhibits signs of corrosion similar to the Submersible Grinder stations. Aluminum ladders for accessing the dry well chambers appear to be in good condition and are functional. Aluminum ladders and handrails in the wet well chambers appeared to be in functional condition at all stations with minor surface corrosion. Some stations are equipped with ladder extensions to facilitate their use; handrail and safety chain are provided at the access opening in the upper control level floor to the lower pump level. Satisfactory service is expected from the access hatches and interior ladders for the planning period. Conditions of wet well hatches, ladders and handrails should be monitored for deterioration. The hatch spring / piston assemblies should be replaced as needed to maintain proper operation and anchors securing ladders and handrails replaced if deficient conditions are observed. The Town should also consider installing ladder extension devices at all locations. Angel Road South was equipped with a short aluminum ladder to access the exterior roof slab an aluminum handrail at the perimeter of the roof slab for fall protection. The handrail appeared to be in functional condition. The grab bar at one side of the ladder was broken at its base plate and should be repaired. With necessary repairs, satisfactory service for the planning period can be expected.

Wood framed building additions were constructed on top of the precast concrete chambers at three stations. Two station additions are single story structures. The Great Road station has a two-story addition and the Sewer Department utilizes this station for storage of spare parts and maintenance supplies. The interiors of these additions are unfinished. No degraded conditions were noted or observed for exposed 2x framing, interior side of sheathing, or plywood decking (where provided). The exterior of the additions appear to be in good to fair condition. Fading or peeling surface coatings were observed and the exterior siding and trim appear to need recoating. Some deterioration of exterior wood trim was observed at the Maria Street station which should be repaired / replaced when the siding is recoated. Exterior wood stairs at Kirkbrae appear to be in good condition and are functional. Exterior concrete stairs at Great Road are functional, but have been damaged and require replacement. The age of the additions was not identified during the site visits. Satisfactory service is expected for the planning period with proper maintenance.

Mechanical / Process

Mechanical process systems for these stations include pumps, piping, valves, and appurtenances. The pumps were not operated specifically to perform detailed operational evaluations. Wet wells were not accessed to observe suction piping, bar racks, or slide gates at Great Road. Specific operating conditions noted for these items are based on reported information from Sewer Department personnel unless noted otherwise.

Four stations are equipped with two pumps and one station with three pumps. All pumps were reported to be operational except for Pump No. 1 at Kirkbrae which was awaiting a service call to troubleshoot and repair rattling observed by Sewer Department personnel during operation. Pump ratings and motor sizes are provided in the Wet Well / Dry Well Pump Station Condition Survey sheets. Two stations were equipped with separate seal water systems and controls. Sewer Department personnel indicated that seal water system at Angel Road South is not

operational due to damage from temporary submergence of the control panel. Pumps, motors, and local disconnect switches also were subjected to temporary submergence when the station flooded, but the pumps are both operational. Assuming that Kirkbrae Pump No. 1 can be returned to service with minor repairs, continued satisfactory service can be expected for all stations except Angel Road South. Continued satisfactory service for that station for extended periods cannot be expected due to the impact of temporary submergence of the pumps and motors.

Based on our observations, the anticipated service life of the pumps, and the Town's description of the pump operations, the Wastewater Facilities Plan should include general provisions for replacing pumps upon reaching twenty years in service. Replacement evaluations and decisions for specific units would be based upon observations of individual performance as the scheduled replacement milestone is approached. Additionally, the Wastewater Facilities Plan should recommend that replacement of the Angel Road South pumps be prioritized due to the deteriorated conditions at that station.

Suction and discharge piping is constructed of flanged ductile iron pipe. Piping and valves observed in the dry wells appear to be in serviceable condition with minor surface rusting observed. Piping should be cleaned and recoated when pumps are replaced. Discharge check valves also should be replaced in conjunction with replacing the pumps. Gravity influent piping was not observed at the stations and Sewer Department personnel did not identify any operational problems or deteriorated conditions for the wet well bar racks at any station or the Great Road station slide gates. Based on this information, continued satisfactory performance can be expected without replacement during the Planning period. However, it should be noted that the buoyancy and flotation conditions reported for at the Angel Road North station could impact the piping system. The wet well and dry well are separate structures with different resistance to floatation due to the water volume contained in the wet well. If the station is subjected elevated groundwater levels such that floatation results, the dry well would be expected to be more buoyant and damage to the suction piping possibly could be experienced due to uneven movement between the two station chambers.

The Great Road and Angel Road South stations are equipped with seal water systems to provide clean water to the sewage pump seals. The system at Great Road is functional, but one of two seal water pumps reportedly is out of service awaiting repairs. The seal water system is not functional at Angel Road South due to control panel damage from temporary flooding. Sewer Department personnel indicated that a constant flow (trickle) of water is directed to the pumps in effort to provide water to the seal. New seal water systems should be provided at both stations if the replacement pumps require such systems.

Sewer Department personnel indicated that odor complaints have occurred at the stations generally due to their proximity to adjacent residential areas but did not identify any specific concerns for excessive odors or complaints. Provisions for odor controls at these stations are limited and could be impractical due to the size and configuration of the station and available space for additional equipment installation. Odor emissions for each station will be discussed coordinated further with the Town during planning process to determine if any odor controls

appear to be needed and considerations for odor controls included in the Wastewater Facilities Plan as may be applicable.

TR-16 recommends that fully valved connections be provided to allow the use of portable pumps to facilitate temporary pumping around pump stations the in the event of equipment malfunction. Currently, no such provisions exist at the Town's pump stations. In addition to emergency operations, portable pump connections can be utilized during scheduled maintenance, replacement, and rehabilitation activities. The Wastewater Facilities Plan should include considerations for temporary pump connections to the pump station discharge force mains prior to the replacement of the pumping equipment at each station.

Instrumentation & Control

The instrumentation and control systems for the pump stations include the pump controls, process monitors, and alarms. The pump controls at four of the Wet Well / Dry Well Pump stations, all except Great Road, basically are the same as the Submersible Grinder Pump station controls (i.e. compressed air bubbler level sensing system and mercury level gauge / switch controls). The proprietary ATC-10 compressed air system controller, Electrogage mercury level gauge, and pump controller all by EG Pump Controls of Jacksonville, FL are provided at three stations. The mercury gauge responds to back pressure on the bubbler system from the wet well level and provides a visual indication of the water level in the wet well. Pump control and alarm wiring is connected to the level gauge and the changing mercury level opens and closes circuits to operate the pumps and activate alarms. Control and alarm set points are adjustable through a series of wiring contact stud connections at the level gauge.

The same Electrogage level gauge and pump controller are provided at Kirkbrae, but the compressed air bubbler system consists of a duplex (lead, lag) air compressor system and air receiver tank. The compressors transfers air to the receiver tank, which supplies air to the bubbler tube to the wet well. Pressure switches monitor receiver tank pressure and activate compressor operation to maintain proper pressure. The lead compressor handles normal operating requirements, the lag compressor is provided in case of lead compressor malfunction.

The control strategy for these four stations also is the same as the Submersible Grinder stations. The pump station control system operates the pumps automatically in response to changing wet well levels with the pump selector switch in the "Auto" position or manually with the switch in the "Hand" position. Lead / Lag pumps can be selected manually or to alternate between the two pumps. The lead pump is intended to handle station flows under normal operating conditions and the lag pump "On" level set point occurs above high wet well alarm level. High and low wet well levels also are monitored by the bubbler system and activated via the level gauge / controller. The stations also are equipped with a float switches to indicate dry well and wet well flood alarm conditions in addition to the pump control system alarms.

The pump controls at these four stations are functional and appear to be in serviceable condition. Sewer Department personnel did not identify any specific operational problems for the bubbler or pump control systems, but performance similar to that described for the Submersible Grinder stations would be expected. As such, the pump controls are expected to remain in serviceable condition for the 20-year planning period, but, replacement of the air compressor control systems

may be necessary by the time these systems reach twenty years in service. The Wastewater Facilities Plan should include general provisions for replacing bubbler system controllers upon reaching twenty years in service. However, replacing the pump controls at the time other major equipment items are scheduled for replacement may be warranted and also will be considered.

The pump controls at the Great Road station also utilize the Electrogage mercury level gauge / switch, but employ Variable Frequency Drive (VFD) equipment to control pump operation and speed in response to changing wet well levels. Two VFD units are provided to operate the three station pumps. One unit operates Pump No. 1 and No. 2; the other unit operates Pump No. 2 and No. 3. A back up pump control system is provided in case of bubbler air / mercury gauge system malfunction. Pumps operate at full speed in response to float switches located in the wet well via 'across the line' (ACL) motor starters that bypass the VFD units. Separate run time meters are provided for VFD and ACL operation for each pump. Sewer Department personnel indicated that the VFDs were not the original units and had been installed 3 or 4 years ago and also indicated that the Town has plans to replace the remainder of the pump control systems in the near future.

Each station was constructed with provisions for sensing and indication of pump suction and discharge pressure. Gauges were operational at some stations but have failed and / or been removed at other locations. Pressure gauges are not required by TR-16, but can be useful in monitoring pump operation and performance and evaluating deficient or degraded operating conditions. New pressure gauges should be provided as part of pump replacement projects.

The alarms systems for the stations include local indicating lights, silence, and reset buttons, and remote transmission of selected alarm conditions by autodialer to the Sewer Department (weekday working hours) or Police Department (nights / weekends). The stations transmit the following alarms: high wet well level, low wet well level, power fail, low air pressure (bubbler system), dry well flooding, wet well flooding, generator running, and generator fail. The alarms transmission autodialer systems have been installed recently by the Town at all stations and are reported to be operating satisfactorily. As the this equipment has recently been replaced and is reported to be in proper operating condition, satisfactory performance is expected for the twenty year planning period.

There are no provisions for direct flow metering or totalizing at any station. An approximation of total flow can be derived from run time meters at constant speed pump stations, but no information on daily flow patterns can be determined from run time only, and there is no meaningful correlation between VFD operation and run time in regard to station flow. TR-16 recommends that a flow measuring device be provided at large pump stations. The Wastewater Facilities Plan should include provisions for flow meters to be installed at each station in conjunction with the pump and / or control systems replacements.

No provisions for combustible and hazardous gas detection were observed at any station. TR-16 requires combustible and hazardous gas detection systems for medium to large pumping stations. The Wastewater Facilities Plan should include provisions for a combustible and hazardous gas monitoring and alarm system to be installed at each station as part of the pump and / or control systems replacements.

HVAC

The HVAC systems observed at the stations include ventilation fans and ducts/pipes, electric unit heaters, and dehumidifiers. Separate exhaust and supply vent pipes are provided for the wet wells and dry wells, ventilation fans are provided on the exhaust system only. Sewer Department personnel indicated that portable ventilation equipment is necessary when wet well ventilation is needed for maintenance access because the wet well fans have failed at all stations and are not operating at any location. Dry well fans also were reported or observed as not operational at most stations. Operational ventilation equipment was observed only at Angel Road North, where intermittent ventilation is provided for the dry pit with the exhaust fan operation interlocked with the light switch for the lower pump level. Sewer Department personnel indicated that the other station dry well ventilation systems, and the wet well ventilation systems, had similar lighting interlocked controls when the systems were operational.

Additional ventilation equipment and motorized shutters interlocked with the emergency generator are provided for where buildings were constructed above the pump stations. The vent piping at the Maria station was not ducted to the louvers in the building addition and the wet well exhaust vent was plugged in effort to reduce odor emissions. A supply fan was retrofit to the wet well supply duct pipe but this equipment was not functional according to Sewer Department personnel.

TR-16 requires forced ventilation of both wet wells and dry wells. Ventilation ducts should be continuous to outside of all building structures. Intermittent ventilation systems should be interlocked with switches that are accessible from outside of the structure so that fans can be activated before personnel entry. The ventilation systems at all stations require repairs to be fully functional and the Wastewater Facilities Plan will include replacement of the ventilation systems and equipment. The ventilation systems should be designed in accordance with TR-16 requirements as well as applicable mechanical and electrical code requirements.

Electric unit heaters are provided at all station dry wells. Dehumidifiers are provided at some station dry wells. No heating is provided at the wet wells. Sewer Department personnel indicated that the unit heaters were functional at all stations. Dehumidifiers were observed to be or are reported to be in satisfactory operating condition at all stations. The service life of electric heating and dehumidification equipment usually is not expected to exceed that of major mechanical equipment items. As such, replacement of these elements usually occurs in conjunction with replacement of major mechanical equipment items. The Wastewater Facilities Plan will include replacement of the electric unit heaters and dehumidifiers with major mechanical rehabilitation work, accordingly.

Plumbing

Plumbing systems include a sump pump at all stations and public water supply service at two stations. The sump pumps are located in the dry well lower level and discharge accumulated water to the station wet well. Each sump discharge pipe is provided with an isolation gate valve and two check valves to prevent backflow from the wet well. The sump pumps were operational at all locations and satisfactory continued operation can be expected. In general, sump pumps would be expected to provide useful service for approximately the same length of time as the

other mechanical systems. Based upon this condition, the sump pumps also should be replaced at the same time as the main sewage pumps are replaced. It should be noted that concerns for possible damage of the sump pump discharge pipe due to potential differential structural movement at the Angel Road North station are similar to those described above for the mechanical process suction piping.

Public water supply service is provided to the Great Road and Angel Road South stations that are equipped with seal water systems for the pumps. A water use meter and backflow prevention device are provided at the service entrance into each station. Exposed water piping appeared to be in generally serviceable condition, with some surface corrosion evident on piping near the seal water tank at Great Road. Satisfactory service is expected for the planning period.

Electrical

The electrical systems include conduit, wiring, enclosures, and devices. The descriptions presented here are based upon observations by C&E and are limited generally to the physical appearance of electrical system components and to conditions described by Sewer Department personnel. No observations or inspections were performed by an Electrical Engineer as such inspection is beyond the scope of this project. Explosion-proof equipment is required in sewage pump station wet wells. Record documents indicate the use of explosion proof equipment in the station wet wells, but detailed evaluation by an Electrical Engineer would be necessary to determine if the components (that remain functional) are in proper operating condition.

The utility power services varied from 230-volt single phase to 460-volt three phase depending on station location. Stations with single phase utility service are equipped with a phase conversion unit to provide three phase power as required for the pump motors. Sewer Department personnel indicated that the phase conversion equipment at Kirkbrae has experience malfunction and failure that the Town attributes to utility power variations and surges. The utility power feed to the site is buried at all but one station. Sewer Department personnel indicated that the Maria utility feed was switched to overhead wiring due to excessive water intrusion through the conduit entrance. The telephone service entrance reportedly experiences similar intrusion and installation of an overhead feed is pending.

Each station is equipped with a skid mounted diesel generator for emergency power. Automatic transfer switches are located in the upper level of the dry well, and two transfer switches are provided at stations with phase conversion equipment. Burnt out / missing indicating lights were observed at the transfer switch enclosure panel at several stations. Sewer Department personnel indicated that the generators and automatic transfer equipment were operational at all locations. No replacement of the emergency generators would be recommended provided that the units are in serviceable condition and of adequate size to handle future station loads.

Electrical and control equipment enclosures for the most part are located in the dry well upper level. Observations on the control equipment are provided above under Instrumentation & Controls. Incandescent lighting systems are provided with the upper and lower levels on separate circuits. Convenience receptacles are provided at various locations. Electrical enclosures, boxes and conduit appeared to be in satisfactory condition except where subjected to flooding or groundwater intrusion. The Wastewater Facilities Plan should include provisions for

repair or replacement of damaged electrical systems as part of major mechanical or control systems replacement.

Wet wells were not accessed to observe the electrical systems therein. Operational lighting was observed only at the Great Road station. Sewer Department personnel indicated that the general condition of the conduit, wiring, and lighting systems in all stations was poor. Based upon this information, the Wastewater Facilities Plan should include considerations for replacement of the wet well electrical systems for all stations. The electrical systems should conform to TR-16 recommendations as applicable electrical code conditions as required.

Above grade exterior lighting was functional at the Angel Road North and South stations. No observations were made of the electrical systems of the upper building additions.

Each station is provided with a single telephone line. The alarms autodialer is connected permanently to the phone line, and a standard telephone jack with handset for personnel dial out also is provided. Using the phone line to dial out temporarily interrupts the ability for the autodialer to transmit any alarms. Satisfactory performance is expected for the planning period for these electrical components.

Conclusions

No major replacement of existing pump station structures are expected to be necessary during the twenty year Wastewater Facilities Planning period. Normal maintenance and replacement of minor components as the need arises should provide for continued satisfactory operation for the foreseeable future. The stations with wood framed buildings constructed above the precast concrete chambers require additional building maintenance for normal upkeep. The Town has implemented efforts to reduce the impact of groundwater at some locations, however, further consideration of possible remedies should be included in any substantial projects planned for each station.

The pumps at all stations are expected to require replacement within the 20-year planning period. The pump control systems are expected to be remain serviceable for the planning period, however, the replacement of the air compressor controls within the pump control system are expected to be necessary within the planning period. The control systems at most of the stations employs dated technology by current industry standards. Replacing only components that exhibit substandard performance or replacing the entire control systems will need to be considered in conjunction with pump replacement requirements to determine the best course of action to pursue.

The station ventilation systems generally exhibit a reduced level of performance at all stations. Dehumidifiers and unit heaters are reportedly operational but replacement is expected to be necessary within the planning period. Replacement of HVAC systems should be included in projects to replace the sewage pumps and / or controls systems. Plumbing systems are expected to provide satisfactory service for the planning period, however, renovation of these systems as needed to support new mechanical equipment and processes and should be included in such projects as necessary.

In general, the dry well electrical systems are expected to provide satisfactory service during the planning period, however, specific portions of these systems that have been subjected to and experienced water damage and require repairs or replacement. Additionally, portions of the electrical installations are associated specifically with the pumps or controls systems and likely would be replaced upon replacing those items. The wet well electrical systems are for the most part not operational and will require repairs or replacement during the planning period.

C&E Engineering Partners, Inc.
Wet Well / Dry Well Pump Station Condition Survey

GENERAL

Owner: Town of Lincoln, RI
Station Name: Angel Road North
Location: Angel Road

Date of Observations: 7/14/05

Survey Performed By: Jonathan S. Gerhard, P.E.
Attended By: Joe Amaral, Lincoln Sewer Department

Year Built / Approximate Age: 1990 / 15 years

SITE

Station is located in residential area and adjacent to existing utililty power easement. A paved driveway is provided from the street to the station. A 6-foot high chain link fence is provided around the station. Fencing is provided with padlocked double leaf access gate. Fencing appears to be in fair to good condition, some areas of damaged chain link fabric were observed. Site is partially screened from street by privacy hedges. At grade construction consists of top of precast wet well and dry well chambers and chamber mounted items, including site lighting, emergency generator, station ventilation piping and the electric utility meter. A sump has been installed by the Town outside the dry well in effort to alleviate groundwater impact on the station.

BUILDING / STRUCTURE

Building structure consists of rectangular precast concrete sections. Wet well and dry well are cast as separate structures and placed side by side. Exposed above grade portions of the precast concrete chambers appear to be in generally good condition. Rust staining was observed at roof slabs at the emergency generator support skid frame. A cracked conduit fitting was observed at the telephone service entrance to the building where the conduit comes up from below grade and penetrates the building. Town Operator indicated that the cracked conduit is attributed to station movement under high groundwater conditions.

Wet Well - Concrete inside wet well appears to be generally in good condition. Gasket material was visible at points along the horizontal joint between precast sections, but no evidence of prior leakage was observed at these points. Town Operator did not identify any areas of concern regarding the wet well interior structure. Some surface corrosion was observed on the wet well access hatch, ladder, and handrails; these items appear to be in functional condition. Overall, the wet well structure appears to be in good condition.

Dry Well - Upper level of dry well appears to be generally in good condition. Minor cracks observed in concrete ceiling at mid-span and at corners of hatch openings. Staining evidence of prior water intrusion between the bottom of the upper level / floor casting and the top of the lower level / ceiling casting and damage to wall surface coatings in lower level were observed near the access opening and ladder. Town Operator indicated that exterior sump and pump installed has resolved water infiltration problem to a great extent. Gasket material was visible at various points of the horizontal joint in the lower / pump level between precast sections, but no evidence of prior leakage was observed at this joint. Staining evidence of prior groundwater intrusion was observed at the wall penetration of the sump

pump discharge piping in the lower / pump level. Dry well access ladders, hatches, handrails, and gratings appear to be in good condition and fully functional. Overall, the dry well structure appears to be in good condition.

MECHANICAL / PROCESS

Pumps: Two (2) Yeomans Model 312 non-clog pumps rated for 290 GPM @ 53' TDH
Motors: 230 volt, 3-phase, 15 HP, vertical close-coupled

Station flow is received by gravity influent sewer piping. Influent flow is screened by manually cleaned bar rack. The Town Operator did not indicate any deficient conditions for the bar rack.

Pumps and motors are located in the lower level of the dry well. Each pump is connected to the wet well by an individual suction pipe with isolation gate valve. Each pump discharge is provided with a check valve and isolation gate valve prior to joining the other pump discharge in a common force main and exiting the station. Suction and discharge piping is flanged ductile iron pipe. Pump suction and discharge piping and station discharge force main are 6-inch diameter. Pressure indicating gauges are provided on the suction and discharge piping of each pump. Both pumps are apparently in satisfactory operating condition. Some minor rusting was evident on the pumps and piping surfaces. A small weep was observed in the Pump No. 1 discharge piping at the 90° fitting where the discharge turns toward the Pump No. 2 discharge / force main header. Pumps and piping appear to be in serviceable condition and are reported to be in satisfactory operating condition.

INSTRUMENTATION & CONTROL

The pump controls consist of an "Electrogage" mercury level indicating gauge / level switch, duplex pump controller, and "ATC-10" duplex air compressor bubbler system controller. All control system components are manufactured by EG Controls of Jacksonville, FL. The pump controls are segregated in a separate control panel enclosure in the dry well upper level. Lead pump operates by level set point from the Electrogage. Lag pump set point is above the high wet well level alarm. Controls and strategy are basically same as other duplex wet well / dry well stations and submersible grinder stations.

Station alarms are transmitted by autodialer to the Sewer Department during the workday and to the Police Department on nights / weekends. Transmitted alarms include: power failure, generator run, generator failure, low wet well level, high wet well level, low air pressure, dry well flooding, and wet well flooding. The autodialer is permanently connected to the telephone service line and is located within a separate enclosure inside the main electrical cabinet that originally contained a computer based control and telemetry system that has been abandoned. A battery backup UPS is provided for the autodialer to enable alarms to be transmitted in the event that both utility power and generator power fail.

Instrumentation and controls are reportedly in satisfactory operating condition and no deficient conditions or malfunctions were observed.

HVAC

The wet well and dry well are both configured for forced exhaust ventilation and gravity supply intake ventilation. The dry well ventilation was operational, the exhaust fan is interlocked with the lighting switch for the lower level. The Town Operator reported that the wet well exhaust fan is not operational.

C&E Engineering Partners, Inc.
Wet Well / Dry Well Pump Station Condition Survey

A dehumidifier was located in the dry well upper level and observed to be in operating condition. An electric unit heater is provided in the dry well lower level and is reportedly in operating condition.

PLUMBING

A sump pump is provided in the dry well lower level to transfer accumulated water to the wet well. Sump discharge piping is fitted with double check valve and isolation gate valve. Sump pump appears to be in satisfactory operating condition. No public water service is provided to the station.

ELECTRICAL

The electrical service to the site is single-phase 115/230 Volt 60 Hertz service. The station is equipped with a phase converter to provide three phase power to the pump motors. A 240 V single phase 50 kW emergency generator is provided in the event of utility power failure. Two automatic transfer switches are provided, one is dedicated to the pumps and the other to the rest of the station loads. The generator and transfer switches are manufactured by Generac. Town Operator indicated that generator and transfer switches are operational. Town Operator indicated that the Town attributes a station malfunction that resulted in a flooded wet well condition to failure of a nearby utility transformer.

Exterior lighting was observed to be operational. Dry well lighting systems were observed to be operational. Dry well electrical enclosures, conduit and fittings appear to be in good condition with exception of conduit and fittings near the access ladder to the lower level where rusting conditions were observed. Evidence of prior groundwater intrusion in this area is apparent. Duplex receptacles are provided in the upper and lower levels. Dry well electrical systems are reportedly operational.

Surface corrosion of the conduit and boxes in the wet well were observed. The Town Operator indicated that the conditions of electrical components are generally deteriorated and the electrical system is not operational in the wet well.

A single line telephone service is provided to the station and is permanently connected to the alarm system autodialer. A telephone handset also is provided in dry well upper level that allows for dial out over the single line. Alarms cannot be transmitted when the handset is in use.

SUMMARY COMMENTS

Pumps and controls are operational are expected to have an additional 5 to 10 years service based upon approximate age of station and anticipated useful service life of 20 to 25 years. Wet well electrical and HVAC systems are not operational. Possible buoyancy of station reported by Town Operator is of concern. Additional investigations may be warranted to determine if flotation conditions need to be addressed.

C&E Engineering Partners, Inc.
Wet Well / Dry Well Pump Station Condition Survey

GENERAL

Owner: Town of Lincoln, RI
Station Name: Angel Road South
Location: Angel Road

Date of Observations: 7/27/05

Survey Performed By: Jonathan S. Gerhard, P.E.
Attended By: Joe Amaral, Lincoln Sewer Department

Year Built / Approximate Age: 1989 / 16 years

SITE

Station is located in residential area. A paved driveway is provided from the street to the station. A 6-foot high chain link fence is provided around the station. Fencing is provided with padlocked double leaf access gate. Fencing appears to be in fair to good condition. At grade construction consists of top of precast wet well and dry well chambers and chamber mounted items, including aluminum ladder and handrails, site lighting, emergency generator, station exhaust ventilation piping and the electric utility meter. A sump is being installed by the Town outside the dry well in effort to alleviate groundwater impact on the station.

BUILDING / STRUCTURE

Building structure consists of rectangular precast concrete sections. Wet well and dry well are cast as separate structures and placed side by side. Exposed above grade portions of the precast concrete chambers appear to be in generally good condition. Rust staining was observed at roof slabs at the emergency generator support skid frame. Small misalignment of wall faces at joint between wet and dry well chambers was observed. Town Operator indicated that this condition is not new and likely has existed since original construction. Grab rail at one side of the access ladder to station roof slab was broken at the base. Aluminum handrail at top slab appears to be in satisfactory condition.

Wet Well - Concrete inside wet well appears to be generally in good condition as observed from access hatch opening. Some minor spalling was observed on the wet well platform at the base of the access ladder. Town Operator did not identify any areas of concern regarding the wet well interior structure. Wet well access hatch, ladder, and handrails appear to be in functional condition with minor surface corrosion. Overall, the wet well structure appears to be in good condition.

Dry Well - Upper level of dry well appears to be generally in good condition. Staining evidence of prior water intrusion between the bottom of the upper level / floor casting and the top of the lower level / ceiling casting was observed at slab openings and damaged peeling dry well wall surface coatings were observed. Aluminum hatches, ladders and handrails in dry well appear to be in good condition. Town Operator indicated that lower level had experienced flooding to approximately 8' above the floor and exterior sump is being installed in effort to address water infiltration problem. Overall, the dry well structure appears to be in good condition, however the station evidently is susceptible to significant groundwater intrusion.

C&E Engineering Partners, Inc.
Wet Well / Dry Well Pump Station Condition Survey

MECHANICAL / PROCESS

Pumps: Two (2) Yeomans Model 6312 non-clog pumps rated for 950 GPM @ 146' TDH
Motors: 460 volt, 3-phase, 60 HP, vertical close-coupled

Station flow is received by gravity influent sewer piping. Influent flow is screened by manually cleaned bar rack. The Town Operator indicated that the bar rack is in generally satisfactory operating condition.

Pumps and motors are located in the lower level of the dry well. Pumps are provided with a separate seal water system. Each pump is connected to the wet well by an individual suction pipe with isolation gate valve. Each pump discharge is provided with a check valve and isolation gate valve prior to joining the other pump discharge in a common force main and exiting the station. Some weeping was observed at the check valve stems. Suction and discharge piping is flanged ductile iron pipe. Pump suction and discharge piping and station discharge force main are 6-inch diameter. Pressure indicating gauges are provided on the suction and discharge piping of each pump. Some minor rusting was evident on the pumps and piping surfaces. Piping appears to be in serviceable condition. Town Operator indicated that the pump motors and disconnects, and the seal water control panel were temporarily submerged when the dry well flooded. Sewage pumps are reported to be operational. Seal water pumps are not operational and water is left on to trickle feed continuously in effort to provide clean water to seals.

INSTRUMENTATION & CONTROL

The pump controls consist of an "Electrogage" mercury level indicating gauge / level switch, duplex pump controller, and "ATC-10" duplex air compressor bubbler system controller. All control system components are manufactured by EG Controls of Jacksonville, FL. The pump controls are segregated in a separate control panel enclosure. Lead pump operates by level set point from the Electrogage. Lag pump set point is above the high wet well level alarm. Controls and strategy are basically same as other duplex wet well / dry well stations and submersible grinder stations. The seal water control panel is located in the dry well lower level. The panel was submerged when the station flooded and is no longer operational.

Station alarms are transmitted by autodialer to the Sewer Department during the workday and to the Police Department on nights / weekends. Transmitted alarms include: power failure, generator failure, low wet well level, high wet well level, low air pressure, dry well flooding, and wet well flooding. The autodialer is permanently connected to the telephone service line and is located within a separate enclosure inside the main electrical cabinet that originally contained a computer based control and telemetry system that has been abandoned. A battery backup UPS is provided for the autodialer to enable alarms to be transmitted in the event that both utility power and generator power fail.

With exception of the seal water system, instrumentation and controls are reportedly in satisfactory operating condition and no deficient conditions or malfunctions were observed.

HVAC

The wet well and dry well are both configured for forced exhaust ventilation and gravity supply intake ventilation. The dry well exhaust fan was not operational and the Town Operator reported that the wet well exhaust fan is not operational. Two dehumidifiers are provided one located in the dry well upper

level and one in the lower level. Both units were reported to be in operating condition. An electric unit heater is provided in the dry well lower level and is reportedly in operating condition.

PLUMBING

A sump pump is provided to transfer accumulated water to the wet well. Sump discharge piping is fitted with double check valve and isolation gate valve. Sump pump appears to be in satisfactory operating condition. Public water service is provided to the station for use in the seal water system. The utility meter and backflow prevention device are located in the dry well lower level approximately 10' above the floor. Town Operator indicated that the backflow preventer was not submerged during the station flood.

ELECTRICAL

The electrical service to the site is three phase 480 Volt 60 Hertz service. A 480 V three phase 150 kW emergency generator and automatic transfer switch are provided the event of utility power failure. The generator and transfer switch are manufactured by Caterpillar. The "Normal" power position indicating light at the transfer switch panel was burnt out. Town Operator indicated that generator and transfer switch are operational.

Exterior lighting was observed to be operational. Dry well lighting systems were observed to be operational. Dry well electrical enclosures, conduit and fittings appear to be in good condition in the upper level. Condition of electrical system components in the lower level is deteriorated due to flooding condition. Dry well upper level electrical systems are reportedly operational, lower level electrical system generally are not utilized due to concern for flood related damage. Lighting system is above the flood level and remains operational.

Surface corrosion of the conduit and boxes in the wet well were observed. The Town Operator indicated that the conditions of electrical components are generally deteriorated and the electrical system is not operational in the wet well.

A single line telephone service is provided to the station and is permanently connected to the alarm system autodialer. A telephone handset also is provided in dry well upper level that allows for dial out over the single line. Alarms cannot be transmitted when the handset is in use.

SUMMARY COMMENTS

Pumps and seal water system were damaged due to flooding and continued satisfactory pump service cannot be expected for extended periods. Controls are operational are expected to have an additional 4 to 9 years service based upon approximate age of station and anticipated useful service life of 20 to 25 years. Wet well electrical and HVAC systems reportedly are not operational. Dry well ventilation system reportedly is not operational and lower level electrical system is only partially operational. Replacement of pumps and rehabilitation of electrical and ventilation systems should be prioritized for this station.

C&E Engineering Partners, Inc.
Wet Well / Dry Well Pump Station Condition Survey

GENERAL

Owner: Town of Lincoln, RI
Station Name: Great Road
Location: Great Road

Date of Observations: 7/27/05

Survey Performed By: Jonathan S. Gerhard, P.E.
Attended By: Joe Amaral, Lincoln Sewer Department

Year Built / Approximate Age: 1989 / 16 years

SITE

Station is located in residential / commercial area next to a church building. A paved driveway is provided from the street to the station, station located well off street. No site fence is provided. Station is partially screened from adjacent property by privacy hedges. At grade construction consists of wood building superstructure constructed on top of precast wet well and dry well chambers.

BUILDING / STRUCTURE

Pump station structure consists of rectangular precast concrete sections. Wet well and dry well are cast as separate structures and placed side by side. A 2-story wood framed building with wood siding and asphalt shingle roofing was constructed on top of the precast station chambers.

Superstructure- Building addition and exposed above grade portions of the precast concrete chambers appear to be in generally good condition. Paint on wood siding is peeling and fading. Concrete steps up to building addition / station top slab require replacement due to damage from being hit by a motor vehicle.

Wet Well - Concrete inside wet well appears to be generally in good condition as observed from the access hatch opening. Town Operator did not identify any areas of concern regarding the wet well interior structure. Wet well access hatch and ladder appear to be in functional condition with minor surface corrosion. Overall, the wet well structure appears to be in good condition.

Dry Well - Upper and lower levels of dry well appear to be generally in good condition. Staining evidence of prior water intrusion between the bottom of the upper level / floor casting and the top of the lower level / ceiling casting was observed at the access ladder opening, some pump removal access openings, and at the exhaust vent penetration. Staining evidence of prior water intrusion also was observed at station discharge force main wall penetration. Town Operator did not indicate any excessive water intrusion concerns for this location. Ladders and handrails in dry well appear to be in satisfactory and functional condition. The safety chain is broken at the access opening to the lower level. Overall, the station structure is in good condition. Overall, the dry well structure appears to be in good condition.

C&E Engineering Partners, Inc.
Wet Well / Dry Well Pump Station Condition Survey

MECHANICAL / PROCESS

Pumps: Three (3) Yeomans Model 6312 non-clog pumps rated for 1600 GPM @ 88' TDH
Motors: 480 volt, 3-phase, 60 HP, vertical close-coupled

Station flow is received by gravity influent sewer piping. Influent flow is screened by manually cleaned bar rack. Wet well has multiple dividable chambers separated by aluminum slide gates and plates. The Town Operator did not indicate any deficient conditions for the bar rack, slide gates and plates.

Pumps and motors are located in the lower level of the dry well. Each pump is connected to the wet well by an individual suction pipe with isolation gate valve. Each pump discharge is provided with a check valve and isolation gate valve prior to joining the other pump discharge in a common force main and exiting the station. Suction and discharge piping is flanged ductile iron pipe. Pump suction and discharge piping are 8-inch diameter. Station discharge force main is 10-inch diameter. Pressure indicating gauges were not observed on the discharge piping of each pump. Some minor surface corrosion was evident on the pump motor housings apparently due to dripping water from openings in ceiling slab above. Pumps are reportedly in satisfactory operating condition. Piping appears to be in serviceable condition with minor surface corrosion. Seal water system is reportedly operational, but Town Operator indicated that one seal water pump is out of service awaiting repairs so seal water system is operating with one pump only. Seal water piping was observed with some surface corrosion.

INSTRUMENTATION & CONTROL

The pump controls consist of an "Electrogage" mercury level indicating gauge / switch, triplex pump control system, and duplex air compressor bubbler system controller. These components are manufactured by EG Controls of Jacksonville, FL. Variable Frequency Drive (VFD) units are provided to allow pump output speed to vary in response to changing wet well level. The pump controls and VFDs for all three pumps are segregated in a separate control panel enclosure in the dry well upper level. Lead and lag pumps operate by level set point from the Electrogage. In addition to pump "On" and "Off" levels, the control system varies pump(s) speed based upon rising / falling wet well level via the Electrogage set points. The third pump serves as standby in the event of lead or lag pump failure. Two VFD units are provided, one serves Pumps No. 1 and No. 2 and one serves Pumps No. 2 and No. 3. Backup float switch level controls provide for constant speed On/Off "across the line" pumping bypassing the VFDs in the event of Electrogage failure. Pumps can be operated in either constant or variable speed from the Hand position. The Town Operator indicated that the VFDs had been replaced with new units approximately 3 or 4 years ago and that the entire pump controls system was planned for replacement in near future.

Station alarms are transmitted by autodialer to the Sewer Department during the workday and to the Police Department on nights / weekends. Transmitted alarms include: power failure, generator run, generator fail, low wet well level, high wet well level, low air pressure, dry pit flooding and wet pit flooding. The autodialer is permanently connected to the telephone service line and is located within a separate enclosure inside the main electrical cabinet that originally contained a computer based control and telemetry system that has been abandoned. A battery backup UPS is provided for the autodialer to enable alarms to be transmitted in the event that both utility power and generator power fail.

Instrumentation and controls are reportedly in satisfactory operating condition and no deficient conditions or malfunctions were observed.

C&E Engineering Partners, Inc.
Wet Well / Dry Well Pump Station Condition Survey

HVAC

The wet well and dry well are both configured for forced exhaust ventilation and gravity supply intake ventilation. Town Operator reported that both the dry well and wet well exhaust fans are not operational. Supply and exhaust vent piping above the precast station top slab was retrofit with aluminum ductwork and hard piped to louvers in the side walls of the building addition. Fan and dampers in the building addition for emergency generator operation are reportedly operational. No dehumidifier is provided at this station. Electric unit heat is provided in the dry well and is reportedly in operating condition.

PLUMBING

A sump pump is provided in the dry well lower level to transfer accumulated water to the wet well. Sump discharge piping is fitted with double check valve and isolation gate valve. Sump pump appears to be in satisfactory operating condition. Public water service is provided to the station for use in the seal water system. The utility meter and backflow prevention device are located in the dry well upper chamber.

ELECTRICAL

The electrical service to the site is three phase 480 Volt 60 Hertz service. The utility service meter is mounted to the exterior of the pump station. Town Operator indicated that conduit / service drop for the station was damaged by motor vehicle collision into utility pole. A 480 V three phase 150 kW. emergency generator and automatic transfer switch are provided the event of utility power failure. The generator and transfer switches are manufactured by Caterpillar. "Normal" indicating lamp was burnt out / missing from automatic transfer switch panel. Town Operator indicated that generator and transfer switches are operational.

Dry well lighting systems were observed to be operational. Dry well electrical enclosures, conduit and fittings appear to be in good condition. Dry well electrical systems are reportedly operational.

Wet well lighting was observed to be operational but the Town Operator indicated that the conditions of electrical components are generally deteriorated and the electrical system is not operational in the wet well. Town Operator also indicated that some control wiring in the wet well was recently replaced due to deficient conditions.

A single line telephone service is provided to the station and is permanently connected to the alarm system autodialer.

SUMMARY COMMENTS

Pumps and controls are operational and are expected to have an additional 4 to 9 years service based upon approximate age of station and anticipated useful service life of 20 to 25 years. VFD equipment is only 3 to 4 years old. Wet well HVAC system reportedly is not operational and electrical systems in poor condition. Dry well ventilation system was not operational. Control wiring repairs should be reviewed to confirm explosion-proof installation.

C&E Engineering Partners, Inc.
Wet Well / Dry Well Pump Station Condition Survey

GENERAL

Owner: Town of Lincoln, RI
Station Name: Kirkbrae
Location: Timberland Drive

Date of Observations: 7/28/05

Survey Performed By: Jonathan S. Gerhard, P.E.
Attended By: Joe Amaral, Lincoln Sewer Department

Year Built / Approximate Age: 1986 / 19 years

SITE

Station is located in residential area. A paved driveway is provided from the street to the station, station located well off street. A 4-foot high chain link fence is provided around the station, there is no gate at the access drive. Fencing appears to be in fair to good condition, some sections of chain link fabric were missing. Site is partially screened from adjacent properties by privacy hedges. At grade construction consists of wood building superstructure constructed on top of precast wet well and dry well chambers.

BUILDING / STRUCTURE

Pump station structure consists of rectangular precast concrete sections. Wet well and dry well are cast as separate structures and placed side by side. A wood framed building with wood siding and asphalt shingle roofing was constructed on top of the precast station chambers. Building / station top slab are accessed by exterior wooden stairway.

Superstructure – Wood building addition, stairs, and exposed above grade portions of the precast concrete chambers appear to be in generally good condition. Spalling concrete was observed at the top slab at the wet well chamber access hatch. Town Operator indicated that this is not a new condition and little or no deterioration has been noted.

Wet Well - Concrete inside wet well appears to be generally in good condition as observed from the access hatch opening. Town Operator did not identify any areas of concern regarding the wet well interior structure. Wet well access hatch and ladder appear to be in functional condition with minor surface corrosion. Overall, the wet well structure appears to be in good condition.

Dry Well - Upper level of dry well appears to be generally in good condition. Minor staining evidence of prior water intrusion between the bottom of the upper level / floor casting and the top of the lower level / ceiling casting was observed at access openings. Staining evidence of prior water intrusion also was observed in the dry well lower level at the wall penetrations for the suction piping to Pump No. 2 and sump pump discharge piping. Some moisture and / or dampness was observed at the dry well lower level floor slab. Town Operator did not indicate any excessive water intrusion concerns for this location. Ladders and handrails in dry well appear to be in satisfactory and functional condition. Overall, the dry well structure appears to be in good condition.

C&E Engineering Partners, Inc.
Wet Well / Dry Well Pump Station Condition Survey

MECHANICAL / PROCESS

Pumps: Two (2) Yeomans Model 4315 non-clog pumps rated for 470 GPM @ 82' TDH
Motors: 230 volt, 3-phase, 20 HP, vertical close-coupled

Station flow is received by gravity influent sewer piping. Influent flow is screened by manually cleaned bar rack. The Town Operator did not indicate any deficient conditions for the bar rack.

Pumps and motors are located in the lower level of the dry well. Each pump is connected to the wet well by an individual suction pipe with isolation gate valve. Each pump discharge is provided with a check valve and isolation gate valve prior to joining the other pump discharge in a common force main and exiting the station. Suction and discharge piping is flanged ductile iron pipe. Pump suction and discharge piping and station discharge force main are 6-inch diameter. Pressure indicating gauges are provided on the suction piping of each pump. Town Operator indicated that Pump No. 1 is off line waiting for service call to investigate slight rattle. Pump No. 2 is reportedly in satisfactory operating condition. Some minor rusting was evident on the pump casing bolts. Piping appears to be in serviceable condition.

INSTRUMENTATION & CONTROL

The pump controls consist of an "Electrogage" mercury level indicating gauge / level switch, duplex pump controller, and duplex air compressor bubbler system controller. All control system components are manufactured by EG Controls of Jacksonville, FL. The pump controls are segregated in a separate control panel enclosure. Lead pump operates by level set point from the Electrogage. Lag pump set point is above the high wet well level alarm. The bubbler air compressor system consists of two air compressors and a single air receiver tank all mounted external to the control panel. Controls and strategy are basically same as other duplex wet well dry well stations and submersible grinder stations, except that bubbler system incorporates air receiver tank and compressors do not operate continuously at this station.

Station alarms are transmitted by autodialer to the Sewer Department during the workday and to the Police Department on nights / weekends. Transmitted alarms include: power failure, generator run, low wet well level, high wet well level, and low air pressure. The autodialer is permanently connected to the telephone service line and is located within a separate enclosure inside the main electrical cabinet that originally contained a computer based control and telemetry system that has been abandoned. A battery backup UPS is provided for the autodialer to enable alarms to be transmitted in the event that both utility power and generator power fail.

Instrumentation and controls are reportedly in satisfactory operating condition and no deficient conditions or malfunctions were observed.

HVAC

The wet well and dry well are both configured for forced exhaust ventilation and gravity supply intake ventilation. The dry well exhaust fan was not operational and the Town Operator reported that the wet well exhaust fan is not operational. Dampers in the building addition for emergency generator operation are reportedly operational. A dehumidifier was located in the dry well lower level and is reportedly in operating condition. An electric unit heater is provided in the dry well lower level and is reportedly in operating condition.

C&E Engineering Partners, Inc.
Wet Well / Dry Well Pump Station Condition Survey

PLUMBING

A sump pump is provided in the dry well lower level to transfer accumulated water to the wet well. Sump discharge piping is fitted with double check valve and isolation gate valve. Sump pump appears to be in satisfactory operating condition. No public water service is provided to the station.

ELECTRICAL

The electrical service to the site is single-phase 115/230 Volt 60 Hertz service. The station is equipped with a phase converter to provide three phase power to the pump motors. A 240 V single phase 50 kW emergency generator is provided in the event of utility power failure. Two automatic transfer switches are provided, one is dedicated to the pumps and the other to the rest of the station loads. The generator and transfer switches are manufactured by Generac. Town Operator indicated that generator and transfer switches are operational. Town Operator indicated that the phase converter is a new unit; old converter failed due to damage attributed to utility power surges.

Dry well lighting systems were observed to be operational. Dry well electrical enclosures, conduit and fittings appear to be in good condition. Dry well electrical systems are reportedly operational.

The Town Operator indicated that the conditions of electrical components are generally deteriorated and the electrical system is not operational in the wet well.

A single line telephone service is provided to the station and is permanently connected to the alarm system autodialer. A telephone handset also is provided in dry well upper level that allows for dial out over the single line. Alarms cannot be transmitted when the handset is in use.

SUMMARY COMMENTS

Pumps and controls are operational and are expected to have an additional 1 to 6 years service based upon approximate age of station and anticipated useful service life of 20 to 25 years. Wet well electrical and HVAC systems reportedly are not operational. Dry well ventilation system reportedly is not operational.

C&E Engineering Partners, Inc.
Wet Well / Dry Well Pump Station Condition Survey

GENERAL

Owner: Town of Lincoln, RI
Station Name: Maria
Location: Maria Street

Date of Observations: 7/28/05

Survey Performed By: Jonathan S. Gerhard, P.E.
Attended By: Joe Amaral, Lincoln Sewer Department

Year Built / Approximate Age: 1988 / 17 years

SITE

Station is located in residential area. A paved driveway is provided from the street to the station, station located well off street. A 6-foot high chain link fence is provided around the station, there are two double leaf gates. Fencing appears to be in fair to good condition, with some pealing paint observed. Site is partially screened from street by pine trees. At grade construction consists of wood building superstructure constructed on top of precast wet well and dry well chambers.

BUILDING / STRUCTURE

Pump station structure consists of rectangular precast concrete sections. Wet well and dry well are cast as separate structures and placed side by side. A wood framed building with wood siding and asphalt shingle roofing was constructed on top of the precast station chambers.

Superstructure- Wood building addition and exposed above grade portions of the precast concrete chambers appear to be in generally good condition. Paint on wood siding is peeling and some of the trim show signs of water damage / rot. Spalling concrete was observed at the top slab at the wet well chamber access hatch.

Wet Well - Concrete inside wet well appears to be generally in good condition as observed from the access hatch opening. Town Operator did not identify any areas of concern regarding the wet well interior structure. Wet well access hatch and ladder appear to be in functional condition with minor surface corrosion. Overall, the wet well structure appears to be in good condition.

Dry Well - Upper level of dry well appears to be generally in good condition. Minor staining evidence of prior water intrusion between the bottom of the upper level / floor casting and the top of the lower level / ceiling casting was observed at pump removal access opening. Minor staining evidence of prior water intrusion also was observed at horizontal section joint in upper dry well level. Town Operator did not indicate any excessive water intrusion concerns for this location. Ladders and handrails in dry well appear to be in satisfactory and functional condition. Overall, the dry well structure appears to be in good condition.

C&E Engineering Partners, Inc.
Wet Well / Dry Well Pump Station Condition Survey

MECHANICAL / PROCESS

Pumps: Two (2) Yeomans Model 4312 non-clog pumps rated for 570 GPM @ 117' TDH
Motors: 480 volt, 3-phase, 40 HP, vertical close-coupled

Station flow is received by gravity influent sewer piping. Influent flow is screened by manually cleaned bar rack. The Town Operator did not indicate any deficient conditions for the bar rack.

Pumps and motors are located in the lower level of the dry well. Each pump is connected to the wet well by an individual suction pipe with isolation gate valve. Each pump discharge is provided with a check valve and isolation gate valve prior to joining the other pump discharge in a common force main and exiting the station. Suction and discharge piping is flanged ductile iron pipe. Pump suction and discharge piping are 6-inch diameter. Station discharge force main is 8-inch diameter. Pressure indicating gauges are provided on the suction and discharge piping of each pump. Some minor rusting was evident on the pumps and piping at connecting bolts and at the pump pedestals. Pumps are reportedly in satisfactory operating condition. Piping appears to be in serviceable condition.

INSTRUMENTATION & CONTROL

The pump controls consist of an "Electrogage" mercury level indicating gauge / level switch, duplex pump controller, and "ATC-10" duplex air compressor bubbler system controller. All control system components are manufactured by EG Controls of Jacksonville, FL. The pump controls are segregated in a separate control panel enclosure. Lead pump operates by level set point from the Electrogage. Lag pump set point is above the high wet well level alarm. Controls and strategy are basically same as other duplex wet well / dry well stations and submersible grinder stations.

Station alarms are transmitted by autodialer to the Sewer Department during the workday and to the Police Department on nights / weekends. Transmitted alarms include: power failure, generator run, low wet well level, high wet well level, low air pressure, and wet pit flooding. The autodialer is permanently connected to the telephone service line and is located within a separate enclosure inside the main electrical cabinet that originally contained a computer based control and telemetry system that has been abandoned. A battery backup UPS is provided for the autodialer to enable alarms to be transmitted in the event that both utility power and generator power fail.

Instrumentation and controls are reportedly in satisfactory operating condition and no deficient conditions or malfunctions were observed.

HVAC

The wet well and dry well are both configured for forced exhaust ventilation and gravity supply intake ventilation. The dry well exhaust fan was not operational and the Town Operator reported that the wet well exhaust fan is not operational. Dry well supply and exhaust vent piping above the precast station top slab was directed toward the louvers in the side walls of the building addition, but was not hard piped / ducted to provide positive connection to outside atmosphere. Wet well exhaust vent piping was plugged reportedly to reduce odors. A fan / blower unit was retrofit the wet well supply vent piping, but this unit is no longer operational according to Town Operator. Fan and dampers in the building addition for emergency generator operation are reportedly operational. A dehumidifier was located in the dry well lower level and is reportedly in operating condition. An electric unit heater is provided in the dry well lower level and is reportedly in operating condition.

C&E Engineering Partners, Inc.
Wet Well / Dry Well Pump Station Condition Survey

PLUMBING

A sump pump is provided in the dry well lower level to transfer accumulated water to the wet well. Sump discharge piping is fitted with double check valve and isolation gate valve. Sump pump appears to be in satisfactory operating condition. No public water service is provided to the station.

ELECTRICAL

The electrical service to the site is three phase 480 Volt 60 Hertz service. Utility power is via overhead service at this station. Town Operator indicated that service was revised to overhead feed due to water intrusion though the original underground feed conduit. A 480 V three phase 60 kW emergency generator and automatic transfer switch are provided the event of utility power failure. The generator and transfer switches are manufactured by Generac. Town Operator indicated that generator and transfer switches are operational. 90° bend fitting on a conduit mounted to / through the exterior wall of the dry well concrete chamber was observed to be missing its back cover.

Dry well lighting systems were observed to be operational. Dry well electrical enclosures, conduit and fittings appear to be in good condition. Dry well electrical systems are reportedly operational.

The Town Operator indicated that the conditions of electrical components are generally deteriorated and the electrical system is not operational in the wet well.

A single line telephone service is provided to the station and is permanently connected to the alarm system autodialer. Town Operator indicated that the telephone service also is to be revised to overhead feed due to concern for water intrusion similar to old electric feed. A telephone handset also is provided in dry well upper level that allows for dial out over the single line. Alarms cannot be transmitted when the handset is in use.

SUMMARY COMMENTS

Pumps and controls are operational and are expected to have an additional 3 to 8 years service based upon approximate age of station and anticipated useful service life of 20 to 25 years. Wet well electrical and HVAC systems reportedly are not operational. Dry well ventilation system was not operational. Vent piping should be continuously ducted to outside of building addition.

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Civil & Environmental Engineering Partners, Inc.

Technical Memorandum #3

Town of Lincoln Wastewater Facilities Plan
C&E Project No. J0506

Date: August 26, 2005
To: N. Kim Wiegand, P.E., Town Engineer

Subject: Existing Pump Stations Evaluation
Lower River Road Screw Pump Station

Introduction

C&E Engineering Partners, Inc. (C&E) has completed an evaluation of the Town's thirty-one (31) existing wastewater pumping stations as described under Task 2 of Exhibit A to the Agreement dated June 16, 2005. The Town's existing pumping stations can be segregated into three (3) general types: Submersible Grinder Pump station, Wet Well / Dry Well Pump station, and Screw Pump station. Twenty-five (25) of the Town's pump stations are Submersible Grinder Pump type stations, five (5) stations are Wet Well / Dry Well type stations, and one (1) station is a Screw Pump type station.

C&E personnel conducted site visits to observe station conditions on July 13, 14, 27, and 28, 2005. Observations were limited to visual inspection of the facilities to establish the anticipated remaining useful service life for the pump stations so that this information can be incorporated into the wastewater facilities planning process. Detailed evaluation of the facilities and specific performance testing were not conducted. A Technical Memorandum prepared for each station type presents the conditions observed at the stations, and conditions reported by Sewer Department personnel, so that the requirements for maintaining these facilities for the 20-year planning period can be established and incorporated into the Wastewater Facilities Plan. The reference standard utilized as the basis for evaluating the pump station is the 1998 Edition of the Guidelines for the Design of Wastewater Treatment Works Technical Report #16 (TR-16) as prepared by the New England Interstate Water Pollution Control Commission.

This Technical Memorandum #3 describes the conditions observed at the Lower River Road Pump Station, which employs screw type sewage pumps. Conditions observed at the Submersible Grinder Pump and Wet Well / Dry Well type stations are presented in Technical Memorandum #1 and #2, respectively.

General Description

As noted above, one (1) of the Town's 31 wastewater pump stations is of the Screw Pump type. TR-16 recommends wet well / dry well type stations as preferable but allows for other types of stations under certain circumstances. TR-16 requires a minimum of two pumps, with each pump being capable of handling the peak design flow. Two screw pumps are provided at the Lower

River Road station and record documents provided by the Town indicate that each pump is capable of discharging the full design load. As such, the existing station design and capacity generally conforms to the current TR-16 capacity guidelines. Record documents indicate each pump is rated for a peak design flow of 300 gallons per minute at 12 feet total dynamic head.

Screw pumps are well suited to low lift pumping applications and have the advantage of providing variable output from constant speed pumps. Pump output matches station influent and varies based upon the wet well sump level. As a result, simple controls systems are inherent in the design of screw pumps. Because there essentially is only one component that requires maintenance (pump / motor) and the simplicity of the controls, system operators find screw pump stations easy to operate and maintain. However, screw pumps require an open system that operates at atmospheric pressure and can be the source of odor complaints due to turbulent and / or septic conditions.

Observations and Evaluation

C&E personnel visited the station on July 28, 2005, accompanied by Town Sewer Department personnel, to perform on-site observations. The following narrative describes specific items and conditions observed and identified. This narrative is itemized into categories in a format similar to that provided for the Submersible Grinder type station in Technical Memorandum #1.

Site (Land Use / Access)
The station site is located in a predominantly Residential area. At grade construction consists of chain link fence, concrete chamber, aluminum handrails at the upper end top slab, vent pipe at the lower end top slab, and the main electrical cabinet enclosure. Fence gate, access hatch and the main electrical cabinet are secured by padlock. The station is screened from the street by privacy hedges. The station site is located immediately adjacent to the public roadway and abuts the Blackstone River canal on the opposite side. No paved access drive is provided.

Building / Structure
The pump station is constructed of precast concrete. The station is assembled as a single overall chamber in which the influent channel, pumps, and effluent channel all are located. There are two top / roof slab levels, the upper level slab is above the effluent end of the station and the pumps, and the lower level slab over the influent end of the station. The exterior of the concrete chamber appeared to be in generally satisfactory condition with no specific deterioration noted or observed. A partial aluminum handrail system is installed on the upper level top slab. Sewer Department personnel indicated that no handrail had been provided for the station until the Town recently installed the current system. Additional railing would be necessary to fully surround the upper level slab perimeter. An aluminum ladder provides access to the upper level top slab. An aluminum hatch is cast into the upper level top slab to provide access to the station interior. The vent piping at the lower level top slab has been modified. Sewer Department personnel indicated that the additional piping was installed to facilitate connecting portable ventilation equipment to supply air to the chamber during maintenance access. The vent pipe is capped / plugged when the station is not occupied.

The interior of the station was not accessed because ventilation is not operable and observations were conducted from outside the chamber through the access hatch and louver opening. The

station access is located at the upper / effluent end and an aluminum ladder with safety extension provides access to the upper level. Interior stairs between the two pump screw columns are provided to access the lower / influent level. Sewer Department personnel did not identify any specific conditions of concern for the interior concrete structure and aluminum grating components.

Satisfactory service is expected for the pump station concrete structure, handrails, vent piping, access hatch and gratings for 20-year planning period. However, all metals should be monitored for deterioration and repaired or replaced as needed to maintain proper function if deficient conditions are observed.

Mechanical / Process

Mechanical process systems for this consists of the tube mounted screw pumps manufactured by Schreiber Corporation of Trussville, AL. Each pump is equipped with a 1.5 HP electric motor and is rated for a peak design flow of 300 gallons per minute at 12 feet total dynamic head. Influent flow enters the wet well via gravity sewer connection and enters the pumps at the lower end of the station. Wastewater is conveyed by the screw flights to the top of the tube and discharged to the effluent channel and exits the station by gravity flow. The station was not accessed to perform a detailed inspection of the pumps, but corrosion was evident on the pump motor housings when viewed from the access hatch opening. Sewer Department personnel indicated that pump operation is satisfactory and did not identify any specific concerns other than the deterioration due to corrosion observed at the pump motors.

Sewer Department personnel indicated that odor complaints have occurred at the station generally due to the proximity to adjacent residential areas but did not indicate a specific concern for excessive odors or complaints. Provisions for odor controls at this station are limited and could be impractical due to the size and configuration of the station and available space for additional equipment installation. Odor emissions will be discussed coordinated further with the Town during planning process to determine if any odor controls appear to be needed and considerations for odor controls included in the Wastewater Facilities Plan as may be applicable.

Record documentation provided by the Town indicates that the pipelines and pump stations are designed to accommodate a future flow projected to the year 2035 and mechanical systems are designed for a 20 to 25 year service life. The fabrication date inside the control panel indicates that this station was constructed in 1988, so the approximate age of the station is 17 years and the mechanical systems are approaching the end of their intended service life. Satisfactory continued performance is expected based upon the conditions observed and reported for this station, but the pumps and motors will require replacement in the near future. The future flow design year is coincident with the end of the 20-year planning period for the current Plan and, as such, it is expected that the buried pipelines and station influent and effluent channels will be serviceable and capable of accommodating flows to the end of the planning period.

Instrumentation & Control

The pumps are constant speed and operate without any level sensing input. The control panel includes a Hand-Off-Auto switch and run time meter for each pump and a pump alternating timer. With each pump in the Auto position, the timer selects and alternates operation between

the two pumps. One pump is operating at all times. If one pump is down for service or otherwise, the other pump can be operated continuously in the Hand mode. Sewer Department personnel indicated the pump controls were operational. Based upon this information, continued satisfactory service is expected for the Planning period. However, replacement of the controls could be necessary in conjunction with mechanical equipment replacements.

An alarms autodialer has been installed in the telemetry panel inside the main electrical enclosure replacing the original computer based system. The autodialer transmits alarms to the Sewer Department (weekdays, working hours) and Police Department (nights / weekends). An uninterruptible power supply (UPS) battery backup unit is provided for the autodialer. The only alarm condition monitored is wet well flood level. Sewer Department personnel indicated that the controls and alarms were operational. Based upon this information, continued satisfactory service is expected for the Planning period.

There are no provisions for direct flow metering or totalizing at the station. TR-16 recommends that a flow measuring device be provided at large pump stations. The Town does not need flow metering for billing purposes and incorporating a gravity flow measuring device into the existing station or on the effluent sewer line likely would be cost prohibitive. No provisions for flow metering at this station are proposed to be included in the Wastewater Facilities Plan.

There are no provisions for combustible and hazardous gas detection at the station. TR-16 requires combustible and hazardous gas detection systems for medium to large pumping stations. The Wastewater Facilities Plan should include provisions for a combustible and hazardous gas monitoring and alarm system to be installed as part of the mechanical and / or control systems replacements.

HVAC

Record documents indicate that the ventilation system consisted of an exhaust fan connected to the lower level vent pipe and gravity supply air intake. The air intake louver is located in the wall of effluent end of the upper level of the chamber. As noted above, the vent piping at the lower level top slab has been modified to facilitate connecting portable ventilation equipment to supply air to the chamber during maintenance access. The vent pipe is capped / plugged when the station is not occupied; the upper level louver provides passive ventilation during unoccupied periods. TR-16 requires forced ventilation for wet wells where fixed equipment requires operation and maintenance personnel access. The Wastewater Facilities Plan should include provisions for forced ventilation system to be installed as part of other mechanical and / or control systems replacement projects.

Electrical

The electrical systems include conduit, wiring, enclosures, and devices. The descriptions presented here are based upon observations by C&E and are limited generally to the physical appearance of electrical system components and to conditions described by Sewer Department personnel. The station chamber was not accessed to perform inspections and no observations or inspections were performed by an Electrical Engineer as such inspection is beyond the scope of this project. Explosion-proof equipment is required in sewage pump station wet wells. Record documents indicate the use of explosion proof equipment in the station wet wells, but detailed

evaluation by an Electrical Engineer would be necessary to determine if the components (that remain functional) are in proper operating condition.

The utility power service to the station is 115 / 230 volt single-phase service. A pad mounted, metallic enclosure cabinet that houses all electrical and control equipment is provided similar to the Submersible Grinder stations. The utility meter and a receptacle for connecting a portable generator for emergency power are mounted to the side of the main electrical enclosure. A manual transfer switch is provided to select Utility or Generator power source. The equipment and main electrical enclosure appeared to be in satisfactory condition. Sewer Department personnel did not identify any specific operating concerns for these items. Based upon this information, continued satisfactory performance is expected.

Interior lighting was operational. Surface corrosion was observed from the access hatch on conduit and junction boxes in the wet well. Sewer Department personnel indicated that conduit and wiring in the remainder of the station interior was in similar condition. Satisfactory continued service cannot be expected for extended periods. The Wastewater Facilities Plan should include replacement of the wet well electrical systems in conjunction with mechanical equipment replacement.

Conclusions

No major repairs to or replacement of the existing pump station structure is expected to be necessary during the 20-year Wastewater Facilities Planning period. Normal maintenance and replacement of minor components as the need arises should provide for continued satisfactory operation for the foreseeable future.

The pumps are expected to require replacement within the 20-year planning period. The pump control systems are expected remain serviceable for the planning period, however, replacement may be necessary to accommodate new pumping equipment. Ventilation equipment and combustible gas monitoring system should be provided when pumps are replaced.

Electrical systems inside the station are expected to require replacement during the planning period. TR-16 and electrical code compliance should be incorporated into any major renovations. Replacing the existing enclosure cabinets could be considered if the majority of the components housed in the enclosure are being replaced.

TOWN OF LINCOLN
DEPARTMENT OF PUBLIC WORKS

SANITARY SEWER MANAGEMENT PROGRAM

NOVEMBER 2003

Revised January 2004

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The purpose of this Management Program is to document the standard operations procedures and actions to be taken by the Town of Lincoln in order to eliminate the occurrence of sewer backups and pumping stations failures. This is a compilation of all the Town's Standard Operation Procedures related to the operation and maintenance of the sanitary sewer collection system.

I. Sewer Inspections and Repairs

The Town of Lincoln Department of Public Works Sewer Division is responsible for the operation and maintenance of the Town's sanitary sewer collection system.

The collection system comprises approximately 100 miles of sanitary sewer lines and thirty (30) pumping stations. The system includes a diversity of laterals: from the 150 year old vitreous clay pipes in the older mill villages to polyvinyl chloride pipe in the more recent sewer construction projects. The majority of the sewer system is less than 25 years old.

Sewer inspections and preventative maintenance measures are conducted on a daily basis by Sewer Division staff. Preventative maintenance measures consist of sewer main jetting using high-pressure water. Root and debris cutting is conducted using a rooting tool. This is effective in cleaning and removing grease, sand, gravel, grit and debris buildup.

In general, preventative maintenance is an on-going task. The maintenance work proceeds at a rate such that the entire Town sewer system is inspected about every ten (10) years.

Sewer Division staff use log books and report forms to track and document the collection system maintenance work and to determine future work requirements. A sewer department report is made each month. The report notes the specific section of sewer and pumping stations that are inspected, cleaned and repaired each month.

Appendix A contains the report forms utilized for sewer and pumping stations maintenance and repairs.

Through routine maintenance and inspections, a history of priority areas has been developed. The Sewer Division maintains a list of these sections of line and pumping stations that are inspected and tracked on a monthly or more frequent basis. The priority areas are where past blockages or failures have occurred. Upon inspection, if a buildup or blockage is found, it is cleared immediately. The Town intends to pursue Community Development Block Grant funding to perform engineering studies and sanitary sewer rehabilitation projects in the eligible areas of the Town that experience chronic priority sanitary sewer problems.

Appendix B contains the Standard Operating Procedure for sanitary sewer system priority location inspections and the Priority Area List.

During the routine inspection process, sewer manholes are inspected for defects and repairs are made as needed. Certain manholes and pumping stations that are susceptible to blockages or failure are identified in the Priority Area List.

The Sewer Division makes sewer repairs as required. The Town is able to make routine repairs to eliminate blockages within the sewer main and in the sewer at the property line from house laterals to the main. If the work is beyond the scope of the Town's ability to repair, utility contractors are utilized. If the blockage is found to be within sewers belonging to the Narragansett Bay Commission, the Commission is notified.

Television inspection of sewer is conducted to identify problems and to provide information. When blockages are suspected, a TV camera is employed to ascertain the exact location and the nature of the blockage. Once located, the blockage is removed. The Town owns and operates the television inspection equipment that is a small video unit with a push cable camera.

Appendix C contains the Standard Operating Procedure for Television Inspection of Sanitary Sewer Lines. The forms used to record and report the results of TV inspections are found in Appendix A.

A general trouble-shooting guide for the collection system is provided in Appendix D.

II. Documentation of Sewer Backups

The Sewer Division documents sewer backup and pumping station problems using field logs, onsite logs and the report forms in Appendix A. The Standard Operating Procedure for responding to sewer blockages is found in Appendix E.

For incidents that require notifying Rhode Island Department of Environmental Management (RIDEM), the RIDEM form in Appendix A is used. The Town is required to immediately notify the RIDEM in the event of any by pass or failure in the sewer system, either collection system or pumping stations, that may result in non-compliance with the RI Pollutant Discharge Elimination System regulations. Events that require notification are releases to the environment. The RIDEM must be notified by telephone as soon as possible, but within twenty-four (24) hours. The RIDEM Operations and Maintenance Section must be contacted at 222-4700. Should the incident occur during non-business hours, contact RIDEM Enforcement at 222-3070. The Town must identify the system, explain what happened, and inform the Enforcement personnel that this should be reported to the Office of Water Resources personnel.

Also, a written report must be provided to RIDEM within five (5) days of the time that the Town becomes aware of the incident. The filled out RIDEM form in Appendix A will be used for the written report.

III. Pumping Station Maintenance

The Town operates and maintains thirty (30) pumping stations as a part of its collection system. The age of these pumping stations varies. The majority of the stations contain duplex submersible grinder type pumps manufactured by the ABS Company. There is one station with a screw type pump and five stations with centrifugal pumps. Specific information regarding the pumping stations is contained in the List of Pumping Stations and Design Loads and Survey of Pumping Station Information, both in Appendix F.

The Standard Operating Procedure for Pumping Station Maintenance is found in Appendix F. The Standard Operating Procedure for Testing Pumping Station Alarm is found in Appendix G.

IV. Safety and Emergency Conditions

Safety Considerations

a. Responsibility for Safety

It is the obligation of the administrators of the Public Works Department to provide safe working conditions. Many of the factors contributing to the occurrences of injury or its prevention are largely in the hands of management, since they provide the work environment, maintain the work facilities, and hire workers. It must be stressed that all employees have a joint responsibility to work safely.

b. Response to Emergencies

It is imperative that carefully prepared plans be made regarding actions to be taken in case of emergencies. These plans include the continued operation of the facility and any necessary equipment bypassing, and a listing of contact people and telephone numbers of various emergency agencies (fire, police, ambulance, etc.) Specific rules should be posted explaining the required actions to be taken and ensure that all employees are aware of these procedures. A list of contacts is given in Appendix H.

c. Training of Personnel

Since the mental aptitude and physical health requirements are different for each classification of work, it is necessary that employees be assigned and trained for tasks that are commensurate with their particular capabilities. The more hazardous duties should be performed at the beginning of each work shift when the workers are more alert and less prone to accidents that can occur due to carelessness or tiredness. The basic skills required to maintain and operate the equipment was relayed to selected

Town personnel during the initial start-up and testing of the facility at the time of construction. Should training of additional employees become necessary, arrangements can be made with the manufacturer or the local representative for such instruction.

d. Visitors

When visiting servicemen are called to the facility, they should be asked whether their work would, in itself, create a hazard or effect the operation of the station. The operator, if required, should offer assistance, so that the work may proceed smoothly and safely.

When non-technical visitors are expected at the facility, the supervisor must require that:

- There is adequate supervision of the group or party
- The normal operating routine is not interrupted

e. Protection Against Mechanical and Physical Hazards

Care must be taken when repairing or performing maintenance on automatic or remote-controlled equipment to ensure that power is shut off so that equipment cannot be started or energized. Local or remote switches should be labeled with a red tag indicating that the switch is to remain in the off position.

Insofar as practicable, lubricating or equipment adjustments should not be made on machinery in operation. If such work is required, then a second workman should be stationed at the closest shut-off switch.

Ladder safety belts, if provided, must be kept in working order and stored in a location of easy access.

Personnel working in areas where tools or other heavy items may be dropped should wear hard hats.

All personnel should become familiar with correct lifting techniques.

f. Prevention of Infections

Workers who come in contact with wastewater could be exposed to waterborne diseases such as typhoid, amoebic dysentery, infectious hepatitis and others. Protective clothing and barrier creams are available for purchase and should be used. An adequate inoculation program to protect employees should be developed by the supervising staff.

g. Protection Against Electrical Hazards

In working around electrical equipment, the following steps to reduce accidents caused by contact with electricity should be taken:

1. Avoid personnel grounding themselves in water or on pipes when working around electricity
2. Only authorized and qualified personnel should work on electrical equipment or wiring. Only licensed, qualified electricians should perform major electrical repairs and maintenance.

3. Consider all electrical circuits to be dangerous.

h. Entering Confined Areas

A good rule to observe is to NEVER go alone into a hazardous location. Someone should be present who can watch the worker's condition and who is equipped to give all necessary assistance in case of emergency.

Personnel should be familiar with the use of oxygen deficiency detectors, a combustible gas detector, and safety belts. The air in the confined space should be tested at frequent intervals.

Prior to entering the wet well, the cover should be opened and the space allowed venting for a minimum of 20 minutes. The air should be tested with the equipment listed above prior to entering the well.

i. First Aid

The recommended minimum requirements for pumping stations is that a person qualified in first aid be available at all times. The American Red Cross offers first-aid courses throughout the region, and such instruction should be used. The most common accidents requiring first-aid procedures are as follows:

- Electrical Shock - Shut off the current or cautiously remove contact from the victim using an insulated or non-conductive item. Follow first-aid procedures obtained from the instructional courses.

- Moving the Injured - Do not move an injured person before a physician or experienced paramedic arrives, unless there is real danger of further injury at the accident site. Follow first-aid procedures obtained from the instructional courses.

Remember—a standard telephone set is installed at each pump station site to be used in case of such emergencies.

General Emergency Conditions

During the normal operation of the pumping station facilities, emergency situations—either natural or mechanical—are likely to occur which will disrupt the daily routine of operation. The purpose of this section is to outline the basic emergencies that may occur and to provide the operator with a planned response with appropriate corrective steps to be used in restoring the pumping station operation to normal.

In general, the following is a recommended pattern of response that the operator should follow regardless of the type of emergency:

- Early Warning Report - The purpose of this report is to advise supervisory personnel of impending danger or of an emergency situation.

- Investigation - Steps should be taken to investigate and evaluate the problem. A determination should be made if a danger to the safety of personnel exists or is imminent.

- Response Course of Action - The proper course of action should be decided upon and implemented.

- Notify the Proper Authorities - Depending upon the scale of the problem, the operator should advise the appropriate local authorities of the situation.

Specific emergency measures are given in Appendix H.

APPENDIX A

Standard Operation Procedure for Sanitary Sewer Maintenance

TOWN OF LINCOLN

SEWER DIVISION

Standard Operating Procedure for Sanitary Sewer Maintenance

Maintenance Task: Jetting

Description of Task: Utilizing the truck-mounted high velocity jet/vac. clean and remove any buildup of grease, sand, gravel, and debris. Break-up solids found within manholes. Wash and clean manhole structure.

Equipment: (1) FMC sewer jet flush truck

Schedule and Frequency: Daily, as needed

Special Considerations: Follow proper traffic routing and confined space entry procedures.

Reporting: Report work completed on Monthly Maintenance Report.

Monthly Maintenance Report

Monthly Maintenance Report for the Month of: _____

The following sewer system maintenance was completed:

Sewer pipe jetted_____ sections (approximately _____ L. F.)

Locations:

Sanitary manholes cleaned:

Locations:

APPENDIX B

Standard Operating Procedure for Sanitary Sewer Priority Location Inspections

Priority Area List

The following are the areas that are susceptible to blockage and/or failure. (Dated 11/03)

Area number	Location/ type of structure	Condition/ problem
1.	AP 6 Lots 196, 197 line from Seventh Day Adventists' Church/ old clay pipe line in back yards	Church connection blocks up, line has blockage
2.	AP 7 Lots 70- 76, south of Ballou Ave./ old clay pipe line in back yards	Line blocks up occasionally
3.	AP 4 Lot 70 and AP 5 Lots 17, 19, 20 21 in Lonsdale, in back of houses/ old clay pipe	Flat line, SMH in poor condition, occasional blockage
4.	School Street in Albion from Kennedy Blvd. To NBC interceptor/ old clay pipe	Line in poor condition, suspected storm water connections
5.	AP 3 Lot 34 to Industrial Drive/ old clay pipe	Line is flat, in poor condition, occasional blockage
6.	AP 37 Lots 90,91,92,113,114,115, Post office parking lot and back of houses along Spring Street/ old clay pipe	Line is in poor condition, occasional blockage
7.	AP 35 Lots 7, 9, 10, in back of lots/ old clay pipe	Line is in poor condition, occasional blockage
8.	Woodland Court/ sewer lines	Suspected infiltration, storm water connections

TOWN OF LINCOLN

Standard Operating Procedure for Sanitary Sewer System Priority Location Inspections

Maintenance Task: Inspection of and cleaning (as needed) of known priority sanitary sewer locations.

Description of Task: At the locations noted on the priority area list, the inspection crew will open the manhole covers to check the flow in the channel. Observe flow status and condition of manhole. Remove and clean blockages as needed. Record findings on the report form.

Schedule and Frequency: Bi-weekly

Special Considerations: Follow proper traffic routing and confined space entry procedures.

Reporting: Report work completed on Sewer Inspection of Priority Area Inspection Forms.

SEWER DIVISION

Priority Area Inspection Form

Date:

Time:

Location:

Personnel responding:

Observations:

Actions taken:

APPENDIX C

Standard Operating Procedure for Television Inspection of Sanitary Sewer Lines

TOWN OF LINCOLN

Standard Operating Procedure for Television Inspections of Sanitary Sewer Lines

Maintenance Task: Television inspection of sanitary sewer lines.

Description of Task: Television inspection may be used for inspection work to examine work completed by a contractor, examine the location of installed taps, and locate illegal taps. Television inspection is also used for maintenance purposes to examine the condition of sewer lines, locate problem areas such as pipe of joint rupture, condition of service connections, obstructions in the line, corrosion, pipe alignment, infiltration through joints and inflow from illegal connections.

Equipment:: Portable T. V. inspection camera

Schedule and Frequency: As needed

Special Considerations: Follow proper traffic routing and confined space entry procedures.

Reporting: Report work completed and service Monthly Maintenance Report found in Appendix A.

APPENDIX D

Troubleshooting Guide for Sewer System

TABLE 12-10 SEWER SYSTEM TROUBLESHOOTING GUIDE

Identification of Problem	Source or Cause	Solution Method	Comments
1. Stoppages—Emergency	1a. Grease	High-velocity cleaner	A high-velocity cleaner will open most grease stoppage
a. Manhole overflowing		Hand rods, power rudder	Rod from downstream manhole with a 4-inch auger into stoppage. When clear, then run 6-inch or larger auger through restricted area. Initiate work order to clean with high-velocity cleaner or ball line as soon as possible. Hand rods and power rodders will usually unplug most grease stoppage.
b. Flooding of residences or businesses	1b. Roots	High-Velocity Cleaner	High-velocity cleaner will usually open stoppage and restore service. Schedule TV inspection and chemical treatment. If unable to clean roots with high-velocity cleaner, power rodder may be necessary.
		Hand Rods	Rod from downstream manhole with 4-inch auger or saw. Be cautious in opening stoppages if there is a high head on the upstream manhole. Remove as much of the root mass as possible. Request TV inspection for root concentration; schedule power rodding to open line and chemically treat to control future root growth. Hand rods are effective 90 percent of the time.
		Power Rodder	If cannot clear roots with hand rods, power rodder may be necessary.
	1c. Debris stoppage such as		Power rod line to clear stoppage. Schedule TV check cleaning, and chemical treatment.

	rocks, lumber	High-velocity cleaner Power Rodder	Caused by broken lines, open manholes, vandalism. Clean line with high-velocity cleaner. Use caution. May jam tool in line requiring a dig up to clean line and remove broken rod and tool
2. Grease a. Stoppage causes grease buildup b. TV report on routine inspection c. Observe buildup on side walls of sewer d. Past records	a. Restaurant on blocked segment of sewer b. Low velocity allowing grease buildup from home deposal unit. Problems often develop where high velocities are suddenly slowed down.	a. High-Velocity Cleaner b. Balling (or tire) c. Scooter (or kite) d. Power Rodder e. Chem-icals e. Bac-teria Cultures f. Bacteria Cultures a. Clean	High-velocity cleaner is an effective tool in removing grease buildups in line sizes up to 15 inches. High-velocity cleaner becomes ineffective in larger diameter pipes. Balling will remove grease deposits from pie walls, but will not clean as effectively as properly used high-velocity cleaner. More effective than high-velocity cleaner in lines above 18-inch diameter. Extensively used, but not as effective in grease removal as high-velocity cleaner and balling; usually ineffective lines above 10-inch diameter. Be sure to insist on a performance contract. Do not pay until the chemical or material performs as claimed. Specific cultures are required for collection system maintenance. Specific cultures are required for collection system maintenance. A regular maintenance program must be

e. Grease trap		trap regul-arly b. Bacteria Cultures	established and continued. Specific cultures are required for collection system maintenance.
3. Roots a. TV report b. Poor joints or damaged pipe allow root entry c. Past Records	a. Trees and Shrubs d. Repairs	b. Chem-icals c. Power Rodder d. High-Velocity Cleaner	For long-term control, chemical treatment provides the best solution with up to three years between applications. Personnel applying root control chemicals may need to be certified and must take all recommended safety precautions when using chemicals. Best suited for opening pipe with root obstruction. If rodding is the only method used, special tools are required to cut roots to the pipe walls and periodic cleaning will be required. Special root cutters are available. If TV report shows only one section of broken line or a few bad joints, dig up and repair. If a great number of defects are observed, consider pressure sealing or relining the pipe by insertion of a liner.
4. Sand, Grit, Debris a. TV report b. Grit settles during low flows c. Grit sticks to grease or slimes	a. Eggshells, coffee grounds, bones from residential disposal units b. Broken china, bones, and glass from	a. High-Velocity Cleaner b. Balling (or tire) c. Scooters and Kites	For light concentrations of grit in small lines; not effective cleaner in lines above 15-inch diameter. The workhorse for cleaning. Large volumes can be removed at a reasonable cost. Requires careful control in shallow lines. More effective in larger lines. Removes some dangers of flooding in shallow lines that balling may create if not

d. Routine inspection e. Past records	restaurant disposal units c. Sand, silt from poor joints and broken lines d. Lines with low flows or velocities permitting deposition of solids	d. Bucket Mach-ines	roperly controlled. Used where extreme concentrations of grit and sand have loaded the line to extent that above methods are ineffective due to cost and handling of material to be removed.
5. H2S and Odor Control a. Odor complaints b. Manhole inspection reveals line deter-ioration	a. Force mains b. Low flows & velocity c. Offset joints d. Bellies in line e. Drop man-holes f. Manhole where trucks dump septic tank contents	a. High-Velocity Cleaner b. Bailing b. Scooter c. Flushing d. Plug lifting and vent holes in manhole cover	Fast cleaning of slimes in lines up to 15-inches diameter. Best for sewers with bellies and offset joints, but expensive operation for odor control only. Fast for larger lines. Small lines. Usually not effective for more than one week. Roofing cement makes a satisfactory hole sealer. Specially made plugs are avilable from vendors.
6. System Inspection	Detects problem areas and permits	a. Closed Circuit TV	Permits through inspection of system. Pinpoints damaged areas such as broken pipe segments, offset joints,

	realistic scheduling of preventive maintenance program		lines not to grade, collapsed pipes, protruding service taps, root intrusion, deterioration of lines, and grease deposits. Informs you of required cleaning and the effectiveness of the cleaning method. If a stoppage reoccurs or you are curious regarding cause of problem, TV the line. The most useful tool in collection system maintenance.
		b. Air and water testing	Detection of sources of infiltration and exfiltration.
		c.Smoke Testing	Locates leaks when groundwater table is below sewer. Also used to determine if buildings and residences are properly connected to collection system and to identify illegal connections.
		d.Dye testing	Identification of illegal connections and location of overflowing or leaking manholes and sewers.
		e, Pipeline Lamping	Inspection of sewers for condition, including alignment and obstructions
		f. Visual	Lift manhole covers and observe conditions.

APPENDIX E

Standard Operating Procedure for Response to Sewer Blockages

Standard Operating Procedure Response to Sewer Blockages

1. Upon notification of problem, obtain name, address, and phone number of the person reporting the problem.

2. Immediately contact the complainant for detailed information regarding the problem. If a plumber or rooter contractor is at the property, try to speak directly to him about the problem. If a response is necessary, inform the complainant of your expected time of arrival.

3. Upon arrival, inspect the Town sewer main. Inspect manholes upstream and downstream from the property to insure the Town main is flowing properly.

4. If the Town main is blocked, call in a crew to clean the main. Go to Step No. 10.

5. If blockage is in the property service lateral to street, you must try to identify the cause and the location of the blockage as this will determine the party responsible for correcting the problem in accordance with the Town ordinance.

Assess the property and adjoining properties for the possible impact of town and/or private trees on the lateral. The Town sidewalk easement is, as a rule, 8' wide for a 24' wide street and 10' wide for a 30' wide street. Check also for any depressions in the roadway that could be the result of a cracked or broken pipe.

6. If the owner has not yet contacted a sewer rooter company, advise him to do so. Inform the owner that if the problem is found to be the responsibility of the Town, a claim can be filed for reimbursement of cleaning costs.

7. Provide owner with your telephone and beeper numbers so that you can be apprised of the outcome. If the block is successfully cleared and roots were the cause of the problem, schedule an appointment for the next business day to televise the lateral to determine the location and responsibility of the block.

8. If the rooter contractor cannot clear the blockage and it is possible that Town tree roots or a broken pipe in the Town street causes the blockage, a Town work crew should be called in to install a clean-out. At that time, the lateral can be televised to determine the exact location of the problem. If the problem falls under Town responsibility in the Town right-of-way, the crew

will proceed to correct it. If the problem is the Town's responsibility but lies on private property or is too deep for the Town crew to excavate, notify your supervisor or the Public Works Director.

9. If any damage to the property has occurred due to the backup, the Director of Public Works will contact the Interlocal Risk Management Trust to have a claims administrator review the damage.

10. Complete a Sewer Incident Report. Provide as much detail as needed to fully record the incident.

SEWER INCIDENT REPORT

TIME NOTIFIED: _____

BY WHOM: _____

PERSONNEL RESPONDED: _____ _____

_____ _____

_____

LOCATION OF TROUBLE: _____

_____

_____

ACTION TAKEN:

Summary of situation:

Actions taken:

Town of Lincoln Pump Station/Collection System Bypass Report

1. Location of bypass: _____

2. Who notified municipality? _____

3. Time and date of above notification: _____

4. Date/time bypass started: _____ bypass ended: _____

5. Cause of failure: _____

6. Amount bypassed: _____

8. Was bypass treated with emergency chlorination? _____ Time chlorination started: _____ Amount of chlorine used: _____

9. What waterbody did the bypass discharge to? _____

10. Detail chronology of events leading to failure/bypass:

_____

_____

_____

11. Detail chronology of response indicating all steps taken to minimize the amount bypassed:

_____

_____

12. If applicable, were septage haulers and/or emergency generators used to minimize the amount bypassed? (If use was possible but not implemented, why not?)

_____

_____

_____

13. What actions are being taken to mitigate and/or prevent further occurrences?

_____

_____

14. Notification of RIDEM (during business hours #; 222-4700; 24-hour emergency #: 222-3070)

Person notified _____ Date/Time: _____

By _____

APPENDIX F

Standard Operation Procedure for Pumping Station Controls and Maintenance

Standard Operating Procedure for Pump Station Maintenance

Maintenance Task: Preventative maintenance of pump stations

Description of Tasks: All pump stations and equipment must be inspected on a weekly basis at a minimum. Pump station inspection and maintenance consists of the following tasks:

- Check of wet well and record levels where available
- Bleed compressors
- Check operation of bubble system
- Check dehumidifier, heaters, fans, lighting
- Check operation of sump pumps
- Check generator fluid levels and batteries
- Check and test pumps
  - -record: lapse time, cycles, pump hours
  - -check motors, couplings, drive shafts
  - -watch operation of check valves
  - -check seal water operation
- Check comminuters
- Check recirculators
- Change chart paper
- Record all necessary information on the Pump Station Condition Report form

Crew Size: Two

Schedule and Frequency: Weekly

PUMP STATION OPERATION AND CONTROLS

OPERATION

A. Sewage Pumps

The majority of sewage pumps are the submersible grinder pumps manufactured by the ABS Company. The major pump components and their maintenance are given below:

1. Lifting rail: Each station is equipped with a lifting rail system for each pump unit to aid in the removal of the pump for either routine or emergency maintenance. Due to the weight of the pumps--approximately 150 pounds--it is recommended that a hoist be used to lift the units. The guide rail facilitates easy lift out as well as to center the pump unit on the base during pump installation. Scum buildup around the bottom of the rail pipe, which generally occurs at normal water levels, should not interfere with proper operation.

2. Base: Each pump is secured to the bottom of the well by a cast iron base, which is bolted to the floor of the concrete manhole. The base is likewise attached to the lifting rail system mentioned above and the discharge piping which connects to the force main.

3. Check Valve: Each pump is equipped with a check valve to prevent the back flow of sewage through the pump and into the well. The valve is attached to the pump unit near the base and is removed with the pump.

4. Grinder/Cutter: The grinder assembly of the pumping unit is composed of a plate and cutter that grinds the waste much like a household kitchen garbage disposal. These parts do wear and need occasional adjustment and routine replacement.

5. Motor: The pump motors are the submersible type 240-volt single phase for the 3 horsepower and the 5 horsepower unit. Each motor is equipped with a seal failure probe that will activate an alarm if the electrical connection chamber is contaminated with water.

B. Pump Controller System

The pump controller system is manufactured by E. G. Pump Controls. The major components and their function are:

1. Air Pump: Each controller cabinet is equipped with two diaphragm type air compressors that supply the control air through the bubbler tube. The backpressure on the air as it exits the tube causes the mercury level gauge to

react. With an increase in backpressure, the mercury level increases, thereby indicating a higher water level in the well. The reverse is likewise true. The compressors are connected to an alternator switch that changes the start mode causing a different unit to start on successive cycles. Each compressor supplies approximately 4 pounds per square inch of air.

2. Air Flow Gauge: The airflow gauge regulates the amount of free air entering the bubbler tube. Adjustments are made by rotation of the needle valve located immediately below the gauge. Generally, the normal setting of the gauge is 5 CFPH.

3. Mercury Level Gauge: The mercury level gauge indicates the water level in the well in both feet and in inches. Graduations are in 3-inch intervals. As the mercury level rises, an electrical contact is made with the screw heads that are visible through the sight glass. Pump control and alarm conditions are activated by such contacts. Adjustments in the settings can be made by connecting the respective wire to the desired screw shaft accessible in the back of the gauge unit. Note: a factory supplied socket tool is attached to the back of the gauge for such adjustments.

Wire leads from the controller components to the gauge connections are labeled as follows:

Low-level alarm
Stop lead pump
Stop lag pump
Start lead pump
High-level alarm
Start lag pump

The contractor makes initial settings of the gauge during facility start-up. These settings should be modified or adjusted during the operational life of the station, since loading conditions change over time. However, as a guideline, there should be minimum distances between settings. For example:

Low level alarm:	6 – 12" above the floor
Stop lead pump:	6 – 12" above low level alarm
Stop lag pump:	6 – 12" above stop lead pump
Start lead pump:	1 – 3 ft. above stop lead pump to obtain pump cycle of 3-5 minutes
High level alarm	6 – 12" above start lead pump
Start lag pump	6 – 12" above start lag pump

4. Local Alarm and Status Annunciate: The front panel of the controller panel indicates the following information concerning the status of the facility:

- Odometer for each pump which indicates the elapsed running time in hours and tenths for that unit
- Pump on light (one for each unit)
- Wet well low level alarm light
- Wet well high level alarm light
- Pump motor seal failure light (one for each unit)

5. Heater Unit: An electrical strip heater of approximately 750 to 1000 watts is located near the bottom of the cabinet to help keep a proper environment for the electronic components. A thermostat, located near the unit, controls the temperature setting. Generally, this setting should be between 40 to 45 degrees Fahrenheit.

C. Valves

The stations are equipped with two different types of valves:

1. Check valves, as stated earlier, are factory-supplied equipment attached to the pump units. Their function is to prevent the draining of the force main.

2. A gate valve for each pump unit is located in the discharge piping manifold. The purpose of this valve is to isolate the pump from the force main, thereby preventing the main from emptying whenever the pump unit is removed.

D. Gauges

Pressure gauges are installed in each pump manifold to determine the actual discharge pressure, thereby aiding in the determination of proper pump performance. The gauges are calibrated in pounds per square inch (psi). The operator should occasionally monitor the readings and compare them with the design total head values itemized in the manufacturers specifications.

E. Hatch

An aluminum hatch provides the operator access to the wet well and allows easy removal of the pump units. A padlock prevents unauthorized access to the facility.

F. Ventilation

A gravity system of ventilation is provided in the form of a 4-inch diameter ductile iron pipe. The facility is NOT classified as a working area; and, therefore, a forced system of ventilation is not required. However, if it is necessary for any reason to enter the wet well, certain precautions must be adhered to.

- Open the hatch and allow the facility to vent for at least 30 minutes.
- Always have a worker standby the facility in case of emergency.

G. Electrical Systems

Electrical power to the facilities, as stated earlier, is either 120/ 240 volt single depending on the station horsepower requirements. A distribution panel contains the breakers that isolate the various circuits.

A duplex outlet provides power for small hand tools or portable lights.

The utility meter is located outside of the main cabinet and is monitored by the National Grid Corp.

Each station is equipped with an exterior electrical weatherproof fitting for a portable generator. These generators provide temporary power during periods of utility company power outages. The pump stations are designed so as to provide a holding capacity of 40 minutes of flow at peak periods above the high level alarm setting in order to give the operator sufficient time to react to the loss of power condition.

H. Records

It is essential that the station operator maintain an adequate record keeping system. Well-maintained record keeping will aid the operator in the scheduling of routine preventative maintenance as well as to provide a written history profile of all work performed on each piece of equipment.

MAINTENANCE

The lifeline of any mechanical system is the maintenance program established. Therefore, it is of prime importance that the operator adheres to the following maintenance schedule in order to ensure continued and safe operation of the mechanical equipment provided. In the following table, "A P M S" refers to *As Per Manufacturer's Specifications.*

A. Preventive Maintenance Schedule

Equipment	Action	Period
Sewage Pumps	Inspect	6 months
	Change cutters	A P M S
Generator	Change oil/filters	A P M S
Gauges	Record reading	Monthly

Controller Panel	Inspect	Weekly
Pump start/stops	Review	Monthly
Air Bubbler Line	Manual blowoff	Bi-monthly or as required
Computer Equipment	Professionally clean	Twice yearly

The pump start/stop cycle information is obtained from the report section of the computer system. Frequent cycle operation (4 starts per hour per pump unit) is not recommended. Adjustment of the mercury gauge settings for pump on/off will allow the operator to modify pump cycle operation. Likewise, should the detention time of the sewage in the well be excessive (4 – 6 hours), a septic condition can develop. Again, the solution is to adjust the settings for the mercury gauge.

B. General Housekeeping Schedule

Action	Period
Cut grass	As required
Remove snow	As required
Paint Control Cabinet and vent	As required

C. Supplies and Tools

The following supplies and tools should be kept on hand for routine maintenance:

Lubricating oils
Rags and cleaning solutions
Spare parts required for the facilities
Metric and American Standard socket sets
Assorted small tools like screwdrivers, pliers, etc.
Power drill and assorted drill bits
Rubber gloves
Rubber boots

The following spare parts were supplied under the sewage program construction contract:

Pump cutters - 1 set
3 hp pump units - 2
Telemetry system remote microprocessor - 1

D. Trouble-Shooting Chart

Symptom	Possible Cause	Action/Remedy
High level alarm	Clogged pump	Remove and clean cutter
	Increased flow to station	Inspect system for infiltration
	Loss of control air	Inspect compressor units & air flow gauge
No flow when pumps operate	Clogged pump	Remove and inspect
	Clogged check valve	Remove and inspect
Low level alarm	Mercury gauge malfunction	Inspect contact setting
Noisy pump operation	Cutter assembly	Inspect and repair
Loss of communication	Telephone unit not on hook	Inspect and correct
	Faulty modem	Call for repair
Improper pump operation	Control settings	Inspect for good connection
	Clogged air line	Perform manual blowoff

E. Utilities

The following public utilities are provided at each pump station site:

- Electric: 120/ 240 volt service from the National Grid Co.
- Telephone: Standard dial-up tone lines are installed at each station from the NYNEX Company.

Due to the special requirements needed to accommodate a public water service in a pump station facility, this utility was not provided. Should flushing water be necessary, it is recommended that arrangements be made with the Lincoln Water Commission for connection to the nearest hydrant.

Pump Station Condition Report

Date:

Personnel:

PUMP	CONDITIONS OBSERVED	MAINTENANCE PERFORMED
Angell Road North		
Angell Road South		
Applewood		
Arlington		
Ashley		
Belmont		
Birchwood		
Cider Mill		
Davies		
Eagle Nest		
Edgehill		
Great Road South		
Great Road 116		
Heidi		
Hillside		
Jason		
Kirkbrae		
Lincoln Center		
Lori Ellen		
Lower Road		
Maria		
Middle		
Mount		
Newland		
Oakhill		
Old Pike		
Paddock		
Rollingwood		
Whitney		
Woodridge		

PUMPING STATION DESIGN AND EXISTING FLOWS

PUMP STATION	FEEDS	TOTAL LOTS	CONNECTED LOTS	DESIGN LOAD	CURRENT LOAD
Angell Road North+	Angell Road South	222	111	194	111
Angell Road South+	NBC*	576	220	596	331
Applewood	Maria	22	15	60	15
Arlington	NBC	50	36	60	36
Ashley	Maria	22	15	60	15
Belmont	Angell Road North	11	10	11	11
Birchwood	NBC	18	5	85	5
Cider Mill	Great Rd. South	13	12	60	12
Davies	NBC	80	55	85	55
Eagle Nest	Oakhill	41	21	85	21
Edgehill	NBC	27	17	60	17
Great Road South	NBC	831	405	925	451
Great Road 116	NBC	18	7	60	36
Heidi	Great Rd. South	19	5	85	5
Hillside	NBC	9	8	60	8
Jason	NBC	42	13	85	22
Kirkbrae	NBC	153	97	153	97
Lincoln Center	NBC	60	60	60	60
Lori Ellen	Angell Rd. South	37	19	85	19
Lower Road	NBC	91	44	91	50
Maria	NBC	219	120	258	140
Middle	NBC	23	15	60	15
Mount	NBC	42	24	60	24
Newland	NBC	6	5	60	5
Oakhill	NBC	20	13	85	34
Old Pike	Great Rd. South	25	9	85	9
Paddock	Jason	21	9	85	22
Rollingwood	Angell Rd. North	51	26	85	31
Whitney	Rollingwood	11	5	60	5
Woodridge	NBC	18	13	85	13

Loads dated from 1999? unless otherwise noted.
*NBC= Narragansett Bay Commission sewer system
+ updated 2/03

TOWN OF LINCOLN

Sewer Lift Pump Station Survey

Pump Station Address	Year Built	Emergency Generator KVA	Average Capacity GPM	Motor Size (HP)	Response Time	Description Mfg., Model, Type
Angell Rd. No., Angell Rd.	1991	KW40	290	15 HP (2)	2 hrs.	Yeoman-4312-Centrifugal
Angell Rd. So., Angell Rd.	1991	KW150	1600	60 HP (2)	1 hr.	Yeoman-6312-Centrifugal
Applewoood, Applewood Ln.	1989	no	115	3 HP (2)	6 hrs.	ABS-Piranha-Grinder Pumps
Arlington, Arlington Dr.	1988	no	115	3 HP (2)	6 hrs.	ABS-Piranha-Grinder Pumps
Ashley, Ashley Dr. **(old)**	1989	no	115	3 HP (2)	6 hrs.	ABS-Piranha-Grinder Pumps
Belmont Pump Station, Belmont Dr.	1998	no	115	3 HP (2)	8 hrs.	ABS-Piranha-Grinder Pumps
Birchwood, Birchwood Dr.	1990	no	160	5 HP (2)	6 hrs.	ABS-Piranha-Grinder Pumps
Butterfly, Ea. Butterfly Way **(old)**	1992	no	160	5 HP (2)	6 hrs.	ABS-Piranha-Grinder Pumps
Davies, Old Pike	1993	KW30	160	5 HP (2)	2 hrs.	ABS-Piranha-Grinder Pumps
Eagle Nest, Eagle Nest Dr.	1991	no	160	5 HP (2)	4 hrs.	ABS-Piranha-Grinder Pumps
Edgehill, Edgehill Ave. **(old)**	1987	no	115	3 HP (2)	8 hrs.	ABS-Piranha-Grinder Pumps
Great Road (116), Great Rd. **(old)**	1989	no	115	3 HP (2)	8 hrs.	ABS-Piranha-Grinder Pumps
Great Road South, Great Rd.	1990	KW150	1600	60 HP (3)	1 hr.	Yeomans-6312-Centrifugal
Cider Mill, Cider Mill Ln. **(old)**	1990	no	115	3 HP (2)	8 hrs.	ABS-Piranha-Grinder Pumps
Heidi, Heidi Road **(old)**	1992	no	160	5 HP (2)	6 hrs.	ABS-Piranha-Grinder Pumps
Hillside, Hillside Ave. **(old)**	1987	no	115	3 HP (2)	8 hrs.	ABS-Piranha-Grinder Pumps
Jason, Jason Drive	1989	no	160	5 HP (2)	4 hrs.	ABS-Piranha-Grinder Pumps
Kirkbrae, Timberland Drive	1988	KW40	470	20 HP (2)	2 hrs.	Yeoman-4315-Centrifugal
Lincoln Center, Lincoln Center Blvd.	1992	no	115	3 HP (2)	6 hrs.	ABS-Piranha-Grinder Pumps
Lori Ellen, Lori Ellen Dr.	1991	no	160	5 HP (2)	6 hrs.	ABS-Piranha-Grinder Pumps
Lower River, Lower River Rd.	1989	no	300	1 I/2 HP (2)	1/2 hr.	Schreiber-Screw Pump
				(Baldor Motor)		
Maria, Maria St.	1989	KW60	570	40 HP (2)	2 hrs.	Yeoman-4312-Centrifugal
Middle St., Middle Street	1987	no	115	3 HP (2)	8 hrs.	ABS-Piranha-Grinder Pumps
Mount Ave., Mount Avenue	1989	no	115	3 HP (2)	6 hrs.	ABS-Piranha-Grinder Pumps
Newland, Newland Ave. **(old)**	1987	no	115	3 HP (2)	8 hrs.	ABS-Piranha-Grinder Pumps

Pump Station Address	Year Built	Emergency Generator KVA	Average Capacity GPM	Motor Size (HP)	Response Time	Description Mfg., Model, Type
Oak Hill, Albion Road	1991	no	160	5 HP (2)	4 hrs.	ABS-Piranha-Grinder Pumps
Old Pike, Old Pike **(old)**	1992	no	160	5 HP (2)	6 hrs.	ABS-Piranha-Grinder Pumps
Paddock, Paddock Drive	1989	no	160	5 HP (2)	6 hrs.	ABS-Piranha-Grinder Pumps
Rollingwood, Wingate Road	1991	no	160	5 HP (2)	4 hrs.	ABS-Piranha-Grinder Pumps
Whitney, Whitney Dr. **(old)**	1995	no	115	3 HP (2)	8 hrs.	ABS-Piranha-Grinder Pumps
Woodridge, Barbette Drive	1991	no	160	5 HP (2)	8 hrs.	ABS-Piranha-Grinder Pumps

APPENDIX G

Standard Operating Procedure for Testing Pump Station Alarms

TOWN OF LINCOLN

Standard Operating Procedure for Testing Pump Station Alarms

Maintenance Task: Testing of all pump station alarms

Description of Task: Each pumping station is equipped with alarms. The pump station alarm signals are relayed to the Town's staff. One Sewer Division worker is on call via the Nextel at all times. The alarm testing consists of the following tasks:

Test pump room alarm (tip float)
Test wet well alarm (tip float)
Test air compressor (bleed and empty)
Check alarm panel at station
Inform supervisor on any alarm problems

Crew Size: One

Schedule and Frequency: Monthly

APPENDIX H

Standard Operating Procedure for:

- **Emergency Generator Maintenance**
- **Emergency Response Plans**
- **Emergency Numbers**

TOWN OF LINCOLN

Standard Operating Procedures for Generator Maintenance

Maintenance Task: Preventative maintenance of pump station emergency generators.

Description of Task:: All pump station emergency generators are inspected and tested. Emergency generator testing consists of the following tasks:

a) Before start-up, the following is checked:
belts
cooling system
block heater
air cleaner
engine crankcase (oil level)
governor (oil level)
fuel system
batteries
gauges
battery charger.

b) During test, on the generator data sheet, the following information is recorded:
start and stop time
oil pressure reading
temperature reading
other remarks.

b) After shut-down:
check fuel level
report any malfunctions to supervisor

Schedule and Frequency: Without load - Monthly
Tested Weekly

EMERGENCY OPERATING CONDITIONS AND RESPONSE PLANS

A. Natural Disasters

Flooding: None of the stations are within a flood hazard area. Therefore, emergencies resulting from storm water flooding should not occur.

Hurricanes: In this area, hurricanes are most likely to occur during the months of August, September and October. The term ***"Hurricane Watch"*** indicates that a hurricane may threaten the area within 24 hours. A ***"Hurricane Warning"*** indicates that a hurricane is expected to strike an area within 24 hours. All appropriate action including the testing of all emergency power plans should be taken.

B. Miscellaneous Emergency Situations

Fire: In case of fire, the operator must call the fire department and alert all supervisory personnel. Portable-type fire extinguishers (type ABC) should be carried in all department vehicles for such emergencies.

Power Failure: A loss of power by the utility company will be signaled to the base computer unit at Town Hall. The operator must respond to the emergency by delivering, connecting and starting the portable generator unit within the 40-minutes response time.

Equipment Breakdown: Vital equipment components, such as sewage pumps and air compressors, are designed with standby units to ensure continued operation in the event of equipment failure.

Labor Strikes: It is essential that the stations be maintained during periods of labor strikes in order to prevent a serious public health hazard. A shut-down of the station will cause backups in the collection piping system.

Explosions: Fires and explosions are closely related. Explosions are most likely to occur in enclosed areas such

as wet wells where explosive gases are apt to form. The most common explosive gas likely to be encountered is methane. When methane is present and when it constitutes between 5% -- 15% of the contained atmosphere, an explosive condition can exist. In the event of an explosion, the operator must administer first aid if required; call the fire department; alert supervisory personnel; and assess damage to the operational status of the facility.

Contamination of Potable Water: Since none of the facilities have a potable water service supply, a cross-connection to that system thereby causing contamination is not a possibility.

Spills of Hazardous Materials into Sewers: Any number of hazardous materials could be discharged into the sewage system. Industrial wastes may contain toxic materials or oils and other types of potentially hazardous materials. The responsibility of the operator is to prevent the formation of an explosive mixture. He should inspect the facilities immediately if a spill is suspected and check the operation of all ventilation equipment. Supervisory personnel should then be notified of the situation.

Failure of the Emergency Warning System: Problems with the electrical circuitry can result in no alarm sounding when in fact an emergency situation exists. Special care and periodic testing should be taken to assure the proper operation of circuitry and alarms. As an added precaution, a list of names and addresses of people qualified to work on the equipment should be posted so that they may easily be contacted for emergency repairs.

Other types of Emergency Situations: Although every effort has been made to note those major emergency situations that may occur at the various facilities, there are probably a number of other situations that may develop that could be considered an emergency. The operator must use good common sense in handling these situations.

The operator's first concern during any emergency should be to safeguard against injury to personnel. He should bring to the attention of the supervisor all situations that could result in a hazard.

RE: Work Schedule

The following work schedule is to be followed on a regular basis unless directed otherwise.

MONDAY:	Check and maintain all stations
TUESDAY:	Bar Racks - check stations
WEDNESDAY:	Check all generators and make sure they start. Every first Wednesday of the month, make sure all generators work under a load.
THURSDAY:	Check and maintain all stations
FRIDAY:	Bar Racks - check stations

While following this schedule, there will be times when things will alter this schedule somewhat. When you have to do inspections, clear a sewer blockage or any other emergency that may occur, you are to take care of the job at hand and then return to the regular work schedule.

When checking stations, one truck is to start at Birchwood Drive and the other at the North Providence end of Town. Both crews should then check station by station working toward the center of Town. This should help to respond much faster to any emergency that may occur.

PUBLIC WORKS

	HOME	NEXTEL
John MacQueen	333-0207	255-2716
Mike Gagnon	437-9807	255-2718

SEWER DEPARTMENT

Sewer Nextel	**255-2714(Call First)**	
Don D'Anjou	762-3008	255-2714
Eric Fox	475-1473	
Joe Amaral	725-5297	
Doug Fletcher	487-1057	
Sewer Beeper:	**938-9575**	

Autodialer alarm pin number: 1111

Emergency Numbers

SEWER DEPARTMENT

Don D'Anjou	**255-2714 (N)**	762-3008 (H)
Sewer Dept. Pager	**938-9575 (Pager)**	
Joe Amaral	725-5297 (H)	763-2426 (Pager)
Eric Fox	475-1473 (H)	255-1824 (cell)
Doug Fletcher	487-1057	

HIGHWAY

Mike Gagnon	**255-2718 (N)**	**938-1717 (Pager)**	**437-9807 (H)**
Bill Beauchemin	**255-3332 (N)**	**334-3739 (H)**	

POLICE **333-1111** **911 Emergency**

SEWER: (800) 370-5233 "Clean Care of N. E."
(After regular business hours)

NARRAGANSETT ELEC. **(800) 264-9096**

PLUMBER: **(508) 883-6010 (Giguere & Marchand—"Louise")**

RIDEM: 222-4700 Operations & Maintenance Section, business hours
222-3070 Enforcement (weekends & 4:30PM- 8:00AM weekdays)

SEWER DEPARTMENT

CONTROL CABINET:

Fred Wise (work)
(508) 520-7835
(508) 327-6581 (pager)

Fred Wise (Home)
(508) 359-4689
(508) 561-7879 (cell)

E. G. Pump Controls
(904) 292-0110

Techniflow
(508)359-2341

GRINDER PUMPS:

ABS Pumps
(203) 238-2700

ELECTRICAL:

MENARD ELEC. (Roger)
766-9563
1-800-202-1505

EMERGENCY:
Roger Menard
Pager: 763-1201

WELL PUMPING:

Schofield Sanitation
334-3339
Truck: 767-7278

Schofield Sanitation
Answering Service:
333-2228

RON CHUDY: **333-2368**
ERNIE LACOMBE: **463-2707** (Civil Defense Director—Emergency Preparedness)

Providence Journal
10/17/06

PUBLIC SCHOOLS

1624 Lonsdale Avenue, Lincoln,, RI
LINCOLN SCHOOL DEPARTMENT
WILL CONDUCT
CHILD OUTREACH Vision, Hearing
and Developmental Screening for Lincoln
Children ages 3-5

SCREENING DATES WILL BE
October 23, 26, 27 and 30th
Site: St. Jude's Hall
Meeting Center

PARENTS MUST CALL:
721-3300 ex. 212
WEEK OF OCTOBER 16TH
BETWEEN 9:00-2:00
FOR AN APPOINTMENT

TOWN OF LINCOLN

Public Notice
Town of Lincoln
WASTEWATER FACILITY PLAN

Notice is hereby given pursuant to the requirements of the RI Rules and Regulations for the State Revolving Fund Program that a public hearing will be held on October 31st, 2006 at 3:00 PM in the Council Chambers of the Town Hall, 100 Old River Road, Lincoln to present the proposed Town of Lincoln Waste Water Facility Plan. The purpose of the public hearing is to consider adopting the Waste Water Facility Plan. Development of the Plan has been funded by RI State Revolving Loan Fund Program. The public hearing is required to maintain eligibility for funding of projects recommended in the Plan through the State Revolving Fund Program.

Town Hall is accessible to the handicapped. Individuals requesting interpreter services for the hearing impaired must notify the Town Clerk's Office at 401-333-8450, 72 hours in advance of the hearing date.

Karen Allen
Town Clerk

and taken to the police station where he was charged.

He was held at the Adult Correctional Institutions until his appearance in court on Monday.

The police yesterday would not confirm the amount taken, but said in reports over the weekend that less than $100 in cash had been recovered from Torres.

pmarcelo@projo.com / (401) 277-7493

Candidates forum set for Foster school board

FOSTER — Residents are invited to a School Committee candidates forum at the Town House on Sunday at 6 p.m.

The nonpartisan election for the three-seat committee has three official candidates and one write-in candidate.

The forum is an opportunity for voters to assess the candidates' philosophy, beliefs, goals, and approach to the local and regional educational system, according to Bob Hollis, the event coordinator.

The evening will include opening statements, questions posed by candidates to each other, closing statements, and a meet-and-greet session for residents.

All the school board candidates have said they will participate.

The Town House is on Howard Hill Road in front of Town Hall.

Mumford, Marcello to debate in Dist. 41

SCITUATE — The North Scituate and Hope libraries will sponsor a debate Oct. 30 between Carol Mumford, the Republican incumbent in House District 41, and her Democratic challenger, Councilman Michael Marcello.

Lucille Benoit of the Valley Breeze & Observer will moderate the debate at 7:30 p.m. at the Hope Library, 374 North Rd. — Route 116 — in the village of Hope.

Waste Water Facility Plan Public Hearing
October 31, 2006
3:00 PM

Attendees sign-in list

NAME	ADDRESS
Kim Wiegand	Town Hall
LAURIE CULLEN	10 HILL FARM LN
John MacLaren	Town Hall
Phyllis D'Ciello	Town Hall

The Town of Lincoln conducted a hearing for public consideration of the proposed Wastewater Facilities Plan on October 31, 2006. Minutes of this hearing were documented via an audiotape recording of the proceedings. A cassette copy of the recorded minutes is forwarded to RIDEM with the Final Wastewater Facilities Plan for record purposes. Written copies of the presentation notes prepared for the Public Hearing are included herein.

October 31, 2006 Public Meeting
Town of Lincoln Wastewater Facility Plan Presentation
Kim Wiegand, P.E. Town Engineer

History
The Town of Lincoln has an extensive sanitary sewer system. Sewers were first constructed in the 1860s for the mills and mill villages. New sewers have continued to be added on so that 95% of the Town is now sewered. A 1971 study documented problems with the Town's wastewater disposal systems due to direct discharges to the Blackstone and other rivers, and numerous areas of failed and inadequate septic systems. Based on the findings in this report, major sewer construction in five phases was proposed in a 1984 design study report. These sewers were designed and installed. New subdivisions continue to be connected to the sanitary sewers.

Objective
The plan identified critical issues with the Town's sanitary sewer collection system. The plan investigated, identified and evaluated in detail the existing conditions in the Town of Lincoln related to wastewater disposal and water pollution control.

Regulatory issues
The Town of Lincoln is required by the Federal Water Pollution Control Act to develop and implement a Waste Water Facilities Plan (WWFP). At a minimum, a plan is required to be developed and updated every 20 years or whenever there are significant changes. Accordingly, the Town has developed a plan in compliance with the RIDEM's requirements and the Federal Water Pollution Control Act. Development of this plan is included in the Town's Community Comprehensive Plan. The Town applied for and received funding for this plan through State Revolving Fund loan program.

The Town developed the WWFP in order to properly maintain existing service and provide future availability. The WWFP is a document that serves as an important planning tool for the Town as well as a basis for action to correct existing problems and improve existing sewerage facilities. The WWFP identifies and evaluates the need for projects. The WWFP is intended to be a broad-based planning document, evaluating wastewater related needs of a community well into the future. The WWFP step is intended to carry out the preliminary engineering necessary to define a viable program for abatement of local problems. The goal of these tasks is to clearly identify needs in the community for improvements to existing sewerage facilities and for improvements to wastewater disposal practices in unsewered areas, and to develop and evaluate locally based, effective efficient and viable methods of addressing such needs.

At the conclusion of this hearing any comments and or questions will be reviewed and included in the minutes of the meeting. Information from this meeting with the final draft of the plan will be sent to RIDEM for final approval.

Outline the specific recommendations in the plan.

Civil & Environmental Engineering Partners, Inc.

Town of Lincoln Wastewater Facilities Plan

- Estimated 2005 population of 21,449 people for the Town of Lincoln and a projected 2025 population of approximately 24,000

- Municipal sewers are available to approximately 99% of the geographic area of the Town.

- The majority of the existing wastewater facilities were installed during the major sewer system construction program conducted during the late 1980s to early 1990s.

- The Town's system consists of 96.7 miles of sewer and thirty-one (31) existing wastewater pumping stations that can be segregated into three (3) general types: Submersible Grinder Pump station, Wet Well / Dry Well Pump station, and Screw Pump station.

- The system design was premised upon saturation development of the zoning conditions in existence at that time, in addition to relatively high per unit wastewater generation rates, with the result that the sewer system is sized to accommodate a peak day design flow of 19.6 MGD.

- The peak day wastewater flow projected by this Facilities Plan is 4.28 MGD based upon metered water use data and the capacity of the existing facilities was determined to be satisfactory for the future conditions.

- The primary recommendations of this Plan include:

    - Investigation and evaluation of existing collection sewers (specifically those pre-dating 1980) to identify sources of potentially excessive extraneous flows and specific rehabilitation requirements.
    - Staged sequence of rehabilitation for the existing pump stations.
    - Continued employment of ISDS treatment in areas isolated from the existing sewer system.

- The estimated total capitol cost of implementing the recommended plan is $6,390,000.

Summary

of

Estimate of Probable Construction Cost

Description	Cost
Collection Sewer Rehabilitation	$4,175,000
Angell Road North PS Rehabilitation	$160,000
Angell Road South PS Rehabilitation	$200,000
Great Road PS Rehabilitation	$380,000
Kirkbrae PS Rehabilitation	$185,000
Maria PS Rehabilitation	$165,000
Lower River Road PS Rehabilitation	$250,000
Submersible /Grinder PS Rehabilitation	$875,000
Total	$6,390,000
Amortized Cost	$639,000

Summary

Project Implementation Schedule

Description	Anticipated Start
Collection Sewer I / I Studies	March 2007
Collection Sewer SSES	June 2007
Collection Sewer Rehabilitation	September 2007
Wet Well / Dry Well and Screw Pump Stations Assessment and Design	January 2007
Angell Road South PS Rehabilitation	June 2007
Maria PS Rehabilitation	June 2008/2013
Lower River Road PS Rehabilitation	June 2008/2013
Great Road PS Rehabilitation	June 2009/2014
Kirkbrae PS Rehabilitation	June 2009/2014
Angell Road North PS Rehabilitation	June 2010/2015
Submersible /Grinder Pump Stations Assessment and Design	January 2007
Submersible /Grinder PS Rehabilitation	
Arlington, Edgehill, Hillside, Middle, Mount, Newland	June 2007/2012
Applewoood, Great Road (116), Jason, Paddock	June 2008/2013
Ashley, Eagle Nest, Birchwood, Cider Mill, Lori Ellen, Oak Hill	June 2009/2014
Lincoln Center, Rollingwood, Woodridge	June 2010/2015
Butterfly, Heidi, Old Pike	June 2011/2016
Davies, Whitney, Belmont	June 2013/2018

DEPARTMENT OF PUBLIC WORKS
Central Services Division
Building and Zoning Division
Engineering Division
Parks and Recreation Division
Sewer Maintenance and Operations
Animal Control
Public Buildings and Property
Tree Warden

TOWN OF LINCOLN
Incorporated 1871

100 Old River Road
P.O. Box 100
Lincoln, Rhode Island 02865

Telephone 333-1100

PUBLIC NOTICE

Town of Lincoln
WASTEWATER FACILITY PLAN

Funded by RI State Revolving Loan Fund Program

The Town of Lincoln has prepared the draft Waste Water Facility Plan. This Plan is available for review in the office of the Town Engineer, Lincoln Town Hall, Public Works Department, 100 Old River Road, Lincoln from 9:00 AM to 4:30 PM week days. Call Kim Wiegand at 333-8415 for more information or any comments.

Pursuant to the requirements of the RI Rules and Regulations for the State Revolving Fund Program, a public meeting will be held on May 17th, 2006 at 5:30 PM in the Council Chambers of the Town Hall, 100 Old River Road, Lincoln to explain the Plan and solicit public opinions and concerns.

Posted April 28, 2006

Waste Water Facility Plan Public Meeting
May 17, 2006
5:30 PM

Attendees sign-in list

NAME	ADDRESS
[illegible]	Town of Lincoln, RI
John MacQueen	Town of Lincoln - Public Works Dept
JON GIERHARD	C&E ENGINEERING, WOONSOCKET, RI

May 17, 2006 Public Meeting 5:30 PM
Town of Lincoln Wastewater Facility Plan
Lincoln Town Council Chambers
Minutes of the Meeting

In attendance for the Town:

John MacQueen, Director of Public Works
N. Kim Wiegand, P.E., Town Engineer
Jonathan S. Gerhard, P.E., C & E Engineering Partners, Inc.

The Town and the consultant waited from 5:30 PM to 6:00 PM to present the plan, but no members of the public appeared.

May 17, 2006 Public Meeting
Town of Lincoln Wastewater Facility Plan Presentation Remarks by Kim Wiegand

History
The Town of Lincoln has an extensive sanitary sewer system. Sewers were first constructed in the 1860s for the mills and mill villages. New sewers have continued to be added on so that 95% of the Town is now sewered. A 1971 study documented problems with the Town's wastewater disposal systems due to direct discharges to the Blackstone and other rivers, and numerous areas of failed and inadequate septic systems. Based on the findings in this report, major sewer construction in five phases was proposed in a 1984 design study report. These sewers were designed and installed. New subdivisions continue to be connected to the sanitary sewers.

Objective
The object of this study was to identify critical issues with the Town's sewer system. The Town investigates, identified and evaluate in detail the existing conditions in the Town of Lincoln related to wastewater disposal and water pollution control.

Regulatory issues
The Town of Lincoln is required by the Federal Water Pollution Control Act to develop and implement a Waste Water Facilities Plan (WWFP). At a minimum, a plan is required to be developed and updated every 20 years or whenever there are significant changes. Accordingly, the Town has developed this draft plan in compliance with the RIDEM's requirements and the Federal Water Pollution Control Act. Development of this plan is included in the Town's Community Comprehensive Plan. The Town applied for and received funding for this plan through State Revolving Fund loan program.

The Town developed the WWFP in order to properly maintain existing service and provide future availability. The WWFP is a document that serves as an important planning tool for the Town as well as a basis for action to correct existing problems and improve existing sewerage facilities. The WWFP identifies and evaluates the need for projects. The WWFP is intended to be a broad-based planning document, evaluating wastewater related needs of a community well into the future. The WWFP step is intended to carry out the preliminary engineering necessary to define a viable program for abatement of local problems. The goal of these tasks is to clearly identify needs in the community for improvements to existing sewerage facilities and for improvements to wastewater disposal practices in unsewered areas, and to develop and evaluate locally based, effective efficient and viable methods of addressing such needs.

Any comments or questions will be incorporated into the document. At the conclusion of this meeting the next step will be review of the plan by other government agencies. Final acceptance of the plan will be by RIDEM.

Civil & Environmental Engineering Partners, Inc.

Town of Lincoln
Wastewater Facilities Plan

- Estimated 2005 population of 21,449 people for the Town of Lincoln and a projected 2025 population of approximately 24,000

- Municipal sewers are available to approximately 99% of the geographic area of the Town.

- The majority of the existing wastewater facilities were installed during the major sewer system construction program conducted during the late 1980s to early 1990s.

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- The primary recommendations of this Plan include:

  - Investigation and evaluation of existing collection sewers (specifically those pre-dating 1980) to identify sources of potentially excessive extraneous flows and specific rehabilitation requirements.
  - Staged sequence of rehabilitation for the existing pump stations.
  - Continued employment of ISDS treatment in areas isolated from the existing sewer system.

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of

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Submersible /Grinder Pump Stations Assessment and Design	January 2007
Submersible /Grinder PS Rehabilitation	
Arlington, Edgehill, Hillside, Middle, Mount, Newland	June 2007/2012
Applewoood, Great Road (116), Jason, Paddock	June 2008/2013
Ashley, Eagle Nest, Birchwood, Cider Mill, Lori Ellen, Oak Hill	June 2009/2014
Lincoln Center, Rollingwood, Woodridge	June 2010/2015
Butterfly, Heidi, Old Pike	June 2011/2016
Davies, Whitney, Belmont	June 2013/2018

C & E Engineering Partners, Inc.

Civil
& Environmental
Engineering Partners, Inc.

342 Park Avenue
Woonsocket
Rhode Island 02895

Phone: 401-762-1711
Fax: 401-235-9088
Info@ceengineer.com

May 22, 2006

Mr. John O'Brien
Rhode Island Statewide Planning Program
One Capitol Hill
Providence, RI 02908

Re: **Town of Lincoln, Rhode Island**
Wastewater Facilities Plan – Intergovernmental Review
C&E Project No. J0506

Dear Mr. O'Brien:

The Town of Lincoln, Rhode Island has prepared a Wastewater Facilities Plan to establish the existing and future needs for its wastewater facilities as necessary to manage wastewater generated within the Town. Guidelines established by the Rhode Island Department of Environmental Management (RIDEM) for the preparation of Wastewater Facilities Plans include requirements for intergovernmental review by various public agencies. The *Executive Summary* and *Chapter 6 – Recommended Plan and Evaluation of Alternatives* from the Wastewater Facilities Plan prepared by C&E Engineering Partners, Inc. for the Town of Lincoln are enclosed so that the required intergovernmental review may be conducted. Please review the enclosed information for consistency with the State Guide Plan and forward any comments to this office by June 15, 2006.

Please feel free contact me if you have any questions regarding this matter.

Sincerely,
C & E ENGINEERING PARTNERS, INC.

Jonathan S. Gerhard, P.E.
Senior Project Engineer

cc: N. Kim Wiegand, P.E., Town Engineer
Arthur Zeman, P.E., RIDEM

TOWN OF LINCOLN
Incorporated 1871
100 Old River Road
P.O. Box 100
Lincoln, Rhode Island 02865

(401) 333-8433

OFFICE OF THE
TOWN PLANNER

June 6, 2006

Mr. Art Zeman, P.E.
RIDEM Office of Water Resources
235 Promenade St.
Providence RI 02908-5767

RE: Town of Lincoln Waste Water Facility Plan

Dear Mr. Zeman:

The Town of Lincoln has developed a Waste Water Facility Plan to provide a comprehensive plan for managing wastewater generated within the Town for a 20-year planning period. Since a majority of the Town currently has municipal sewer service available, the primary emphasis of the plan is the proper management and maintenance of the existing sewer system and related pumping facilities. I have reviewed the proposed Facility Plan and have determined that the projects and recommendations contained within are consistent with the goals and objectives of the Town's 2003 Comprehensive Plan as it relates to waste water management with Town.

Very Truly Yours,

Albert Ranaldi, Jr. AICP
Town Planner

RHODE ISLAND STATEWIDE PLANNING PROGRAM
One Capitol Hill
Providence, Rhode Island 02908
401-222-6480

Memorandum

To: Art Zeman, Principal Engineer,
Wastewater Treatment Facilities Program
DEM Office of Water Resources

From: NH Nancy Hess, Principal Environmental Planner

Date: June 14, 2006

Subject: Town of Lincoln- Wastewater Facilities Plan Update – April 2006

This memo reviews amendments to the Lincoln Wastewater Facility Plan (WWFP). Lincoln operates a wastewater collection system with the treatment of wastewater by the Narragansett Bay Commission at the Bucklin Point Treatment Plant. The purpose of the amendment is to address future capacity for the existing sewer system rather than expansion of the system and upgrades to the various parts of the collection system.

I reviewed the report for consistency with the State Guide Plan Elements concerning natural and water resources as noted below. This memo summarizes my findings for consistency with the State Guide Plan. If you have any questions or require further clarification, please let me know. Thank you for the opportunity to comment.

125 - Scituate Reservoir Watershed Management Plan

There is no conflict with this element since Lincoln is not located in the Scituate Reservoir Watershed.

161- Forest Resources Management Plan

There is no conflict with this element since the amendment involves upgrades to an existing sewer system within established road right-of-ways and will not effect the management of the forest resources of the State. Any individual extensions or changes in routing of existing pipes would require independent review for compliance with this element.

162 - Rivers Policy and Classification Plan

There is no conflict with the goals and policies of this Element to protect and enhance the quality and the use of Rhode Island's freshwater rivers and water bodies.

171 –Rhode Island Comprehensive Solid Waste Management Plan

The update has no conflicts with this element and the goals of the State concerning source reduction, recycling, land filling, management of special waste, and financing costs of solid waste.

715 – Comprehensive Conservation and Management Plan for Narragansett Bay
731 – Rhode Island Nonpoint Source Pollution Management Plan

The concerns identified in both of these elements are being addressed together, as they are closely related. Page 6-7- Re: 6.1.3 ISDS; **For consistency with these elements** the town should 1) adopt an ordinance for mandatory tie-ins to the existing sewer lines for all existing ISDS that occur in sewered areas, and 2) establish a wastewater management district for those areas identified in Table 6-1. Page 6-16 cites evidence that there is not an excessive failure rate for ISDS. Documentation of the number of failure per year and age of systems should be provided to substantiate this claim. Page 6-17 Any pump station changes or changes in routing of existing pipes would require independent review for compliance with these elements.

721 -- Water Supply Policies for Rhode Island
722 -- Water Supply Plan for Rhode Island
723 – Water Emergency Response Plan for the State of Rhode Island

The concerns of these elements are addressed together as all they are closely related. The issues of these elements concern the availability of drinking water, the protection of drinking water, as well as, the operation of drinking water systems. The amendments raise no conflicts with the elements concerning water supply and protection of drinking water supplies.

OTHER COMMENTS

Figure 1-1, the word "corrider" is misspelled. It should be corridor

Cc: N.Kim Wiegand, Lincoln Town Engineer
Jonathan Gerhard, C & E Engineering Partners, Inc.

C & E Engineering Partners, Inc.

Civil
& Environmental
Engineering Partners, Inc.

342 Park Avenue
Woonsocket
Rhode Island 02895

Phone: 401-762-1711
Fax: 401-235-9088
Info@ceengineer.com

August 11, 2006

Ms. Nancy Hess, Principal Environmental Planner
Rhode Island Statewide Planning Program
One Capitol Hill
Providence, RI 02908

Re: **Town of Lincoln, Rhode Island**
Wastewater Facilities Plan – Intergovernmental Review
C&E Project No. J0506

Dear Ms. Hess:

C&E Engineering Partners, Inc. (C&E) forwarded portions of the April 2006 Wastewater Facilities Plan prepared for the Town of Lincoln, Rhode Island (Town) to the Rhode Island Statewide Planning Program (Program) on May 22, 2006 for State Guide Plan Consistency Review. Please accept this correspondence in response to the comments relating to State Guide Plan Elements 715 and 731 as found in the June 14, 2006 Program memorandum to Art Zeman of the Rhode Island Department of Environmental Management (RIDEM) Office of Water Resources. There is no conflict with the other State Guide Plan Elements concerning natural and water resources as noted in the Program memorandum.

As indicated in Chapter 6 of the Wastewater Facilities Plan previously forwarded to the Program, the recommended Plan includes Town review and update of the current Sewer Ordinance. The Town will need to include considerations with respect to ISDS that occur in sewered areas within their review to update the Sewer Ordinance.

Information on existing ISDS systems is provided in Section 3.3.3 of the Wastewater Facilities Plan, a copy of which is enclosed for your reference. The ISDS annual 'failure' rate is less than one system per year based upon review of RIDEM permit histories, which indicate 21 repair or alteration applications were submitted from Lincoln during the period from 1980 to the preparation of the Wastewater Facilities Plan. Municipal sewers are available to approximately 99% of the geographic area of the Town, and it is estimated that only 170 existing ISDS units occur in locations currently without access to the public sewer system. Although State legislation allows municipalities to establish wastewater management districts for the purpose of preventing contamination of state waters due to malfunctioning disposal systems, based on the low 'failure' rate and limited extent of areas where the use of on - site wastewater disposal systems will continue, establishing a wastewater management district in the Town of Lincoln is not recommended. The Wastewater Facilities Plan recommends establishing a Community Required Maintenance program combined with an areawide Educational Program for areas where ISDS management will remain.

The Wastewater Facilities Plan identifies the general possibility for pump station or pipe routing changes but does not provide specific design recommendations. Detailed studies must be performed in order to develop and evaluate design requirements for any specific changes to be proposed. Review for State Guide Plan consistency would be included in the evaluation of specific projects as necessary.

We trust that the above information will satisfy the concerns identified in the Program's June 14, 2006 memorandum. Should you have further questions or comments following review of this information, we ask that the Program provide any additional concerns to this office before August 30, 2006 for inclusion in the final Wastewater Facilities Plan and public hearing process as may be necessary.

Please feel free contact me if you have any questions regarding this matter.

Sincerely,
C & E ENGINEERING PARTNERS, INC.

Jonathan S. Gerhard, P.E.
Senior Project Engineer

cc: N. Kim Wiegand, P.E., Town Engineer
Arthur Zeman, P.E., RIDEM

C & E Engineering Partners, Inc.

Civil
& Environmental
Engineering Partners, Inc.

342 Park Avenue
Woonsocket
Rhode Island 02895

Phone: 401-762-1711
Fax: 401-235-9088
Info@ceengineer.com

May 22, 2006

Rhode Island Historical Preservation and Heritage Commission
Old State House
150 Benefit Street
Providence, RI 02903

Re: **Town of Lincoln, Rhode Island**
Wastewater Facilities Plan – Intergovernmental Review
C&E Project No. J0506

To Whom It May Concern:

The Town of Lincoln, Rhode Island has prepared a Wastewater Facilities Plan to establish the existing and future needs for its wastewater facilities as necessary to manage wastewater generated within the Town. Guidelines established by the Rhode Island Department of Environmental Management (RIDEM) for the preparation of Wastewater Facilities Plans include requirements for intergovernmental review by various public agencies. The *Executive Summary* and *Chapter 6 – Recommended Plan and Evaluation of Alternatives* from the Wastewater Facilities Plan prepared by C&E Engineering Partners, Inc. for the Town of Lincoln are enclosed so that the required intergovernmental review may be conducted. Please review and forward any comments regarding the enclosed information this office by June 15, 2006.

Please feel free contact me if you have any questions regarding this matter.

Sincerely,
C & E ENGINEERING PARTNERS, INC.

Jonathan S. Gerhard, P.E.
Senior Project Engineer

cc: N. Kim Wiegand, P.E., Town Engineer
Arthur Zeman, P.E., RIDEM

J0506

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
HISTORICAL PRESERVATION & HERITAGE COMMISSION
Old State House • 150 Benefit Street • Providence, R.I. 02903-1209
TEL (401) 222-2678 FAX (401) 222-2968
TTY (401) 222-3700 Website www.preservation.ri.gov

June 20, 2006

Mr. John S. Gerhard
Senior Project Engineer
C. & E. Engineering Partners, Inc.
342 Park Avenue
Woonsocket, RI 02895

Re: Wastewater Facilities Plan
Lincoln

Dear Mr. Gerhard:

The Rhode Island Historical Preservation & Heritage Commission staff has reviewed the Wastewater Facilities Plan that has been prepared for the Town of Lincoln. We have the following comments.

As stated in this plan, Lincoln has an extensive system of wastewater sewers and pumping stations and it is generally not expected that new or expanded facilities will be needed in the foreseeable future. Therefore, system management would call for repair of the existing facilities as needed. Some probable areas for repair would be the older sewer lines located in the town's mill villages. Several of the villages are historic districts listed in the National Register of Historic Places, including Albion, Lonsdale and Saylesville. We will need to review excavation work proposed in these areas to determine what impacts, if any, there may be to historic resources.

There are also some possibilities for new construction where gravity sewers might replace pump stations. The areas under consideration include the Great Road National Register Historic District and Old Ashton National Register Historic District on Lower River Road. We will need to review the areas where new construction is proposed to determine its sensitivity and the potential need for historic resources assessments.

These comments are provided in accordance with the National and Rhode Island Historic Preservation Acts. If you have any questions or comments, please contact Richard E. Greenwood, Project Review Coordinator of this office.

Very truly yours,

Edward F. Sanderson
Executive Director
Deputy State Historic Preservation Officer

(060620.04)

C & E Engineering Partners, Inc.

Civil
&Environmental
Engineering Partners, Inc.

342 Park Avenue
Woonsocket
Rhode Island 02895

Phone: 401-762-1711
Fax: 401-235-9088
Info@ceengineer.com

May 22, 2006

Rhode Island Department of Transportation
Two Capitol Hill
Providence, RI 02903

Re: **Town of Lincoln, Rhode Island**
Wastewater Facilities Plan – Intergovernmental Review
C&E Project No. J0506

To Whom It May Concern:

The Town of Lincoln, Rhode Island has prepared a Wastewater Facilities Plan to establish the existing and future needs for its wastewater facilities as necessary to manage wastewater generated within the Town. Guidelines established by the Rhode Island Department of Environmental Management (RIDEM) for the preparation of Wastewater Facilities Plans include requirements for intergovernmental review by various public agencies. The *Executive Summary* and *Chapter 6 – Recommended Plan and Evaluation of Alternatives* from the Wastewater Facilities Plan prepared by C&E Engineering Partners, Inc. for the Town of Lincoln are enclosed so that the required intergovernmental review may be conducted. Please review and forward any comments regarding the enclosed information this office by June 15, 2006.

Please feel free contact me if you have any questions regarding this matter.

Sincerely,
C & E ENGINEERING PARTNERS, INC.

Jonathan S. Gerhard, P.E.
Senior Project Engineer

cc: N. Kim Wiegand, P.E., Town Engineer
Arthur Zeman, P.E., RIDEM

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Rhode Island Department of Transportation
OFFICE OF THE CHIEF ENGINEER
Two Capitol Hill, Rm 224
Providence, RI 02903-1124
PHONE 401-222-2492
FAX 401-222-3435 TDD 401-222-4971

May 31, 2006

Jonathan S. Gerhard, P.E.
Senior Project Engineer
C&E Engineering Partners, Inc.
342 Park Avenue
Woonsocket RI 02895

Dear Mr. Gerhard:

This is in response to your May 22, 2006 letter regarding the Wastewater Facilities Plan for the Town of Lincoln.

Thank you for sharing your plan for our review. The interests of the Rhode Island Department of Transportation (RIDOT) involve the safety of the motoring public and the continued integrity of our roadway system. Any work on a state highway should be designed to both minimize the impact to the traveling public, and to avoid, where possible, the installation of utilities under the paved surfaces.

Please note that the intersection of Route 123 and Breakneck Hill Road in Lincoln includes a relatively new pavement surface. Once the final recommendations of your plan have been made, any work proposed to a state highway would require a utility permit.

Thanks again for the opportunity to comment on your recommendations.

Sincerely,

Edmund T. Parker, Jr., P.E.
Chief Engineer

cc: Nami Moghadam

C & E Engineering Partners, Inc.

Civil
& Environmental
Engineering Partners, Inc.

342 Park Avenue
Woonsocket
Rhode Island 02895

Phone: 401-762-1711
Fax: 401-235-9088
Info@ceengineer.com

May 22, 2006

Narragansett Indian Tribe
P.O. Box 268
Charlestown, RI 02813

Re: **Town of Lincoln, Rhode Island**
Wastewater Facilities Plan – Intergovernmental Review
C&E Project No. J0506

To Whom It May Concern:

The Town of Lincoln, Rhode Island has prepared a Wastewater Facilities Plan to establish the existing and future needs for its wastewater facilities as necessary to manage wastewater generated within the Town. Guidelines established by the Rhode Island Department of Environmental Management (RIDEM) for the preparation of Wastewater Facilities Plans include requirements for intergovernmental review by various public agencies. The *Executive Summary* and *Chapter 6 – Recommended Plan and Evaluation of Alternatives* from the Wastewater Facilities Plan prepared by C&E Engineering Partners, Inc. for the Town of Lincoln are enclosed so that the required intergovernmental review may be conducted. Please review and forward any comments regarding the enclosed information this office by June 15, 2006.

Please feel free contact me if you have any questions regarding this matter.

Sincerely,
C & E ENGINEERING PARTNERS, INC.

Jonathan S. Gerhard, P.E.
Senior Project Engineer

cc: N. Kim Wiegand, P.E., Town Engineer
Arthur Zeman, P.E., RIDEM

C & E Engineering Partners, Inc.

Civil
& Environmental
Engineering Partners, Inc.

342 Park Avenue
Woonsocket
Rhode Island 02895

Phone: 401-762-1711
Fax: 401-235-9088
Info@ceengineer.com

May 22, 2006

Mr. Richard Enser, Coordinator
Rhode Island Natural Heritage Program
235 Promenade Street
Providence, RI 02908

Re: **Town of Lincoln, Rhode Island**
Wastewater Facilities Plan – Intergovernmental Review
C&E Project No. J0506

Dear Mr. Enser:

The Town of Lincoln, Rhode Island has prepared a Wastewater Facilities Plan to establish the existing and future needs for its wastewater facilities as necessary to manage wastewater generated within the Town. Guidelines established by the Rhode Island Department of Environmental Management (RIDEM) for the preparation of Wastewater Facilities Plans include requirements for intergovernmental review by various public agencies. The *Executive Summary* and *Chapter 6 – Recommended Plan and Evaluation of Alternatives* from the Wastewater Facilities Plan prepared by C&E Engineering Partners, Inc. for the Town of Lincoln are enclosed so that the required intergovernmental review may be conducted. Please review and forward any comments regarding the enclosed information this office by June 15, 2006.

Please feel free contact me if you have any questions regarding this matter.

Sincerely,
C & E ENGINEERING PARTNERS, INC.

Jonathan S. Gerhard, P.E.
Senior Project Engineer

cc: N. Kim Wiegand, P.E., Town Engineer
Arthur Zeman, P.E., RIDEM

FACILITY PLAN REAFFIRMATION, FEBRUARY 2012

ENGINEERING SUCCESS **TOGETHER**

February 27, 2012

Mr. John Manning, P.E.
Office of Water Resources
Rhode Island Department of Environmental Management
235 Promenade Street
Providence RI 02908-5767

RE: Facility Plan Reaffirmation
Lincoln, RI

Dear Mr. Manning:

This letter report reaffirms the 2006 Wastewater Facility Plan for the Town of Lincoln that was originally approved by the Rhode Island Department of Environmental Management (RIDEM) on January 11, 2007. The format of the Facilities Plan Reaffirmation (FPR) is based on portions of the RIDEM Office of Water Resources FPR Review Checklist applicable to the Town's wastewater infrastructure and approved Facilities Plan.

STATEMENT OF CURRENT NEED

In general, conditions within the Town relative to wastewater management are consistent with the 2006 Facility Plan. The Town is currently conducting a Sewer System Evaluation Survey on the system tributary to the Angell Road South and Great Road Pumping stations. The Town has also conducted a condition survey of each of the 32 pump stations in the collection system. The rehabilitation of the sewer pumping stations is proceeding in conformance with the plans identified in the Facilities Plan. Sewer extensions are proceeding in conformance with the plans.

PLANNING AREA

The planning area for the Facilities Plan remains the entire Town of Lincoln, Rhode Island. Lincoln is located in Providence County and is bordered by the Towns of Smithfield and North Smithfield to the west, the City of Woonsocket to the north, the Town of Cumberland to the north and east, the City of Central Falls to the east, and the Town of North Providence and City of Pawtucket to the south.

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Planning area conditions within the Town of Lincoln have not changed significantly since the 2006 Facility Plan. Detailed planning area information can be found in Chapters 3 and 4 of the 2006 Facility Plan. Updated information is provided in the following text.

Population

According to the 2010 Census, the population of Lincoln was 21,105. This represents a 1.0 percent increase over the year 2000 population of 20,898. The growth rate over this time period is slower than that projected by the Statewide Planning Program in Technical Paper No. 154, where a year 2010 population of 21,908 was projected. This slower than anticipated growth rate is primarily due to a weak economic climate statewide.

Since no new population projections have been developed, those reported in Technical Paper No. 154 are still considered valid although they are likely to overestimate the planning year (2025) population of 24,498. Projected population figures for the remainder of the planning period are summarized in Table 1.

TABLE 1
Statewide Planning Population Projections for Lincoln, RI

Year	2015	2020	2025	2030
Population	22,596	23,363	24,019	24,498

According to the 2010 census, Lincoln had 8,465 occupied housing units, of which 5,900 were owner occupied. The population living in owner occupied housing units was 15, 684 resulting in an occupancy rate of 2.66 persons per dwelling. Similarly, the occupancy rate in renter occupied units was 2.04 persons per dwelling. The overall occupancy rate of 2.49 persons per dwelling is consistent with the rate of 2.54 persons per unit reported in the Facilities Plan.

Based on current wastewater flows, population projections, and the design capacity of the sewer system discussed in the Facilities Plan, the existing sewer system is considered to be adequate to beyond the end of the current planning period.

Rate Structure

The sewer user fee is based on the Narragansett Bay Commission's sewer rate structure. The most recent rate structure was effective as of July 1, 2011 and is shown in Table 2.

TABLE 2
Sewer Rate Structure

RESIDENTIAL

Customer Charge:	$ 168.21	per dwelling unit per year
Consumption Charge:	$ 2.71	per hundred cubic feet of 100% of water used
Residential Well Customers*:	$ 384.27	

*Based upon fixed fee and average annual usage of 79.61 HCF

INDUSTRIAL

Customer Charge:	Based on meter size. Per meter per year	
Meter Size	Fixed Fee	
5/8"	$ 402	
3/4"	$ 600	
1"	$ 999	
1 1/2"	$ 2,004	
2"	$ 3,201	
3"	$ 5,997	
4"	$ 9,994	
6"	$ 19,996	
8"	$ 31,993	
10"	$ 45,991	
Consumption Charge	$ 2.53	per hundred cubic feet of 100% of water used

COMMERCIAL

Customer Charge:	Based on meter size. Per meter per year	
Meter Size	Fixed Fee	
5/8"	$ 402	
3/4"	$ 600	
1"	$ 999	
1 1/2"	$ 2,004	
2"	$ 3,201	
3"	$ 5,997	
4"	$ 9,994	
6"	$ 19,996	
8"	$ 31,993	
10"	$ 45,991	
Consumption Charge	$ 2.53	per hundred cubic feet of 100% of water used

EFFLUENT LIMITATIONS

As stated in the Facilities Plan, the Town of Lincoln does not hold a Rhode Island Pollutant Discharge Elimination System (RIPDES) permit to discharge treated wastewater to the waters of the State. Wastewater collected by the Town's sewer system is conveyed to wastewater interceptors and treatment facilities owned and operated by the Narragansett Bay Commission (NBC). Sewage from most of the geographic area (north and east) of the Town is conveyed to NBC's Bucklin Point Wastewater Treatment Facility in East Providence. Sewage from the southwesterly portion of Town predominantly tributary to NBC's Louisquisset Interceptor and ultimately conveyed to NBC Field's Point Wastewater Treatment Facility in Providence.

EXISTING CONDITIONS IN PLANNING AREA

As stated previously, existing conditions in the planning area have not changed significantly since the 2006 Facilities Plan. There have been small sewer extensions completed since 2006. Table 3 lists the sewer extensions including location, number of new lots created, status, length of new sewer and approval date:

TABLE 3
Sewer Extensions

Subdivision Name	Cross Street	New Lots Created	Status	Approval date	Length of Sewer
Presidential Estates	Harris Avenue	10	Complete	02/08/2006	1260 Feet
Winterberry Estates	Winterberry Road	7	Complete	12/04/2006	570 Feet
Lincoln Meadows I	Angell Road	7	Complete	04/30/2007	650 Feet
Angell Road - Phase I	Angell & Whipple Rd	8	Complete	12/27/2007	1400 Feet
Cider Mill Subdivision	Cider Mill Lane	8	Complete	11/16/2007	372 Feet
Lincoln Garden Estates	Old Louisquisset Pike	5	Complete	2/29/2008	238 Feet
Riverfront Estates	Angell Road	5	Complete	6/2/2008	400 Feet
Great Road Estates	Great Road	14	Complete	9/3/2008	1000 Feet
Sables Road - Phase I	Angell Road	9	Preliminary Plan	7/26/2006	900 Feet
Lincoln Meadows II	Angell Road	20	Preliminary Plan	2/22/2006	1879 Feet
Hills of Monticello	Albion Road	14	Preliminary Plan	2/27/2008	1970 Feet
Kirkbrae Ledges - Phase XI	Lancers Ln - Hemlock Rd	13	Master Plan	10/25/2006	1025 Feet

Subdivision Name	Cross Street	New Lots Created	Status	Approval date	Length of Sewer
Stone Way Subdivision	Dexter Rock Road	3	Master Plan	1/27/2010	350 Feet
Sables Road - Phase II	Lantern & East Lantern	8	Preliminary Plan	11/15/2006	1100 Feet Private to Public
YMCA MacColl Field	Breakneck Hill Road	0	Master Plan	11/18/2009	1900 Feet Private to Public
Residences at Stone Creek	Breakneck Hill Road	61 Condos	Preliminary Plan	1/26/2011	2974 Feet Private to Public

ENVIRONMENTAL ASSESSMENT

Environmental conditions within the Town of Lincoln have not changed significantly since the 2006 Facility Plan. Detailed environmental information can be found in Chapters 3 and 4 of the 2006 Facility Plan.

PUMP STATIONS

The 2006 Facilities Plan included an evaluation of the Town's sewer pump stations based on a limited conditions assessment. The Facilities Plan also included a schedule and estimated costs to rehabilitate each of the pump stations. Three types of pump stations are in use within the Lincoln sewer system:

1. 26 submersible pump stations, with three having emergency generators
2. 5 major dry pit / wet pit pump stations, with all five having emergency generators
3. 1 screw pump station

During the summer of 2011, a more comprehensive pump station evaluation program was undertaken to identify concerns associated with each station and to recommend required repairs or rehabilitation. Mechanical elements of the stations were evaluated by Richard A. Chiodini, P.E., while SAR Engineering, Inc. assessed electrical and instrumentation system and Laszlo Siegmund, P.E., Lincoln Town Engineer, evaluated structural components and site conditions.

The evaluation was followed by recommendations for replacement or repairs and resulted in the following:

- For the small submersible stations, the rehabilitation and repair recommendations were:
    a. Replacement of pump controls in new stainless steel cabinets
    b. Replacement of older pumps nearing the end of their design life

c. Improved electrical pump wiring connections

d. Miscellaneous minor upgrades and repairs

- For the five (5) major stations, the following improvements were recommended:
  a. Repairs to the existing buildings and the addition of new control enclosures
  b. Total replacement of the ventilation systems
  c. Replacement of dehumidifiers, sump pumps and other minor equipment
  d. Upgrading pump controls
  e. Major maintenance / repairs to generators
  f. Elimination of leaks (groundwater)
  g. Miscellaneous minor upgrades and repairs
- For the screw pump station, complete refurbishing was recommended, including:
  a. New pumps and controls
  b. Building enclosure
  c. Generator
  d. Ventilation and lighting
  e. Structural maintenance

Table 4 provides an updated schedule for the rehabilitation of all the Town's sewer pump stations.

TABLE 4
Pump Station Rehabilitation Schedule

Station Type	Design Completion Date	Construction Completion Date
Screw Pump Station	**November 2011**	**August 2012**
Submersible Stations	**April 2012**	**December 2013**
Dry Pit / Wet Pit	**April 2012**	**December 2012**

Table 4 is an updated Opinion of Probable Construction Costs for the rehabilitation of the Town's sewage pump stations.

TABLE 5
Pump Station Rehabilitation
Opinion of Probable Construction Costs

Station Number	Station Name	Estimated Cost of Improvements
1	Lori Ellen	$ 29,780
2	Angell Road South	$ 136,090
3	Paddock	$ 34,385
4	Jason	$ 29,940
5	Sables	$ 3,316
6	Rolling Wood	$ 17,500
7	Angell Road North	$ 170,186
8	Woodridge	$ 32,185
9	Davies	$ 27,945
10	Whitney	$ 25,380
11	Belmont	$ 23,920
12	Heidi	$ 18,870
13	Old Pike	$ 17,250
14	Middle	$ 30,400
15	Mount	$ 29,360
16	Newland	$ 31,020
17	Hillside	$ 30,940
18	Edgehill	$ 31,830
19	Great Road South	$ 192,974
20	Arlington	$ 40,470
21	Butterfly	By Others
22	Ashley	$ 29,580
23	Maria	$ 140,194
24	Cider Mill	$ 1,545
25	Applewood	$ 30,390
26	Lower River Road	$ 228,880
27	Great Road North	$ 32,230
28	Lincoln Center	$ 30,030
29	Kirkbrae	$ 123,692
30	Oak Hill	$ 31,215
31	Eagles Nest	$ 31,836
32	Birchwood	$ 30,080

Subtotal	$ 1,663,413
Contingency (20%)	$ 332,683
Total	**$ 1,996,096**

WASTEWATER COLLECTION SYSTEM

The 2006 Facilities Plan included an Infiltration / Inflow Preliminary Assessment based on available wastewater flow meter data. This data consisted of Narragansett Bay Commission (NBC) flow

monitoring data from temporary flow meters that were installed for NBC's I/I investigation program, as well as permanent meter stations that receive flow from Lincoln's collection system.

Utilizing the flow monitoring data and information collected from sewer department personnel, the Town began an Infiltration/Inflow (I/I) Analysis and Sewer System Evaluation Survey of the sewersheds tributary to the Angell Road (South) Pump Station and Great Road Pump Station in February of 2011. The study included two phases, with Phase I having been completed and Phase II to be completed in 2012.

Phase I was conducted from March of 2011 through June of 2011 and included the installation of flow meters, and rainfall and groundwater gauges to assist in the determination of infiltration and inflow rates in the study area. An analysis of the data was completed and recommendations were made for additional work that will be accomplished during Phase II of the study. Table 6 shows the recommended investigative methods that will be performed during Phase II along with quantities and anticipated implementation costs.

Table 6 Investigative Methods, Quantities and Prices

Method	Unit	Subarea 1 Quantity	Subarea 3 Quantity	Subarea 9 Quantity	Subarea 10 Quantity	Subarea 13 Quantity	Total Quantity	Unit Price	Total Cost
Manhole Inspections	Each	73	74	107	95	62	411	$23.63	$9,711.93
Above Ground Survey	Linear Foot	11,522	19,627	21,273	19,403	10,081	81,906	$0.08	$6,880.10
Smoke Testing	Linear Foot	11,522	19,627	21,273	19,403	10,081	81,906	$0.34	$27,848.04
Building Inspections	Each	*	*	*	*	*	150	$52.50	$7,875.00
Televised Inspection	Linear Foot	11,522	0	21,273	19,403	10,081	62,279	$1.26	$78,471.54
								Total	**$130,786.61**

* Indeterminate Quantity

As shown, Phase II will utilize smoke testing, manhole inspections, above ground survey, groundwater TV inspection, and building inspections to identify individual I/I. The Phase II Report will provide a cost effective analysis for rehabilitation methods, a prioritized list of projects, an

estimate of the volume of infiltration and inflow that will be removed and an I/I mitigation project schedule.

In summary, each aspect of the FPR (i.e., present conditions, existing wastewater management methods, planned treatment plant upgrades, planned sewer extension projects, and anticipated future flows) found no significant changes or variances from the information presented in the original Facility Plan.

With minor modifications to the original schedule for the pump station rehabilitation program, the 2006 Facilities Plan accurately reflects conditions related to wastewater within the Town of Lincoln.

We trust this FPR meets the requirements of the RIDEM Office of Water Resources. Please call should you have any questions or comments.

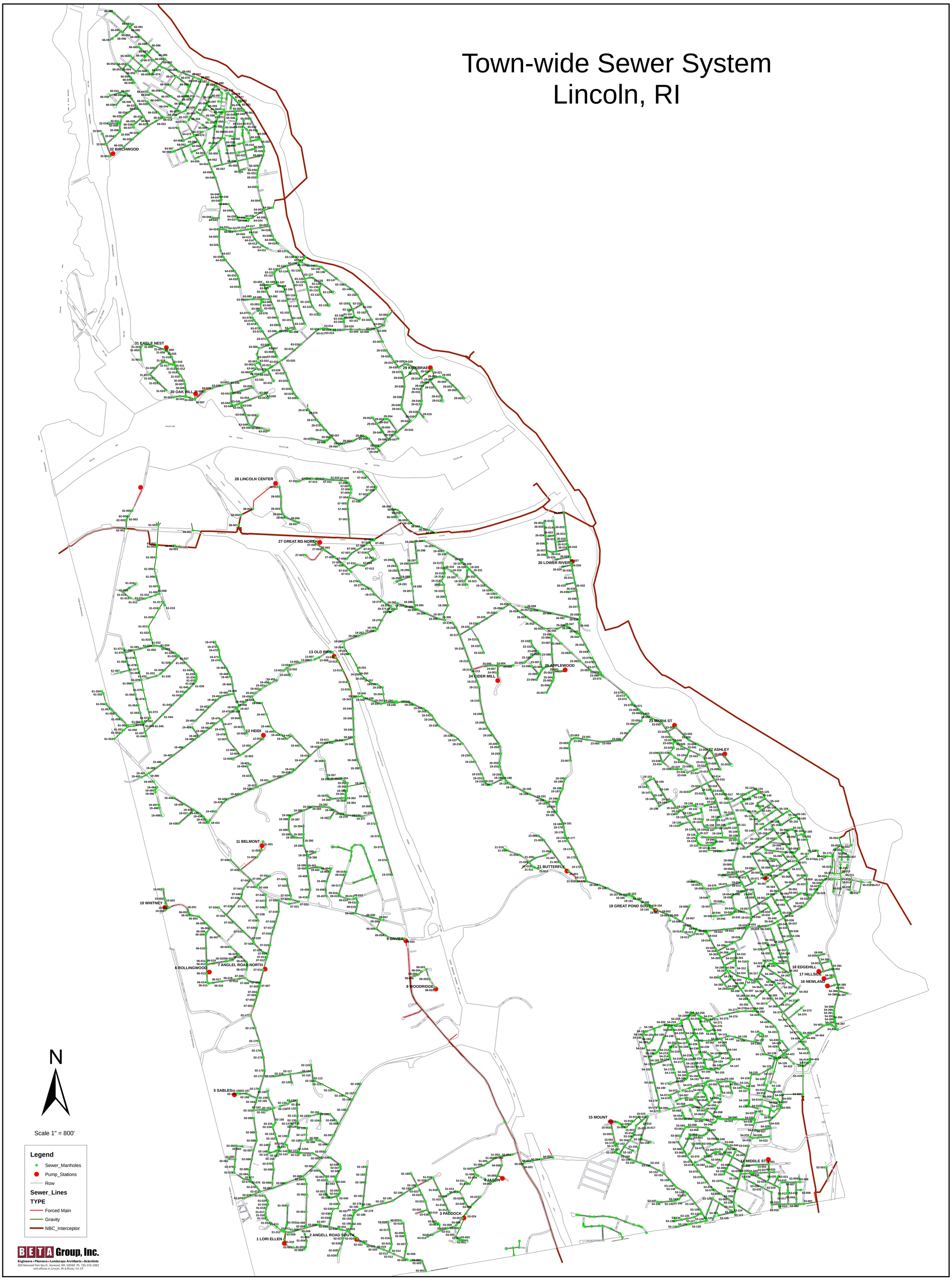
Sincerely,
BETA Group, Inc.

Andrew Dennehy, P.E.
Project Manager

cc: Michael Gagnon. – Town of Lincoln
Laszlo Siegmund, P.E. – Town of Lincoln

OVERALL SEWER MAPPING

Town-wide Sewer System
Lincoln, RI



BETA Group, Inc.
Engineers • Planners • Landscape Architects • Scientists
315 Norwood Park South, Norwood, MA 02062 Ph. 781.255.1982
with offices in: Lincoln, RI & Rocky Hill, CT

DRAFT WASTEWATER COLLECTION SYSTEM
OPERATION AND MAINTENANCE MANUAL
SEPTEMBER 2016

September 2016

Wastewater Collection System Operations and Maintenance Manual (Draft)

Town of Lincoln, Rhode Island

Department of Public Works
Town of Lincoln, RI

BETA
315 Norwood Park South
2nd Floor
Norwood, Massachusetts 02062
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CHAPTER 1: INTRODUCTION

1.1. PURPOSE

The purpose of this manual is to familiarize Department of Public Works and its Sewer Department personnel with the layout of and individual components of the Town's wastewater collection system, maintenance procedures that are required for satisfactory operation of the system, emergency response and preparedness, and programs that have been developed for preventive maintenance and protection of assets and those serviced by the wastewater collection system. The scope of the manual relates only to the wastewater collection system.

Each section of the manual will provide the reader with a general understanding of the topic and its purpose relative to the overall operation of the wastewater collection system. In addition, sections pertaining to major equipment will describe typical operation of the equipment and maintenance procedures.

This manual should be considered a working manual. It should be updated and revised as procedures are changed, modifications are made, and new facilities are constructed. This manual is dedicated to you – the Operator to make this your manual. This will help you and those who follow you in the important task of protecting Lincoln's assets, residents, and the environment.

The purpose of investing in wastewater collection and transmission facilities is to prevent pollution of nearby waterways and the environment and to protect the health and safety of the public and wildlife. However, the design capabilities of the collection system and its facilities can only be effectively utilized if department personnel provide the attention and maintenance required.

Although the collection system facilities have many automatically controlled operations that require little attention by an Operator, nothing can replace the experience, judgment, and observations of trained personnel. Staffing this department with conscientious and interested personnel will aid in providing the best possible operation of collection system facilities.

1.2. OBJECTIVES

This manual covers the assets we manage in our wastewater collection system and combines preventive, predictive and corrective maintenance strategies with our best management practices. This manual has been prepared to help DPW personnel effectively manage our wastewater collection system and achieve the following goals:

- Prevent public health hazards
- Protect the environment
- Comply with regulations
- Minimize the frequency of SSOs
- Mitigate the impact of SSOs

- Convey wastewater to the Narragansett Bay Commission (NBC) system for treatment with a minimum of inflow and infiltration (I/I)
- Protect Lincoln's investment in the wastewater collection system by maintaining maximum capacity and extending the useful life of the associated assets
- Minimize disruptions in service
- Minimize complaints
- Provide quick response to any disruption in service that occurs
- Prevent unnecessary damage to public/private property
- Efficiently use the funds available for the maintenance of the infrastructure and the operation of services
- Reduce expenditures for emergency maintenance
- Provide immediate, responsive, and efficient service to all emergency calls
- Provide a safe work environment for employees, employers, and residents of Bristol
- Perform all operations in a safe manner to prevent personal injury
- Utilize evolving technology to increase our effectiveness and efficiency
- Provide reliable service now and into the future

1.3. OPERATION AND MAINTENANCE

Administration, operation and maintenance of Town's wastewater facilities the fall under the responsibility of the Department of Public Works (DPW) and are delegated to the Sewer Department and Engineering Department. The Sewer Department (Department) is responsible for the operation and maintenance of the Town gravity sewers and wastewater pumping facilities. The Sewer Department Supervisor (Supervisor) manages the department's staff of operations and maintenance personnel under the supervision of the Director of Public Works. The Engineering Department provides technical support to all Town departments, reviews and approves development plans, maintains engineering records and maps, and provides for the design of Town infrastructure and facilities. The Town Engineer manages the Engineering Department staff to perform these duties under the supervision of the Director of Public Works. Sewer Department consists of a full time staff of one supervisor and four operators who are responsible for routine operations, maintenance and emergency response.

1.4. DOCUMENT PRIORITY

This Operation and Maintenance Manual includes appendices that were developed between 2004 and 2016. These appendices are included as a reference. Work undertaken between 2011 and 2016 may have made some information contained in the appendices obsolete; and in the event of conflicts or discrepancies among them, they shall be interpreted on the basis of the following priorities:

First: Sections 1 through 6 of the Wastewater Collection System Operations and Maintenance

Second: Appendix A of the Wastewater Collection System Operations and Maintenance

Third: Appendix B of the Wastewater Collection System Operations and Maintenance

Fourth: Appendix C of the Wastewater Collection System Operations and Maintenance

CHAPTER 2: COLLECTION SYSTEM GENERAL INFORMATION

2.1. GENERAL

This chapter will describe general details of the Town's wastewater collection system, including statistics, historic information, nomenclature, a summary of pipe information, and a description of available drawings and mapping of the system. The Town's wastewater collection system map is presented in Appendix A.

2.2. DESCRIPTION AND STATISTICS

The Town of Lincoln is located in the northeast area of Rhode Island, bordered by the Towns of Smithfield and North Smithfield to the west, the city of Woonsocket to the north, the Town of Cumberland to the north and east, the City of Central Falls to the east, and the Town of North Providence and City of Pawtucket to the south. The total size of the Town is approximately 12,100 acres (18.9 square miles). The Rhode Island Statewide Planning Program reports 2010 census population of 21,105 people for the Town of Lincoln and a projected 2025 population of approximately 24,000.

The Town has a rolling topography and is tributary to two major drainage areas, the Moshassuck River and the Blackstone River. Land use within the Town is diverse, ranging from developed urban areas to historic villages to commercial/industrial campuses to suburban and pastoral landscapes. The Town has an extensive existing wastewater collection and conveyance system with over 100 miles of gravity and force main sewers and thirty-two (32) pumping stations. The Town of Lincoln is presently responsible for management, operation and maintenance of the existing wastewater facilities.

Municipal sewers are available to approximately 99% of the geographic area of the Town. Areas where municipal sewer service is not available are served by individual sewage disposal systems (ISDS). All sewage flow conveyed by the Town facilities is directed to the Narragansett Bay Commission (NBC) system for treatment and disposal at the Bucklin Point Wastewater Treatment Facility in East Providence or the Field's Point Wastewater Treatment Facility in Providence. Areas tributary to the NBC Blackstone Valley Interceptor and Moshassuck Valley Interceptor, either directly or via the Saylesville Pumping Station, ultimately are conveyed to the Bucklin Point Wastewater Treatment Facility in East Providence. Areas that flow to the City of Pawtucket public sewer system also are conveyed to Bucklin Point. Areas tributary to the NBC Louisquisset Interceptor and the Town of North Providence public sewers ultimately are conveyed to the Field's Point Wastewater Treatment Facility in Providence. As such, the Town is fully integrated into the NBC regional system. The Town does not own or operate any municipal wastewater treatment facilities.

There are approximately 100 miles of gravity sewers and 6 miles of forcemain within the Town's collection system. These sewers were constructed during various periods, and the existing system ranges from sewers dating prior to 1900 that remain in service in some sections of the Town to sewers installed during recent development and subdivision projects. Many of the sewers were installed under the Town's major sewer system projects constructed between 1985 and 1992. Most sewers installed

since 1985 are of polyvinyl chlorid (PVC) construction, with ductile iron utilized where necessitated by installation constraints, such as shallow depth of cover. The Town's wastewater collection system map is presented in Appendix A.

All sanitary sewers in Lincoln are considered to be separate sanitary type designed to convey only sanitary wastes. However, the Town has observed isolated areas where stormwater connections are suspected.

Construction of the Town-wide sewer system was proposed in the 1971 and 1984 planning documents, and the existing system was constructed generally in accordance with the proposed plans. However, construction of several reaches of gravity sewers apparently were deemed infeasible due to environmental constraints, including wetlands and river crossings. While the originally proposed systems envisioned at least ten pumping stations due to the rolling topography of the Town, four of the Town's five larger pump stations became necessary. Subsequent development employed sewage pumping as needed to accommodate topographic constraints in order to connect to existing sewers. As such, the Town's sewer system includes thirty-two Town owned pumping stations.

The sewer system is sized to accommodate a peak day design flow of 19.6 MGD. The peak day wastewater flow projected by Final Wastewater Facility Plan (November 2006) is 4.28 MGD based upon metered water use data. The existing sewer system capacity is considered adequate. Table 2-1 presents existing wastewater flow figures estimated for the Town of Lincoln based upon average water use for the 5-year period from 2000 to 2004 inclusive and assuming 85% of the total water use is directed to the sewer system. NBC bills individual customers for sewage treatment and disposal based upon metered water use records and the billing rate formula is based upon 85% of meter water use entering the sewer system.

Table 2-1: Estimated Wastewater Flow

Category	Flow (MGD)
Commercial	0.29
Industrial	0.19
Residential	1.33
I / I Allowance	0.43
Average Day	2.24
Peak Day	3.77

Although public sewers serve a majority of the Town, there are a few areas generally isolated from the public system where sewers have not been extended and on-site Individual Sewage Disposal Systems (ISDS) are required for wastewater treatment. These areas occur in the following general locations:

- Breakneck Hill Road at Old Louisquisset Pike and Route 146
- Twin River Road at Old Louisquisset Pike and Route 146
- Whipple Road, Lantern Road and East Lantern Road area

- North of Wilbur Road along Old Louisquisset Pike and Route 146
- Old Great Road at Route 146, Sayles Hill Road at Route 99
- Woodward Road

In addition to these isolated areas, ISDS systems remain in use in scattered locations throughout the sewered areas of the Town. Septage generated in Town is privately hauled for disposal. NBC owns and operates a regional septage receiving station in Lincoln located on Route 116.

2.3. NOMENCLATURE

For organizational purposes, the collection system has been divided into separate subareas numbered 1 through 66 (with undedicated numbers for future expansion), each distinguishable by physical characteristics and drainage patterns. The subareas represent tributary flows to interceptor sewers and pump stations owned and operated by NBC. Within each subarea, sewer manholes have been given a unique manhole identification number. A manhole's identification number is indicated first by the subarea number in which it lies, followed by a hyphen and a specific manhole number within that subarea (i.e.: 13-006). Sewer pipe segments are denoted by their respective upstream and downstream manhole identification numbers (i.e.: 13-006 to 13-007).

2.4. PIPELINE SIZES AND LENGTHS

The following is a summary of wastewater piping inventory within the Town of Lincoln's wastewater collection system:

Table 2-2: Sewer Pipeline Inventory

Pipe Diameter (Inches)	Approximate Linear Feet	Miles
8	421,000	79.7
10	26,100	4.9
12	30,000	5.7
14	1,200	0.2
15	15,100	2.9
16	1,900	0.4
18	8,800	1.7
20	500	0.1
21	1,800	0.3
24	4,200	0.8
Total	510,600	96.7

The Town's wastewater collection system consists of 96.7 miles (510,600 LF) of gravity pipe 6 miles (31,500 LF) of force main pipe. Gravity pipe sizes vary from 6 to 24 inches in diameter, with the majority being 10 inches or less (approx. 87%). The prevalent pipe material found in the Town's system is PVC.

Most sewers installed since 1985 are of polyvinyl chlorid (PVC) construction, with ductile iron utilized where necessitated by installation constraints, such as shallow depth of cover. Other pipe materials include vitrified clay (VC), asbestos cement (AC), and reinforced concrete (RC).

2.5. SERVICE CONNECTIONS

As discussed in Section 2.2 of this chapter, over 99% of the Town's population is serviced by the wastewater collection system. Property owners are serviced through approximately 9,000 individual building service connections to the system. The property owner is responsible for maintaining their service connection from the sewer main to the building's foundation.

2.6. COLLECTION SYSTEM DRAWINGS AND MAPPING

Any available drawings and maps of the collection system are located in a central location within the Town Hall Building in the DPW Department and are readily available for use by all personnel. A town-wide maps depicting the layout and connectivity of the wastewater collection system, including the locations of manholes, pipelines, and pumping stations is in Appendix A.

It is also recommended that duplicate copies of all record information be kept safe and maintained in a secondary location elsewhere on the property or within the Town in the event of an unforeseen disaster such as a fire, flood, etc. Original copies of record information, as well as record service connection information, are kept within the DPW office in the Town Hall Building.

The Town's sewer collection system mapping is also available in two electronic formats, AutoCAD and GIS. The AutoCAD mapping contains a schematic representation of the collection system and includes the general locations of manholes, gravity pipes, force mains, pumping stations and street information.

The GIS mapping is more accurate and was assembled utilizing the following sources of information:

- GPS location of interceptor manhole structures
- Digitization of available record drawing information
- Field surveys to obtain missing record information

A database was created for the collection system which contains information associated with the sewer network, including manholes, pipes, and facilities. The database was populated with record information for manhole locations as well as pipe connectivity, size, and material.

The GIS mapping information is continuously updated as new information is collected and as necessary changes are identified through field verification.

CHAPTER 3: SUMMARY OF PUMP STATIONS

3.1. GENERAL

There are thirty-two (32) Town-owned pumping stations within Town of Lincoln. The Town's existing wastewater pumping stations can be separated into three general types:

- Submersible Grinder Pump Stations
- Wet Well/Dry Well Pump Stations, and
- Screw Pump Station.

Twenty-six (26) of the Town's pump stations are Submersible Grinder Pump type stations, five (5) stations are Wet Well/Dry Well type stations, and one (1) station is a Screw Pump type station. All of Wet Well/Dry Well type stations and one Screw type Pump Station are consider major pump stations.

The location of each pumping station has been depicted in the Town's wastewater collection system map, presented in Appendix A. In 2006, a physical condition assessment was conducted for each of the Town's pump stations; reports of the conditions observed are provided in Appendix B.

A pump stations inventory is provided in Table 3-1.

3.2. PUMP STATION INSPECTION

All six major pump stations should be regularly inspected daily. All twenty-six Submersible type stations should be inspected bi-weekly.

The Operator should conduct a thorough inspection of major system components at each station, should record all observations, and required measurements on the department-standard inspection forms. The Operator should immediately notify the department supervisor of any issues or potential issues identified during the inspection process from mechanical, electrical equipment failure to unusual noises, vibrations, overheating equipment, etc.

Table 3-1: Pump Station Inventory

No.	Station Name	Station Type	Pump Model	No. of Pumps	Generator	Station Category
1	Lori Ellen	Submersible	M50/2W	2		Minor
2	Angell Road South	Wet/Dry pits		2	Yes	MAJOR
3	Paddock	Submersible	PE45/2W	2		Minor
4	Jason	Submersible	PE45/2W	2		Minor
5	Sables	Submersible	M50/2W	2	Yes	Minor
6	Rollingwood	Submersible	PE45/2W	2		Minor
7	Angell Road North	Wet/Dry pits		2	Yes	MAJOR
8	Woodridge	Submersible	M25/2W	2		Minor
9	Davies	Submersible	AF4044	2	Yes	Minor
10	Whitney	Submersible	M25/2W	2		Minor
11	Belmont	Submersible	M25/2W	2		Minor
12	Heidi	Submersible	M50/2W	2		Minor
13	Old Pike	Submersible	M25/2W	2		Minor
14	Middle	Submersible	M25/2W	2		Minor
15	Mount	Submersible	M25/2W	2		Minor
16	Newland	Submersible	M25/2W	2		Minor
17	Hillside	Submersible	M25/2W	2		Minor
18	Edge Hill	Submersible	M25/2W	2		Minor
19	Great Road South	Wet/Dry pits		3	Yes	MAJOR
20	Arlington	Submersible	M25/2W	2		Minor
21	Butterfly	Submersible	XFP80CCB1	2	Yes	Minor
22	Ashley	Submersible	M25/2W	2		Minor
23	Maria Street	Wet/Dry pits		2	Yes	MAJOR
24	Cider Mill	Submersible	M25/2W	2		Minor
25	Applewood	Submersible	M25/2W	2		Minor
26	Lower River Road	Screw pumps	20" Tube Screw Mounted	2	Yes	MAJOR
27	Great Road North	Submersible	M25/2W	2		Minor
28	Lincoln Center	Submersible	M25/2W	2		Minor
29	Kirkbrae	Wet/Dry pits		2	Yes	MAJOR
30	Oak Hill (at Albion Rd.)	Submersible	PE45/2W	2		Minor
31	Eagle Nest	Submersible	PE45/2W	2		Minor
32	Birchwood	Submersible	M50/2W	2		Minor

3.3. DESCRIPTION OF PUMP STATIONS

3.3.1 Submersible Grinder Pump Stations

Two pumps are provided for all 26 Submersible Grinder pump stations with each pump capable of discharging the full design load. Construction of the Submersible Grinder Pump stations occurred between 1986 and 1998, with the majority of stations constructed prior to 1992 and three stations (Belmont, Davies, and Whitney) constructed in 1993 or later. A summary of the Submersible Grinder type pump stations is provided in Table 3-2.

The wet well for each station is constructed of precast concrete manhole ring and base sections and a flat slab top section with a cast-in aluminum access hatch. An aluminum ladder is provided to allow access to the base level of the wet well chamber. A vent pipe through the top slab provides passive ventilation of the wet well chamber. Influent flow enters the wet well via gravity sewer connection(s) constructed primarily of PVC pipe, with concrete materials apparently utilized at a few stations. The Birchwood station receives flow from an individual residential pressure sewer connection in addition to gravity flow.

At grade construction consists of the wet well and valve chamber (where provided) top slabs and the main electrical cabinet enclosure. Access hatches and the main electrical cabinet are secured by padlock, and chain link security fencing with padlocked gate is provided at some stations. Based on their proximity to adjacent streets, most stations appear to be located within public right of way. Paved bituminous access/parking drives occur at some stations.

Table 3-2: Submersible Grinder Pump Stations

Station Name	Pump Size (HP)	Approximate Age	Pump Model
Applewoood	3	28	M25/2W
Arlington	3	29	M25/2W
Ashley	3	26	M25/2W
Belmont	3	17	M25/2W
Birchwood	5	26	M50/2W
Butterfly	5	24	XFP80CCB1
Cider Mill	3	26	M25/2W
Davies	5	22	AF4044
Eagle Nest	5	26	PE45/2W
Edge Hill	3	29	M25/2W
Great Road (116)	3	28	M25/2W
Heidi	3	24	M50/2W
Hillside	3	29	M25/2W
Jason	5	27	M45/2W
Lincoln Center	3	25	M25/2W
Lori Ellen	5	26	M50/2W
Middle	3	29	M25/2W
Mount	3	29	M25/2W
Newland	3	29	M25/2W
Oak Hill	5	26	PE45/2W
Old Pike	5	24	M25/2W
Paddock	5	27	M45/2W
Rollingwood	5	25	PE45/2W
Sables	5	20	M50/2W
Whitney	3	20	M25/2W
Woodridge	3	15	M25/2W

Electrical and control equipment is housed in a pad mounted enclosure cabinet. New controls were installed by Advanced Controls, Inc. between 2013 and 2016. The electric service meter socket and receptacle for connecting a portable emergency generator are mounted on the exterior of the cabinet. Only the Davies station is provided with a permanent emergency diesel generator installation on-site. No utility meter is provided at the Lincoln Center station as this station reportedly is fed by the local (Amica) electrical power distribution system. The electric service panelboard, switches/breakers for transfer between emergency and utility power supply, pump controls and motor starters, and alarm dialer with a battery backup power supply are located in the main enclosure. Provisions for transfer between utility and emergency power vary from station to station. Some stations are provided with a manual transfer switch in a separate enclosure. Other stations have the Utility and Emergency power main breakers mounted side by side with a slide bolt guard to prevent both breakers from being set to the

"On" position at the same time; the slide bolt guard is configured with a set screw to maintain its position over the selected breaker. An automatic transfer switch is provided for the permanent emergency generator at the Davies station.

The pump control system is based on changing level in the wet well. All station's are equipped with pressure transducers with back-up high and low floats. The pump controllers are PAC-based controllers.

Pump controls are segregated behind a separate inner door inside the main enclosure cabinet. The pump level gauge, status and alarm lights, pump run time meters, and pump H-O-A switches are mounted on the face of the inner door, as are the side by side Emergency and Utility power main breakers for stations without a separate enclosed manual transfer switch. Pump controller module, relays, and motor starters are mounted behind the pump control panel door.

The pump stations originally were equipped with a computer based monitoring system within a separate panel inside the main enclosure. Town personnel indicate that the use of this system was discontinued due to malfunction and unsatisfactory performance. The Town subsequently has installed a SCADA system, to transmit selected alarms to the Sewer Department (weekday working hours) and Police Department (nights/weekends). An uninterruptible power supply (UPS) battery backup unit is provided for the PAC system in the main enclosure.

3.3.2 Wet Well/Dry Well Pump Stations

The Town's five Wet Well/Dry Well type wastewater pump stations are: Angell Road North, Angell Road South, Great Road, Maria Street, and Kirkbrae. These five pump station, together with Lower River Road (Screw) Pump Station are considered major pump stations.

Original construction of the Wet Well/Dry Well Pump stations occurred between 1986 and 1990. In 2012, the Town has authorized rehabilitation of all five Wet Well/Dry Well pump stations. The rehabilitation contract includes for all five pump stations: new electrical components, instrumentation, alarms, ventilation and controls. The contract also includes site work, painting, plumbing, and mechanical upgrades. For two pump stations, the Angell Road North and Angell Road South, the rehabilitation also includes installing two new control buildings on the existing station vaults.

A summary of the Wet Well/Drywell type pump stations is provided in Table 3-3.

Table 3-3: Wet Well/Dry Well Pump Stations

Station Name	Number of Pumps	Pump Size (HP)	Approximate Original Age	Rehabilitated Age
Angell Road North	2	15	25	0
Angell Road South	2	60	23	3
Great Road	3	60	23	3
Kirkbrae	2	20	26	0
Maria Street	2	40	27	0

The original Wet Well/Dry Well stations are constructed of precast concrete rectangular structures with the wet well and dry well chambers cast separately. The upper sections of the wet well and dry well chambers are exposed above grade, with the top slab general a few feet above the surrounding ground surface. Aluminum access hatches are provided in the top/roof slabs to provide entry to the chambers. Aluminum ladders are provided to allow access to the wet well operator platform and to the control level and pump level in the dry well. The Town originally constructed wood framed building structures above the precast concrete chambers at the Great Road, Maria and Kirkbrae stations. The rehabilitation efforts added buildings to Angell Road North and Angell Road South.

Influent flow enters the stations via gravity sewer connection and flows through a manually cleaned bar rack as it enters the wet well. The Great Road station has a divided wet well with slide gates to isolate the two sections, the other four stations have a single undivided wet well. All stations are equipped with centrifugal pumps with close-coupled vertically mounted 3-phase electric drive motors. Seal water systems were removed at the Great Road and Angell Road South stations and replaced with mechanical seals. There are no odor control systems at the stations. Each pump is connected to the wet well by individual suction piping with isolation gate valve. Each individual pump discharge is provided with a check valve and isolation gate valve prior to joining at a common force main and exiting the station. The pump suction and discharge piping is constructed of flanged ductile iron. The pumps and piping systems are located in the lower (pump) level of the dry well chamber.

The pump control system is based on changing level in the wet well. Similar to the Submersible Grinder Pump stations, all Wet Well/Dry Well stations are equipped with a pressure transducer and backup high and low floats. Pump controls are segregated from other electrical equipment in a separate control panel enclosure(s) in the upper level within the buildings. Variable Frequency Drive equipment that changes the pump speed in response to changing wet well water level conditions in effort to match pumping rates to station influent is provided at the Great Road pump station. The pumps operate at constant speed, in response to pump “On” and “Off” wet well level controls at the other four stations.

The wet well/dry well pump stations also were equipped originally with a computer based monitoring system; however, SCADA has been installed, replacing the computer based system,

to transmit selected alarms to the Sewer Department (weekdays, working hours) and Police Department (nights/weekends). An uninterruptible power supply (UPS) battery backup unit is provided for the PAC controller.

Wet wells and dry wells are provided with separate mechanical ventilation systems, and those systems were updated between 2014 and 2016. Electric unit heaters are provided in the dry wells, no heating is provided to the wet wells. A sump pump is provided in the pump level of each station dry well. Sump pump discharge piping is provided with two check valves and an isolation gate valve prior to penetrating through the structure to discharge back into the wet well.

Electrical and control equipment generally is located in the upper (control) level of the dry well chamber. Main electrical disconnects, distribution panels, automatic transfer switch, and pump controls are located in the upper level. The electric service meter socket is located on the exterior of the stations. A stationary emergency diesel generator unit is provided at each station mounted on the top slab of the precast concrete chambers. The emergency generators are inside the building.

3.3.3 Screw Pump Station

The Lower River Road pump station is the Town's Screw Pump type wastewater pump station. This station, together with five wet well/dry well pump stations, is considering as a major pump station. Two screw pumps are provided at the Lower River Road station and each pump is capable of discharging the full design load. The pump is rated for a peak design flow of 300 gpm at 12 feet total dynamic head. Each pump is powered by a 1.5 HP electric motor.

Screw pumps are well suited to low lift-pumping applications and have the advantage of providing variable output from constant speed pumps. Pump output matches station influent and varies based upon the wet well sump level. As a result, simple controls systems are inherent in the design of screw pumps. Because there essentially is only one component that requires maintenance (pump/motor) and the simplicity of the controls, screw pump stations are relatively easy to operate and maintain. However, screw pumps require an open system that operates at atmospheric pressure and can be the source of odor complaints due to turbulent and/or septic conditions. Town personnel identified that odor complaints have occurred generally due to the close proximity of adjacent residential areas but specific concerns for odors or excessive complaints were not indicated for this station.

The pumps are constant speed and operate continuously without any level sensing input. The control panel includes a Hand-Off-Auto switch and run time meter for each pump and a pump-alternating timer. With each pump in the auto position, the timer selects and alternates operation between the two pumps. One pump is operating at all times. If one pump is down for service or otherwise, the other pump can be operated continuously in the Hand mode.

New pump controls and SCADA has been installed, replacing the computer based system alarm system, to transmit selected alarms to the Sewer Department (weekdays, working hours) and Police Department (nights/weekends). An uninterruptible power supply (UPS) battery backup unit is provided for the PAC controller.

Similar to Angell Road South and Angell Road North, a new control building was built at this station in 2013. At that time, new ventilation equipment was installed in both the pump structure and the new building. A new engine/generator was also installed at that time.

3.4. MAINTENANCE EQUIPMENT

An array of maintenance equipment and tools are readily available to DPW personnel for use in performing various scheduled and unscheduled tasks at remote pumping station locations and throughout the wastewater collection system. The department is able to achieve uninterrupted operation of the Town's wastewater collection system and associated pumping stations with sufficient maintenance equipment at its disposal. The majority of the maintenance equipment is stored at the Town's maintenance yard in designated, easily accessible storage areas, while some smaller hand tools and equipment are stored within several Town-owned maintenance vehicles for use by personnel.

Some equipment is stored at pumping stations within the collection system for use at a particular station. In this scenario, the equipment may only be required for use at that pump station and may not be needed in another location. Storing the equipment in close proximity to where it may be specifically needed will reduce the possibility of misplacing it or not having it readily available in an emergency situation (i.e. located in a different vehicle, stored at the Town's maintenance yard, etc.).

CHAPTER 4: PREVENTIVE MAINTENANCE PROCEDURES

4.1 PUMPING STATION MAINTENANCE

Pumping station maintenance is crucial to ensure reliable wastewater collection and conveyance to the NBC interceptor sewer system. Maintenance operations consist of daily, weekly, monthly, quarterly, semi-annual, and annual tasks. Table 4-1 and 4-2 outline the major tasks and their frequency.

Table 4-1 Major Pump Stations Inspection and Maintenance Schedules

Category	Equipment	Activity	Minimum Frequency
Mechanical	Screen	Screening Removal	Daily
	Wetwell	Inspect	Daily
		Clean	Weekly
	Wastewater Pumps	Check Operation	Weekly
		Check Seals	Weekly
		Lubricate bearings	Quarterly
		Inspect Pump Shafts	Monthly
		Check for Vibration	Weekly
	Sump Pumps	Check Operation	Weekly
		Inspect/Clean	Weekly
		Inspect Impeller	Annually
		Inspect Bearings	Annually
	Check Valves	Inspect/Clean	Weekly
	Gate Valves	Exercise	Monthly
		Inspect Seal	Weekly
	Ventilation	Check Operation	Weekly
		Check Belt Tension	Monthly
		Inspect/Clean	Semi-Annually
		Lubricate Motor Bearings	Annually
	Monorail and Hoist	Inspect Bearings	Monthly
		Inspect hook and Chain	Monthly
Electrical	Lighting	Check	Weekly
		Operation	Semi-Annually
		Clean	Semi-Annually
		Change Bulbs	As Needed
	Engine / Generator	Exercise	Weekly
		Inspect	Monthly
		Service	Per Manufacturer's Recommendations
	Power Distribution	Inspect	Annually

Table 4-1 Major Pump Stations Inspection and Maintenance Schedules

Category	Equipment	Activity	Minimum Frequency
	VFD's	Clean	Quarterly
		Inspect for Overheating	Quarterly
Instrumentation and Control	Transducer	Check Operation	Weekly
	Floats	Check Operation	Weekly
		Inspect Float Balls	Weekly
		Test Level Alarm	Weekly
	Indicating Lights	Check Operation	Weekly
	Pump Control Switches	Check Operation	Weekly
	Alarms	Check Operation	Weekly
Structural/Site	Station Building	Check Locks	Weekly
		Check Lights	Weekly
		Check Doors	Weekly
		Check Paint Condition	Weekly
		Check Site Conditions	Weekly
		Check Building Cleanliness	Weekly
		Inspect Ladders/Hatches	Monthly
		Inspect Flooring/Grating	Monthly
		Inspection Roof	Monthly
		Inspect Fencing	Monthly
		Inspect Windows	Monthly
	Wetwell	Inspection Access Hatch	Weekly
		Inspection Cracks/Leaks	Annually

Table 4-2 Minor Pump Stations Inspection and Maintenance Schedules			
Category	Equipment	Activity	Minimum Frequency
Mechanical	Wetwell	Inspect	Bi-Weekly
		Clean	Weekly
	Wastewater Pumps	Check Operation	Weekly
		Inspect Pump Rails	Weekly
		Check for Vibration	Weekly
	Check Valves	Inspect/Clean	Weekly
	Gate Valves	Exercise	Monthly
		Inspect Seal	Weekly
Electrical	Manual Transfer Switch and Receptacle	Inspect	Monthly
		Test Operation	Semi-Annually
	Power Distribution	Inspect	Annually
	VFD's	Clean	Quarterly
		Inspect for Overheating	Quarterly
Instrumentation and Control	Transducer	Check Operation	Weekly
	Floats	Check Operation	Weekly
		Inspect Float Balls	Weekly
		Test Level Alarm	Weekly
	Indicating Lights	Check Operation	Weekly
	Pump Control Switches	Check Operation	Weekly
	Alarms	Check Operation	Weekly
Structural/Site	Station	Check Locks	Weekly
		Check Lights	Weekly
		Check Enclosure Doors	Weekly
		Check Paint Condition	Weekly
		Check Site Conditions	Weekly
		Inspect Hatches	Monthly
		Inspect Fencing	Monthly
	Wetwell	Inspection Access Hatch	Weekly
		Inspection Cracks/Leaks	Annually

For the full Management Program adopted by the Town of Lincoln, see Appendix C. The purpose of this Management Program is to document the standard operations procedures and actions to be taken by the Town of Lincoln in order to eliminate the occurrence of sewer backups and pumping stations failures. This is a compilation of the entire Town's Standard Operation Procedures related to the operation and maintenance of the sanitary sewer collection system.

4.2 COLLECTION SYSTEM CLEANING AND INSPECTION

The Town's collection system must be cleaned and maintained on a regular basis to prevent system blockages, which could result in system overflows and basement backups. System blockages may result from grease/debris buildup or excessive root growth within pipelines or manhole inverts.

4.2.1 Cleaning Procedures

Pipelines shall be cleaned by means of hydraulically propelled or high velocity water jet cleaning equipment. Cleaning equipment shall be capable of removing dirt, grease, rocks, sand, iron tuberculation and other deleterious materials and obstructions from pipelines. During pipeline cleaning operations, personnel should take precautions to protect the pipelines from damage that might be inflicted by the improper use of cleaning equipment. Also, whenever hydraulically propelled cleaning tools, which depend upon water pressure to provide their cleaning force or any tools which retard the flow of water in the pipeline are used, precautions shall be taken to ensure that the water pressure created does not cause any damage or flooding to public or private property.

4.2.2 Material Removal and Disposal

Suitable screening or other means of trapping and blocking shall be utilized in the downstream manhole to prevent cleaned material from passing to downstream portions of the collection system. All captured materials resulting from the cleaning operations which could cause pipeline blockages shall be removed promptly by necessary means and shall be properly disposed in accordance with State and/or Federal regulations.

4.2.3 Pipeline Inspection

After cleaning, pipelines may require visual inspection to ensure the completeness of cleaning operations or to inspect the existing condition of the pipeline. Pipelines shall be inspected by means of closed-circuit television inspection (CCTV) equipment. The camera used shall be designed and constructed for such conditions, equipped with a light to allow a clear picture of the entire periphery of the pipe, operative in 100 percent humidity conditions, and equipped with manual or power winch, TV cable, powered rewinds or other devices that do not obstruct the camera view to move the camera through the pipeline. The television inspection equipment shall also be equipped with a distance meter for locating observations and defects within a pipeline by measurement.

Personnel may be required to conduct audio and video recording of pipeline inspection operations for documentation of observations such as locations of building service connections, unusual conditions, infiltration, roots, storm water connections, broken pipe, separated or dropped joints, presence of scale and corrosion, deposits, protrusions, or other discernible features. Inspections shall be recorded on DVD, as well as printed television logs.

Inspection records shall identify the following information:

1. Identification of the pipeline section inspected (upstream and downstream manhole identification numbers, street location, pipe size and material).
2. Location (footage) of observations in reference from starting manhole.

Television inspection records shall include the characteristics of the Town of Lincoln's identification system for the wastewater collection system. Personnel shall incorporate the Town's identification system into recorded video and printed logs to clearly document the portion of the collection system in which an inspection was performed. The identification system is detailed in Chapter 2 of this document.

All pipeline cleaning and inspection procedures shall follow the most current protocol as part of department's "Sanitary Sewer Management Program". For the program see Appendix C.

Maintenance personnel shall notify the Supervisor immediately upon discovery of pipeline conditions requiring immediate attention. Conditions warranting immediate attention may include collapse, severely broken pipe, separated pipe joints, etc.

4.2.4 Manhole Inspection

In addition to pipelines, inspection of manholes is essential for the complete assessment of the existing condition of the Town's collection system.

Personnel shall utilize the standard form, "Manhole Inspection Report", to conduct and document all manhole inspections. A copy of the form has been included within Appendix D of this volume. Personnel shall follow the Town's collection system identification requirements for documenting inspections of manholes. The identification system is detailed in Chapter 2 of this document.

Manhole inspections reports shall include the following information:

a) Manhole location description including unique manhole identification number, street, landmark, etc.
b) Name of inspector, department, company (if performed by an outside firm), etc. and date of inspection
c) Manhole measurements (depth, diameter) and material
d) Structural condition of frame and cover, rungs, grading rings, cone, risers, shelf, and invert
e) Operational condition as related to active sources of inflow/infiltration or signs of previous leakage, evidence of surcharging, presence of debris, etc.
f) Presence of previously installed rehabilitation materials/products
g) Additional comments necessary for proper condition assessment of the manhole following inspection

Maintenance personnel shall notify the Supervisor immediately upon discovery of manhole conditions requiring immediate attention. Conditions warranting immediate attention may include collapse, obstruction of flow, public safety hazards (i.e. broken, loose, or missing covers), etc.

Personnel may be required to take digital photographs of manholes during the inspection process to document existing conditions and observations discovered. The photographs may then be printed, and affixed to and filed with the manhole inspection reports for reference. Photographs may include frame and cover photos, reference photos at grade, internal photos showing defects, leaks, overall conditions, etc.

4.2.5 Required Staffing

At a minimum, two personnel from the department shall be utilized for collection system cleaning and inspection operations. In the event that a location is within a roadway containing significant traffic flow, additional staff, as necessary to successfully complete the task, should accompany the maintenance crew to provide traffic control. This would be dependent on the traffic characteristics of the location at the time of the cleaning and maintenance activities. The requirement of additional personnel to perform the cleaning and maintenance tasks shall be determined by field conditions and/or shall be at the discretion of the Supervisor. It may be necessary to contact the Lincoln Police Department for traffic control assistance.

4.3 STANDARD MAINTENANCE PROCEDURE

The Standard Maintenance Procedure was established as a preventive procedure to maintain collection system capacity and prevent system blockages that may result in surcharging and sewer system overflows. Work associated with the Routine Cleaning Program includes but is not limited to:

- Pipeline cleaning by water jetting
- Detailed pipeline closed-circuit television inspection
- Root cutting where required
- Removal and disposal of grease, debris, other material generated during cleaning activities
- Manhole inspection

A copy of the Standard Operation Procedure for Sanitary Sewer Maintenance is located in Appendix C as part of Sanitary Sewer Management Program.

4.4 PRIORITY LOCATION MAINTENANCE PROCEDURE

There are portions of the wastewater collection system that require more frequent attention than the rest of the system. These portions of the system must be cleaned and maintained on a regular basis to prevent system blockages, which could result in system overflows and basement backups. Frequent cleaning of the pipelines is required due to grease and debris buildup caused by structural and hydraulic

deficiencies. The Standard Operation Procedure for Sanitary Sewer Priority Response was established to create a recurring preventive maintenance plan and schedule for these troublesome locations. A copy of the procedure, including Priority Area List and priority Area Inspection Form, is located in Appendix C.

Preventive maintenance is performed on the portions of the collection system included within the Priority Area List on a bi-weekly basis. The frequency selected for these locations is sufficient to successfully prevent the recurrence of system blockages that may result in surcharging and sewer system overflows from the collection system. Locations may be added to or removed from the list as new issues are discovered or as existing issues are eliminated by collection system improvements. The Priority Area List shall be updated as changes arise.

4.5 EASEMENT MAINTENANCE

Easements give Lincoln the right to install and maintain collection system facilities on property not owned by the Town. Easements are recorded as deed records that are accessed through the Town Assessor's Office.

Easements are important for our ability to operate and maintain our collection system. The DPW's goal is that all collection system easements remain clear of any brush, fences, buildings, gardens, trees, shrubs and extensive landscaping, to allow equipment access for maintenance of the collection system. The DPW is not liable to repair or replace any such items that are removed in the process of completing repairs or maintenance on the collection system. Crews are, however, instructed to work with the property owner whenever possible.

CHAPTER 5: REACTIVE MAINTENANCE PROCEDURES

5.1 RESPONSE TO PRIVATE PROPERTY COMPLAINTS (CALLOUTS)

5.1.1 Private Property Overflows/Backups

Sanitary sewer overflows can occur on private property and typically include backups through facilities in homes and businesses. Private property overflows are typically contained within the walls of the building being impacted, and depending on the severity of the overflow, can cause significant damage to property and impact the health of residents or inhabitants of the building.

Private property overflows can occur as a result of the causes included in Section 5.2.1 of this Manual, "Sanitary Sewer Overflows (SSOs)". The Town would be responsible for private property overflows occurring as a result of these causes.

A property owner is responsible for their sewer service connection from their building to the sewer main. Private property overflows occurring as a result of problems within a property owner's sewer service connection would be the responsibility of the owner. The following are typical causes for private property overflows occurring within a property owner's sewer service connection:

- A collapse of the service lateral
- A blockage within the service lateral that may include grease, debris, or roots
- The failure of low pressure service equipment

In general, personnel should follow these simple steps when responding to a private property overflow:

- Respond immediately
- Instruct inhabitants to avoid the affected area
- Quickly assess the situation / identify the cause
- Determine responsibility
- Eliminate / mitigate situation
- Assist property owner with contacting businesses that specialize in the services required to resolve their issue, as required
- Assist property owner with cleanup efforts

The DPW has a formal guide to assist personnel and react in the response and management of private property overflows. The guides, titled Standard Operating Procedure Response to Sewer Blockages, Troubleshooting Guide for Sewer System and Emergency Response Plan are included within the Standard Operation Procedure for Sanitary Sewer Maintenance which is located in the Department's office as well as in Appendix C. This guides covers the complete management of a situation involving a private property overflow. Personnel should familiarize themselves with this

guide in order to mitigate the impact of a private property overflow from providing immediate response and elimination of the overflow to assisting with the containment and cleanup effort required. Becoming familiar with this guide will help to minimize the impact a private property overflow can have on human health and minimize the potential damage to a property owner's possessions. The Supervisor should provide personnel with copies of all Standard Operating Procedures (SOPs) for the department.

5.1.2 Odor Complaints

Odor control is a concern common to all wastewater pump stations. Odor complaints have occurred generally due to the proximity of adjacent residential areas to the existing pump station locations. Excessive complaints or recurrent concerns for odors were not identified for any specific location. However, odor concentrations can be affected by weather (temperature, wind direction and speed, etc.), as well as disruptions in pump operation (equipment breakdowns etc.). Odor control considerations should be re-evaluated if an increase in the frequency of complaints or other change in conditions is observed to suggest excessive odor emissions may be occurring. DPW personnel utilize additional means to control the odors released from the facility when complaints are received.

Complaints involving odors that emit from the wastewater collection system are infrequently received by the department, but occur nonetheless. In most cases, personnel discover that odors are generally experienced upon issues occurring within a property owner's service connection and/or the building's plumbing system. Connection issues that have the potential to introduce odors include open/broken cleanout caps, broken/leaking service piping, improper venting of building plumbing, and dry plumbing traps (infrequently used building facilities).

Odors can also be caused by issues occurring within the other Town-owned and maintained sections of the collection system including from manholes (wetwells, etc.). Odors can be experienced at manhole locations where force main and low pressure sewers discharge. Odors from manholes can also indicate mainline blockages and/or surcharged system conditions.

In all scenarios, DPW personnel should be trained to respond to the callout, identify the source of the odor, identify the problem (if any), and rectify the situation as required. Personnel shall be prepared to provide assistance to the property owner should the issue be either the Town's or the owner's responsibility. Gases released from the wastewater collection system can be harmful to humans and ensuring the safety of the residents of Lincoln should be a priority to Town personnel.

5.2 RESPONSE TO COLLECTION SYSTEM/PUMPING STATION FAILURES

The Town's wastewater collection system experiences infiltration and inflow associated with high seasonal groundwater and extreme wet-weather events. Forecasted rainfall events should be monitored closely, especially during high groundwater seasons. SSO's can occur when flow

exceeds system capacity due to the presence of excessive infiltration and inflow in the collection system. The occurrence of SSO's are more likely to occur during extreme wet-weather events in the months of March, April, and May but can occur at any time of the year and can be the result of causes other than wet-weather. The following are other common causes of SSO's:

- Flow backs up because of a system "plug" or restriction caused by the presence of roots and/or the accumulation of grease/debris in the collection system pipelines and manholes or as a result of a pipe collapse.
- Equipment failures such as pump station breakdowns interrupt transmission of flow within the collection system and cause flow to back up into the system.

The DPW has formal guides to assist personnel in the response and management of SSO's. This is the same guides that cover the response and management of private property overflows. The guides, titled Troubleshooting Guide for Sewer System, Standard Operating Procedure Response to Sewer Blockages and Emergency Response Plan are included within the Standard Operation Procedure for Sanitary Sewer Maintenance which is located in the Department's office as well as in Appendix C. Troubleshooting Guide for Sewer System covers the management of identification of problem, Source and cause a situation involving an SSO from the solution method and response to the mitigation of the situation to the cleanup effort. Personnel should familiarize themselves with this guide to prevent delay during such an occurrence and to safely and efficiently handle the situation. Becoming familiar with this guide will help reduce the potential effects an SSO can have on personnel, Town residents, and the surrounding environment such as wildlife and surface water.

CHAPTER 6: USER COMPLIANCE REGULATIONS AND PROGRAMS

6.1 NBC RULES AND REGULATIONS

The Town of Lincoln does not hold a Rhode Island Pollutant Discharge Elimination System (RIPDES) permit to discharge treated wastewater to the waters of the State. Town wastewater flows are conveyed to the Narragansett Bay Commission wastewater collection and treatment facilities either by direct connection or indirectly via the municipal sewer systems of the Town of North Providence and City of Pawtucket. These wastewater flows ultimately are conveyed to the NBC system for treatment. Sewage from most of the geographic area of the Town north and east is conveyed to the NBC Bucklin Point Wastewater Treatment Facility. Sewage from the southwesterly portion of Town that is tributary either to the NBC Louisquisset Pike Interceptor or North Providence sewers is conveyed to the NBC Field's Point Wastewater Treatment Facility. As such, the Town is subject to meeting the discharge limitations and requirements of these entities.

The NBC may limit, reject or prohibit any direct or indirect discharge of pollutants or combination of pollutants, as defined by applicable Federal or state law into the facilities. NBC's Article 5 of "Rules and Regulations for Use of Wastewater Facilities within the Narragansett Bay Commission District" outline the provisions by which those serviced by the Town's wastewater collection system must abide by. As "users" of the Town's wastewater collection system, those serviced are subject to these provisions as well as required user fee schedules and enforcement procedures for non-compliance. Users are responsible and accountable for the quality of effluent wastewater that is discharged to the Town's collection system from their facilities.

6.2 PRETREATMENT PROGRAM

Because wastewater treatment facilities are not designed to remove metals and other toxic chemicals from the wastewater, the US Environmental Protection Agency (US EPA) requires the NBC to have a pretreatment program that controls the release of these substances into the sewer system. To accomplish this, commercial and industrial users throughout the NBC district are required to obtain a permit so that the NBC can monitor the varied pollutants that are released into the sewer system and ensure compliance with state and Federal requirements.

There are commercial and industrial properties in Lincoln that are serviced by the Town's wastewater collection system. These properties are required to participate in the NBC's Pretreatment Program and are thus required to comply with the provisions of the NBC's Industrial User Pretreatment Discharge Permit (Permit). The Permit defines allowable parameter limits for wastewater effluent discharges from program participants' facilities. All program participants are required to adhere to the provisions of the Permit and are subject to inspections and fines should their effluent quality not meet the acceptable limits.

NBC billing information identifies 20 services as Industrial customers. Seven of the Industrial customers use in excess of 10,000 gallons of water per day based upon the NBC billing information. These larger customers and their approximate daily wastewater flow generated based upon 85% of 2004 metered water use is provided in Table 6-1.

Table 6-1: Approximate Daily Wastewater Flow High Volume Industrial Sources

Name	Address	Flow (GPD)
General Cable Industries LLC	3 Carol Drive	23,500
Stern-Leach Company	4 Carol Drive	10,800
Richard E Beaupre	11 New England Way	11,600
Tanury Industries Inc	6 New England Way	32,700
A T Cross Co	1 Albion Road	22,900
Arcrivis Ltd	1 Crownmark Drive	12,200
Technical Materials Inc.	5 Wellington Road	54,900

These approximate flow figures are based upon the assumption that the production operations are continuous for 7-day per week without weekend shutdowns. These seven customers account for approximately 93% of the flow from Industrial customers identified in the 2004 NBC billing information.

6.3 FATS, OILS AND GREASE (FOG) PROGRAM

The presence of fats, oils and grease in wastewater can result in major operational problems in sewer lines and pump stations owned by the Narragansett Bay Commission, cities and towns, and at the wastewater treatment facilities. The goal of the NBC FOG Program is to reduce the amount of grease that is discharged to the Town's wastewater collection system by those serviced by the system. Grease discharged down the drain may also plug up plumbing in homes and businesses. Grease causes problems in sewers by solidifying on the inside walls of sewer pipes restricting the flow of sewage. Sewer line backups and complete blockages have resulted from grease build up, causing raw sewage to back up onto public streets or into the basements of homes and businesses. Further, grease has fouled equipment and controls at treatment facilities, and high concentrations of grease and oils in wastewater can inhibit the biological wastewater treatment processes reducing the level of treatment we can provide.

The NBC Grease Removal Program goal is to control the discharge of fats, oils and grease from restaurants and food preparation facilities into the sewer system. Grease discharges are predominantly generated from washing and cleaning operations and not from fryolators or deep frying units as most people might think. The pot washing sinks and dishwasher pre-rinse stations in restaurants and food preparation facilities are the major sources of grease discharges to the sewer system

The NBC controls the discharge of fats, oils and grease through the issuance of Wastewater Discharge Permits. All commercial and industrial facilities that may conduct food preparation operations are required to obtain a wastewater discharge permit from the NBC Pretreatment Section. The Town, as part of NBC wastewater collection system, requires installation and operation of grease removal systems at connections to the wastewater collection system where food preparation or food processing operations are conducted (excluding private living quarters of residential property). Facilities required to obtain a discharge permit to control grease discharges may include:

- Restaurants
- Hotels
- Schools
- Hospitals
- Nursing Homes
- Other establishments where food is prepared and there is potential for discharge of grease to the collection system

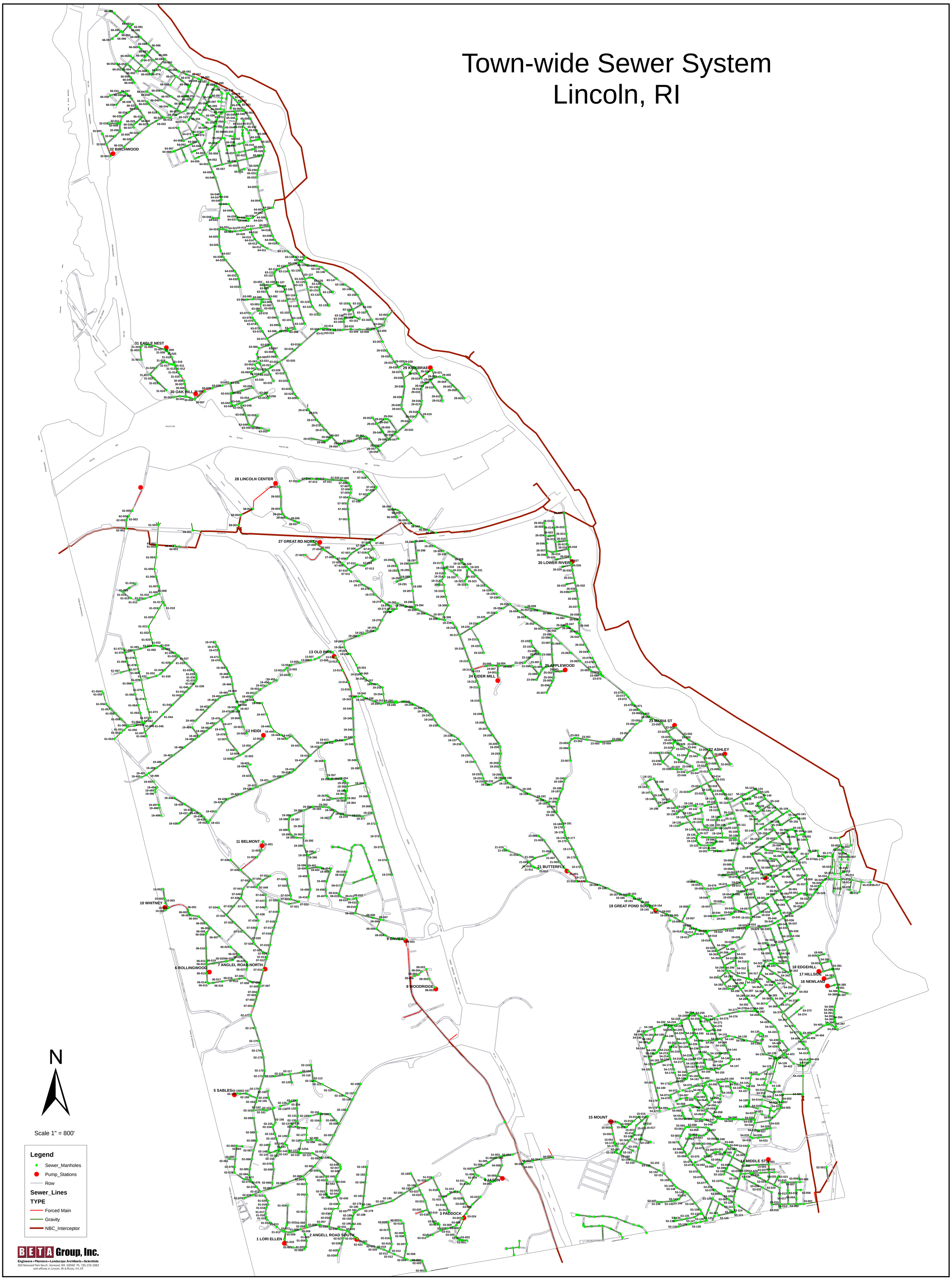
The following list outlines key components of the NBC's FOG Program:

- Compliance Assistance: Pollution Prevention Engineers from the University of Rhode Island and the NBC are available to meet with restaurant owners and managers both one-on-one and in educational workshop settings to help implement sound and sustainable FOG Best Management Practices and better comply with NBC regulations.
- Self-Evaluation: Restaurant owners and/or operators will be given training through Compliance Assistance efforts to self-evaluate their facility in order to certify their FOG management practices utilizing the NBC Oil & Grease Compliance and Best Management Practices Workbook.
- Regulatory Inspections: The NBC Pretreatment Program will continue to inspect all restaurants on a regular basis. Participation in the FOG-ERP will help firms prepare for regulatory inspections and help them comply with NBC regulations.
- Certification: Restaurants that demonstrate a superior FOG management performance level will be issued a Certification of Best Management Practices which may be displayed in their place of business.

APPENDIX A

Wastewater Collection System Map

Town-wide Sewer System
Lincoln, RI



BETA Group, Inc.
Engineers • Planners • Landscape Architects • Scientists
315 Norwood Park South, Norwood, MA 02062 Ph. 781.255.1982
with offices in: Lincoln, RI & Rocky Hill, CT

APPENDIX B

Pump Stations Condition Assessment Reports

C&E Engineering Partners, Inc.
342 Park Avenue
Woonsocket, RI, 02895
Ph: (401) 762-1711
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Civil & Environmental Engineering Partners, Inc.

Technical Memorandum #1

Town of Lincoln Wastewater Facilities Plan
C&E Project No. J0506

Date: August 26, 2005
To: N. Kim Wiegand, P.E., Town Engineer

Subject: Existing Pump Stations Evaluation
Submersible Grinder Pump Stations

Introduction

C&E Engineering Partners, Inc. (C&E) has completed an evaluation of the Town's thirty-one (31) existing wastewater pumping stations as described under Task 2 of Exhibit A to the Agreement dated June 16, 2005. The Town's existing pumping stations can be segregated into three (3) general types: Submersible Grinder Pump station, Wet Well / Dry Well Pump station, and Screw Pump station. Twenty-five (25) of the Town's pump stations are Submersible Grinder Pump type stations, five (5) stations are Wet Well / Dry Well type stations, and one (1) station is a Screw Pump type station.

C&E personnel conducted site visits to observe station conditions on July 13, 14, 27, and 28, 2005. Observations were limited to visual inspection of the facilities to establish the anticipated remaining useful service life for the pump stations so that this information can be incorporated into the wastewater facilities planning process. Detailed evaluation of the facilities and specific performance testing were not conducted. A Technical Memorandum prepared for each station type presents the conditions observed at the stations, and conditions reported by Sewer Department personnel, so that the requirements for maintaining these facilities for the 20-year planning period can be established and incorporated into the Wastewater Facilities Plan. The reference standard utilized as the basis for evaluating the pump stations is the 1998 Edition of the Guidelines for the Design of Wastewater Treatment Works Technical Report #16 (TR-16) as prepared by the New England Interstate Water Pollution Control Commission.

This Technical Memorandum #1 describes the general conditions observed at the Submersible Grinder Pump stations. Specific conditions identified for individual stations are provided in the Submersible Grinder Pump Station Survey Summary Table appended to this Technical Memorandum. Conditions observed at the Wet Well / Dry Well and Screw Pump type stations are presented in Technical Memorandum #2 and #3, respectively.

General Description

As noted above, 25 of the Town's 31 wastewater pump stations are of the Submersible Grinder Pump type. TR-16 recommends wet well / dry well type stations as preferable but allows for other types of stations under certain circumstances. TR-16 requires a minimum of two pumps,

with each pump being capable of handling the peak design flows. Two pumps are provided for all Submersible Grinder pump stations and record documents provided by the Town indicate that each pump is capable of discharging the full design load. As such, the existing station design and capacities generally conform to the current TR-16 capacity guidelines. As the pump stations are in serviceable condition and each conveys a relatively small flow volume, station replacement at each location for the sole purpose of providing a Wet Well / Dry Well type station would not be recommended.

The wet well for each station is constructed of precast concrete manhole ring and base sections and a flat slab top section with a cast-in aluminum access hatch. An aluminum ladder is provided to allow access to the base level of the wet well chamber. Influent flow enters the wet well via gravity sewer connection(s) constructed primarily of PVC pipe, with concrete materials apparently utilized at a few stations. One station receives flow from an individual residential pressure sewer connection in addition to gravity flow. A vent pipe through the top slab provides passive ventilation of the wet well chamber.

All of these stations employ duplex pumping systems with two (2) submersible grinder pumps. The individual discharge from each pump is piped to a common station effluent force main. The individual discharge and effluent force main piping is constructed of galvanized steel. The individual pump discharges are fitted with a check valve and isolation gate valve prior to joining at the common force main. Pumps are removed and installed via a galvanized steel guide rail system. While the isolation valves and connections to the common effluent force main are located within the wet well structure at the majority of stations, some locations have a separate precast concrete chamber in which the isolation valves and connection to the common force main are located. The valve chamber has a flat top slab with cast-in access hatch at these locations and is provided with a drain pipe with an isolation gate valve and check valve to prevent backflow from the wet well allow the valve chamber to be drained to the wet well as may be needed. There are no odor control systems at the submersible grinder stations.

At grade construction consists of the wet well and valve chamber (as applicable) top slabs and the main electrical cabinet enclosure. Access hatches and the main electrical cabinet are secured by padlock, and chain link security fencing with padlocked gate is provided at some stations. Based on their proximity to adjacent streets, most stations appear to be located within public right of way. Paved bituminous access / parking drives occur at some stations.

Electrical and control equipment is housed in a pad mounted enclosure cabinet. The electric service meter socket and receptacle for connecting a portable emergency generator are mounted on the exterior of the cabinet. However, one station is provided with a permanent emergency generator installation on-site and one station did not have a utility meter on the enclosure. The electric service panelboard, switches / breakers for transfer between emergency and utility power supply, pump controls and motor starters, and alarm dialer with a battery backup power supply are located in the main enclosure. Provisions for transfer between utility and emergency power vary from station to station. Some stations are provided with a manual transfer switch in a separate enclosure. Other stations have the Utility and Emergency power main breakers mounted side by side with a slide bolt guard to prevent both breakers from being set to the "On" position at the same time; the slide bolt guard is configured with a set screw to maintain its

position over the selected breaker. An automatic transfer switch is provided where a permanent emergency generator is on site.

The pump control system is based on changing level in the wet well. All but one station is equipped with a compressed air bubbler level sensing system and a mercury level gauge / switch controls. A microprocessor based pump controller and submersible pressure transducer that responds to changing water level in the wet well are provided at the one station that is not equipped with a bubbler level system and mercury level gauge controls. Pump controls are segregated behind a separate inner door inside the main enclosure cabinet. The pump level gauge, status and alarm lights, pump run time meters, and pump H-O-A switches are mounted on the face of the inner door, as are the side by side Emergency and Utility power main breakers for stations without a separate enclosed manual transfer switch. Pump controller module, relays, motor starters and bubbler system equipment is mounted behind the pump control panel door.

The pump stations originally were equipped with a computer based monitoring system within a separate panel inside the main enclosure. An autodialer has been installed in the separate enclosure, replacing the computer based system, to transmit selected alarms to the Sewer Department (weekday working hours) and Police Department (nights / weekends). Abandoned computer system hardware remains in the enclosure at some stations. An uninterruptible power supply (UPS) battery backup unit is provided for the autodialers in the main enclosure.

Record documentation provided by the Town indicates that the pipelines and pump stations are designed to accommodate a future flow projected to the year 2035 and mechanical systems are designed for a 20 to 25 year service life. Construction of the Submersible Grinder Pump stations occurred between 1986 and 1998, with the majority of stations constructed prior to 1992 and three stations constructed in 1993 or later. This information indicates that the mechanical systems at the many of these facilities are approaching the end of their intended service life and may require replacement in the near future. The future flow design year is coincident with the end of the 20-year planning period for the current Plan and, as such, it is expected that the buried pipelines and pump station wet wells will serviceable and capable of accommodating flows to the end of the planning period.

Observations and Evaluation

C&E personnel visited each station, accompanied by Town Sewer Department personnel, to perform on-site observations. Observations and considerations to be incorporated into the Wastewater Facilities Plan are provided in the following narrative. Additional detail on specific items observed and conditions identified are provided for individual locations in the Station Survey Summary Table appended hereto. The summary table is itemized into categories corresponding to the headings listed below. The following narrative also provides detailed description of the conditions and annotations that appear in the summary table.

Site (Land Use / Access)

Site conditions generally are provided for informative purposes and are not significant wastewater management planning considerations unless specifically noted. The wet well, valve chamber (where occurring), and electrical enclosure cabinet were accessible at all locations. The

Summary Table provides the general land use in the vicinity surrounding the station under the Land Use heading and provisions for accessing the site under the Access heading as follows:

Land Use	
R	Residential
I	Industrial
C	Commerical

Access	
S	Street access, no site drive
D	Access drive access provided from street to station

Most of the stations are located in predominantly Residential areas with access from the adjacent public street.

Building / Structure

Interior conditions of station wet wells were observed from grade level through the access hatch opening. Station wet wells were not entered to perform the observations. The precast concrete structures appear to be in generally sound condition at all stations and no substantial deteriorated conditions were observed. Several stations accumulate a grease ring at the upper / lead pump on water level and the extent of accumulation varies from station to station. The Town reportedly has implemented the use of prepackaged biological treatment products, which has reduced the accumulation of grease in its facilities. Hydraulic integrity of the stations appears to be satisfactory however, evidence of possible infiltration through ring section joints and / or pipe penetrations was observed at some locations. No active evidence of infiltration into the wet wells was observed, but it should be noted that groundwater conditions are assumed to be at seasonal (summer) low levels at the time the observations were conducted. Satisfactory service is expected for the pump station precast concrete structures for all locations for the 20-year planning period.

Access hatches were padlocked and functional at all stations and the covers and frames exposed to view in good condition. The spring / piston assembly and its cover exhibit signs of corrosion to varying extents and the covers have rusted through at some locations. Aluminum ladders for accessing the wet well chambers appeared to be in functional condition at all stations with minor surface corrosion observed. Some stations are equipped with ladder extensions to facilitate entering and exiting. Satisfactory service is expected from the access hatches and ladders for the planning period. However, the spring / piston assemblies should be replaced as needed to maintain proper operation and anchors securing ladders to the wet well should be monitored for signs of deterioration and replaced if deficient conditions are observed. The Town should also consider installing ladder extension devices at all locations.

The exposed vent piping appears to be in satisfactory condition at all sites. The inlet to the vent piping inside the wet wells was not observed. Most sites have flanged ductile iron vent piping, but welded steel pipe construction occurred at a few locations and one station vent was PVC. Surface coatings and conditions varied from site to site and no significant deterioration was

observed. Vent piping should be cleaned and repainted to protect the piping where coating conditions are degraded. Bird / vermin screens were mostly in place, but repair or replacement is necessary at some locations. Surface coating and bird / vermin screen assessment and repairs should be included in routine maintenance activities for the stations. Satisfactory service is expected for all locations for the 20-year planning period provided that these routine maintenance activities are sustained.

The Building Structure column in the Summary Table identifies the station conditions as follows:

G	Good, no conditions observed or reported that are expected to impact performance
F	Fair, conditions of minor deterioration observed or reported that are not expected to impact performance
P	Poor, conditions of minor to significant deterioration observed that can be expected to impact performance

Mechanical / Process

Mechanical process systems for these stations include the submersible grinder pumps, piping, valves, and appurtenances. The pumps were not accessed for inspection and any specific operating conditions indicated are based on reported information from Sewer Department personnel unless noted otherwise.

Each station is equipped with two (2) ABS "Piranha" submersible grinder pumps with either 3HP or 5HP motors. Both pumps at each station are the same size and rating. Pump motors are single-phase at all but one station, which has three-phase motors. Both pumps were reportedly operational at most stations, but Sewer Department personnel indicated some stations had one pump out of service awaiting removal, troubleshooting, and repair. As indicated above, some stations have been in service for nearly twenty years, in which case the pumps are approaching the end of their expected service life. The Town maintains an inventory of spare pumps in case of need and Sewer Department personnel indicated that replacement pumps have been installed and remained in service on occasion.

Each pump is provided with a run time meter in the control panel. Sewer Department personnel indicated that these meters have not been reset; in which case current readings would be total run time for the pump position (Pump No. 1 and Pump No. 2) but may not represent the specific unit in service at this time if a replacement unit was installed. In general, the operation and performance of pumps approaching twenty years in service should be monitored on a frequent basis and replacement scheduled when satisfactory conditions are not provided. Based on our observations, the design life of the submersible grinder pumps, and the Town's description of the operation and performance of the various stations, the Wastewater Facilities Plan should include evaluating pumps for replacement upon reaching twenty years in service in effort to minimize the chance of service interruptions. Replacement decisions for specific units would be based

upon observations of individual performance as the scheduled replacement milestone is approached.

Pump Size, Approximate Age, and Projected Replacement are provided in the Summary Table. Pump size is the motor rating, either 3 or 5 HP. Approximate Age is based upon the fabrication date indicated in the control panel. Projected Replacement is based on 20 years of service and the Approximate Age listed for the pumps.

Each pump is provided with a guide rail for installation and removal. Configurations and conditions of the pump guide rails, upper guide brackets, and related supports observed varied from station to station. Mild to moderate surface corrosion was observed on most of the guide rails, which appear to be constructed of galvanized steel pipe. The heaviest corrosion generally was observed between the normal pump on and pump off operating levels where the guide rails are subjected to repeated submersion and exposure due to pump cycling.

The upper guide brackets appear to of cast iron or steel construction with moderate to heavy surface corrosion observed. The upper guide bracket is used to anchor the guide rail to the structure. At some installations the guide bracket is mounted directly to the precast concrete structure at the hatch opening, at others the guide bracket is secured to a structural steel angle beam that is mounted to the precast structure. Moderate to heavy surface corrosion of the structural steel angle was evident at locations where a steel beam is incorporated in the mounting configuration.

The guide rails, brackets and supports appear to be in functional condition at all locations at this time. Repairs and / or replacement should be considered when other mechanical replacement or repair work is scheduled or becomes necessary. Guide rails, brackets, and / or supports that are not degraded can remain in service where the existing installation is compatible with replacement mechanical systems. The condition of degraded items should be monitored and replacement performed before deterioration results in improper performance. Replacement will be necessary where the existing installation is incompatible with replacement mechanical systems regardless of condition.

Conditions identified in the Summary Table for the guide rail system include:

L	Limited surface corrosion observed, continued satisfactory performance expected
M	Moderate surface corrosion observed, continued satisfactory performance expected, conditions should be monitored for further deterioration
H	Heavy surface corrosion observed, continued satisfactory performance can not be expected for extended periods, conditions should be monitored and items replaced where improper performance occurs

The individual pump discharges and station effluent force main in the wet wells are constructed of galvanized steel piping. While this material is considered to be corrosion resistant, the harsh environment and conditions associated with raw wastewater and prevalent in the wet wells has resulted in moderate to aggressive corrosion of the process piping at the pump stations. Sewer Department personnel indicated that pipe failure was not uncommon and noted that the pump discharge piping at one station was scheduled for repairs due to pipe failure. Significant surface corrosion and / or evidence of prior repairs were observed at several stations and a failed discharge pipe was discovered at one station during the site visit.

Based upon the conditions observed and the operating history described by the Town, a twenty to twenty-five year service life appears to be an overly optimistic expectation and satisfactory performance of the pump discharge piping in the wet wells is not anticipated for any extended period. At this time, the Town should continue to monitor and observe the piping conditions and implement repairs as they become necessary to maintain acceptable station operations. The Wastewater Facilities Plan will include provisions for piping materials with better resistance to corrosion, such as stainless steel or PVC, in effort to provide a longer anticipated useful service life and a long-term solution for the discharge piping conditions experienced by the Town.

The individual discharge and force main piping appeared to be in good condition at locations where a separate valve chamber is provided and satisfactory service is expected for the 20-year planning period. Conditions for wet well piping are identified in the Summary Table and include:

G	Pipe appears to be in good condition with minor surface corrosion observed, continued satisfactory performance expected
F	Pipe appears to be in fair condition with moderate surface corrosion observed, continued satisfactory performance expected, conditions should be monitored for further deterioration
P	Pipe appears to be in poor condition, heavy surface corrosion observed, continued satisfactory performance can not be expected for extended periods, conditions should be monitored and items replaced where improper performance occurs
X	Pipe failure reported or observed, repairs / replacement required immediately
XR	Evidence of prior pipe repairs observed or reported

Each individual pump discharge includes a guide rail base and discharge elbow, a check valve to prevent backflow, and a gate valve to isolate the pump from the discharge force main. The guide rail base, discharge elbow, and check valve are located below the low water level operating range and remained submerged during the site observations. The gate valves are of PVC body

construction and appeared to be in generally satisfactory condition. Specific observations and / or operating conditions noted by Sewer Department personnel are provided in the Summary Table as applicable. Evaluation of these components should be performed when major mechanical / process equipment replacement is scheduled and degraded items replaced as needed.

The gravity influent piping observed at the stations appeared generally to be in satisfactory condition. Pipe materials are PVC at a majority of the stations, however the piping appeared to be concrete at some locations. Most of the exposed piping entering the wet well appeared to be cut clean more or less square to the pipe. Minor irregularities at the inlet stubs were observed at some locations, but no unusual discharge conditions were observed as flow entered the wet wells. Grease accumulates at the lead pump on / operating range high water level at many stations and the Town indicated that bagged biological treatment additives are utilized to reduce the impact due to grease buildup. The Summary Table does not provide conditions for influent piping due to the limited extent of observations. Based upon the information in record documents that the pipelines are designed to accommodate a future flow to the year 2035, the station influent sewers are expected to provide satisfactory service for the planning period.

Sewer Department personnel indicated that odor complaints have occurred at the stations generally due to their proximity to adjacent residential areas but did not identify any specific concerns for excessive odors or complaints. Provisions for odor controls at these stations are limited and could be impractical due to the size and configuration of the station and available space for additional equipment installation. Odor emissions for submersible grinder pump stations will be discussed coordinated further with the Town during planning process to determine if any odor controls appear to be needed and considerations for odor controls included in the Wastewater Facilities Plan as may be applicable.

Instrumentation & Control

The pump station control system operates the pumps automatically in response to changing wet well levels with the pump selector switch in the "Auto" position or manually with the switch in the "Hand" position. Lead / Lag pumps can be selected manually or to alternate between the two pumps at the pump controller. The lead pump is intended to handle station flows under normal operating conditions. The lag pump "On" level set point is above high wet well alarm level and the lag pump is not called to operate unless the high wet well alarm level is exceeded. High and low wet well levels also are monitored and alarms activated via the pump controller. Some stations are also equipped with a wet well flood level float switch to indicate wet well flood alarm conditions in addition to the pump control system alarms.

All but one station is equipped with a compressed air bubbler level sensing system and a mercury level gauge. The mercury gauge responds to back pressure on the bubbler system from the wet well level and provides a visual indication of the water level. Pump control and alarm wiring is connected to the level gauge and the changing mercury level opens and closes circuits to operate the pumps and activate alarms. Control and alarm set points are adjustable by through a series of wiring contact stud connections at the back of the level indicating gauge. A microprocessor based pump controller and submersible pressure transducer that responds to changing water level in the wet well are provided at the other station. The compressed air bubbler system and pump

controllers, including the microprocessor based controller, are proprietary systems by EG Pump Controls of Jacksonville, FL.

The compressed air bubbler systems consist of two small air compressors and an air system controller, there are no compressed air receiver tanks and the lead compressor operates continuously. According to Sewer Department personnel, fouling of components within the air compressor control systems has resulted in degraded performance of compressed air bubbler systems and station operations. Two of the stations constructed after 1993 utilize a later generation bubbler system controller (BAMS Bubbler Air Monitor System vs ATC-10 Air Transfer Chassis), the submersible pressure sensor and digital pump controller are provided at the most recently constructed station in place of the bubbler system and mercury level gauge controller.

Although the bubbler systems include a primary and backup compressor, these controls do not provide system redundancy as there is no backup in the event of an air system controller failure. Similarly, a single pressure transmitter with no backup level sensing is provided for the microprocessor based controller system. The pumps will not operate in the event of a failure of the air system controller or the pressure transducer. Any future control systems should include redundancy for improved reliability.

The air system controllers monitor pressure and the autodialer will transmit an alarm in the event of low air system pressure allowing for immediate response and action as necessary at the bubbler system stations. However, there are no apparent provisions to sense or transmit either level signal / transducer failure or high wet well level independently of the transducer the other station. Based upon these conditions, it appears that the station could become inoperable and no alarm condition reported to alert the Town that conditions exist that require response or action.

The pump controllers are functional at all stations and appear to be in serviceable condition. Sewer Department personnel indicated that various operational difficulties and malfunctions have occurred within the pump controllers that the Town attributes to utility power surges. Control relays, motor starters, wiring and other miscellaneous hardware have been replaced where necessary where such conditions have occurred and overall the pump controls are operating acceptably at all stations. As noted above, the Town has experienced reduced performance of the air compressor control systems as the stations remain in service for longer periods. Based these conditions, the pump controllers are expected to remain in serviceable condition for the twenty year planning period, but, replacement of the air compressor control systems apparently will be necessary by the time these systems approach twenty years in service. The Wastewater Facilities Plan should include provisions for evaluating bubbler system controllers for replacement upon reaching twenty years in service.

Although Sewer Department personnel indicate that the later generation (BAMS) bubbler system controllers exhibit improved performance, this improvement could be associated with the shorter period that these systems have been in service. Similar performance conditions also may be experienced as these units age, and the Wastewater Facilities Plan will include evaluation of these units for replacement on a similar schedule. The submersible pressure transducer and digital controller are considered to be state of the art systems and satisfactory performance is

expected for the planning period, but a pressure signal fail and / or wet well flood level alarm should be provided.

The alarms systems for the stations include local indicating lights, silence, and reset buttons, and remote transmission of selected alarm conditions by autodialer to the Sewer Department or Police Department (nights / weekends). All stations transmit the following alarms: high wet well level, low wet well level, power fail, and low air pressure (bubbler system). Some stations also transmit a wet well flooding alarm that is signaled by a float switch independent of the level sensing system. The alarms transmission autodialer systems have been recently installed by the Town at all stations and are reported to be operating in satisfactorily. The UPS unit at one station was found to be inoperable during the site visit conducted and reportedly will be replaced by the Town. As the alarm transmission equipment has recently been replaced and is reported to be in good operating condition, satisfactory performance is expected for the twenty year planning period.

Conditions identified in the Summary Table for Instrumentation & Controls include:

S	Satisfactory, control system reported to be in operating condition
M	Marginal, control system reported to be in operating condition with some malfunctioning or inoperable components
P	Poor, major components of control system reported as failed or inoperable, station operating on modified control system

Each station was constructed with provisions for sensing and indication of the station effluent force main discharge pressure. Most stations had the indicating dial gauge mounted on the force main piping in the wet well and reading the gauge required accessing the wet well chamber. As such, readings were not routinely recorded for these gauges according to Sewer Department personnel. The discharge gauge connection is located in the on the effluent force main inside the valve chamber at stations with a separate valve chamber. Some stations have the indicating dial gauge remotely mounted inside the electrical cabinet enclosure, which facilitates reading the gauge. Sewer Department personnel indicated that current operations and maintenance routines do not include taking pressure readings at any station.

Discharge pressure gauges are recommended by TR-16 for use in monitoring pump operation and performance and evaluating deficient or degraded operating conditions. TR-16 generally recommends that stations be designed so that routine access to wet wells is not required and that pressure gauges be mounted away from process pipe. Installing a submersible intrinsically safe pressure transmitter mounted to the effluent force main with remote readout to replace the existing (and previously removed) pressure gauges is recommended to be included in the Wastewater Facilities Plan.

Electrical

The electrical systems include conduit, wiring, enclosures, and devices. The descriptions presented here are based upon observations by C&E and are limited generally to the physical appearance of electrical system components and to conditions described by Sewer Department personnel. No observations or inspections were performed by an Electrical Engineer as such inspection is beyond the scope of this project. Explosion-proof equipment is required in sewage pump station wet wells. Record documents indicate the use of explosion proof equipment in the station wet wells, but detailed evaluation by an Electrical Engineer would be necessary to determine if the components are in proper operating condition.

A 230-volt three-phase service and permanent emergency generator with automatic transfer switch is provided at one location. All other stations have 115 / 230 volt single-phase electric utility service and a receptacle for connecting a portable generator for emergency power. Most station sites are in primarily residential locations, fed by the available (residential) power grid in the area and Sewer Department personnel indicated that deficient operating conditions experienced at several stations have been attributed by the Town to utility power inadequacies. No utility metering was observed at the station located in the Amica complex; Sewer Department personnel reported that the station is fed from the Amica complex power grid and not directly from utility power. Assessment of utility power requirements and / or potential deficiencies for the pump stations is beyond the scope of this evaluation.

A pad mounted, metallic enclosure cabinet that houses all electrical and control equipment is provided at each station. The enclosures were padlocked at all locations and are constructed of painted steel at older stations and stainless steel a newer installations. Utility service meter box and portable generator receptacle are mounted on the exterior of the enclosure. The stainless steel enclosures appear to be in good condition. The painted metal enclosures generally appear to be in serviceable condition with minor to moderate surface corrosion noted at some locations. Evidence of water infiltration into the enclosure was observed at some stations and Sewer Department personnel indicated that water has entered the cabinet through the electric and / or telephone service conduits that stub up into the bottom of the cabinet at certain locations. These conduits should be sealed against water infiltration. Satisfactory performance is expected for the planning period for the electrical enclosure cabinets at all but one station, which appears to need repairs or replacement to address corrosion at the base of the cabinet. Replacement enclosures could be necessary when control systems are being replaced in order to accommodate new control system components. Observations on the control equipment within the main enclosure are provided above under Instrumentation & Controls.

As indicated in the General Description above, the provisions to enable transfer from utility to emergency power varies from station to station. In general, the older stations are furnished with a self enclosed manual transfer switch within the main enclosure and newer stations have Utility and Emergency main breakers mounted at the pump control panel door with a thumb-screw lockable slide bolt to prevent energizing the station from both source at the same time.

The circuit breaker panel boards generally appeared to be in good condition. Dedicated receptacles for process systems, such as the alarm dialer, and a GFIC circuit receptacle for convenience and maintenance activities typically are provided. Each station is provided with a

single telephone line. The autodialer is connected permanently to the phone line, and a standard telephone jack also provided inside the main enclosure. The Town has installed a telephone handset at several locations, however, using the phone line to dial out temporarily interrupts the ability of the autodialer to transmit any alarms. The handset must be returned and properly cradled or disconnected from the from the phone jack following use so that the autodialer can transmit alarm conditions as necessary. Sewer Department personnel did not identify any particular operational issues for the basic electrical equipment. Satisfactory performance is expected for the planning period for these electrical components within the main enclosure.

The electrical system observed in the wet wells includes conduit, junction boxes, and receptacles for the submersible pumps. Moderate to heavy surface corrosion was observed on these items. The pump receptacles and boxes have been replaced at some locations with new corrosion resistant boxes and Sewer Department personnel indicated that replacements at all stations are proposed to occur as the need arises and as maintenance schedules permit. In general, the receptacle boxes in the wet wells are in fair to poor condition where not replaced and would not be expected to provide satisfactory service for an extended period. The replacement boxes appear to be in generally satisfactory condition and continued acceptable service is expected for these items. Explosion-proof equipment is required in sewage pump station wet wells, however, assessment of the existing systems with respect to explosion-proof conditions is beyond the scope of this evaluation.

Conditions identified in the Summary Table for Electrical items include:

A	Automatic transfer switch and permanent emergency generator
M	Manual transfer switch and receptacle for portable emergency generator connection
CB	Dual circuit breaker with thumb-screw mechanical interlock and receptacle for emergency generator
W	Water infiltration observed or reported at conduit entry stub up
R	Surface rusting observed inside enclosure
T	Telephone handset provided in enclosure
C	Moderate to heavy surface corrosion observed at pump receptacle boxes in wet well
FRP	Pump receptacle boxes in wet well replaced with FRP junction boxes.

While most of the electrical systems generally are expected to provide satisfactory service, certain components apparently will require replacement during the planning period due to the deteriorated conditions or because of integral association with other equipment that requires

replacement (pumps, controls). The electrical systems design should conform to TR-16 recommendations regarding accessibility of submersible pump wiring junction boxes and connectors from outside the wet well as well as applicable electrical code requirements where electrical system components are to be replaced.

Conclusions

No major repairs to or replacement of the existing pump station structures are expected to be necessary during the twenty year Wastewater Facilities Planning period. Normal maintenance and replacement of minor components as the need arises should provide for continued satisfactory operation for the foreseeable future. Replacement of structural components of the guide rail systems is to be coordinated with pump replacement as necessary.

The pumps, discharge and effluent force main piping, and piping supports at all stations are expected to require replacement within the 20-year planning period. The pump control systems are expected to be remain serviceable for the planning period, however, the replacement of the air compressor controls within the pump control system are expected to be necessary within the planning period. The control systems at the station are a proprietary system and most stations employ dated technology by current industry standards. Replacing only components that exhibit substandard performance or replacing entire station control systems should be considered in conjunction with pump replacement requirements to determine the best course of action to pursue.

In general, the electrical systems are expected to provide satisfactory service during the planning period. However, portions of the electrical installations associated specifically with the pumps and controls systems and would be replaced upon replacing those items. TR-16 and electrical code compliance should be incorporated into any major renovations. Replacing the existing enclosure cabinets also may be necessary when electrical and control systems are replaced.

Town of Lincoln Wastewater Facilities Plan
Submersible Grinder Pump Station Survey Summary Table
(Refer to Technical Memorandum #1 dated 8/26/05 for legend and descriptive information)

C&E Engineering Partners, Inc.
J0506

Station	Site		Building/Structure		Mechanical/Process					Instrumentation & Controls	Electrical		Comments
					Pumping System			Guide Rails	Piping				
	Land Use	Access	Concrete Chamber	Hatch & Ladder	HP	Age (Approx)	Projected Replacement				@Panel	@Wet Well	
Applewoood	R	S	G	P	3	18	2007	M	XR	S	M	C	Hatch spring housing rusted out
Arlington	R	S(1)	G(8)	F	3	19	2006	H	X	S	M	C	Patch above / chip below influent pipe
Ashley	R	S	G	P	3	16	2009	M	X(8)	S	M,R(8)	C	Hatch spring housing rusted out; Failed piping; Main enclosure rusting through
Belmont	R	S	G	G	3	7	2018(7)	L	G	S(8)	CB		Pressure transducer/DigiGage controller
Birchwood	R	S	G	F	5	16	2009	M	F	S	M,T	FRP,C	One gravity, one pressure sewer influent
Butterfly	R	S	G	F	5	14	2011	M	G	S	CB,T	C	Overflow MH provided
Cider Mill	R	S	G	F	3	16	2009	H	F	S	M,T	C	Station to be relocated/replaced by developer
Davies	R,C	S(1)	G(2,3,8)	F	5	12	2013	M	F	S(8)	A	C	BAMS air controller; Influent trash basket
Eagle Nest	R	S	G(6)	F	5	16	2009	H	F	S	M,R,T	FRP	
Edgehill	R	S	G(8)	F	3	19	2006	M	P	S	M,W,T	C	Limited spalling at precast ring joint
Great Road	R	S	G	F	3	18	2007	H	F	S	M	C	
Heidi	R	S	G	F	3	14	2011	M	F	S	CB	C	Two influent gravity sewer connections
Hillside	R	S	G	F	3	19	2006	M	X(8)	S	M,T	FRP	WW piping to be replaced
Jason	R	D	G	G	5	17	2008(7)	L	F	P(5)	M	C	
Lincoln Center	C	S	G(2,8)	F	3	15	2010	M	G	S	M(8),T	C	Chip/patch at ring joint; No utility meter
Lori Ellen	R	D	G	F	5	16	2009	L	F	M(4)	M,T	FRP	Two influent gravity sewer connections
Middle	R,C	S(1)	G	F	3	19	2006	M	P	S	M	C	
Mount	R	S	G	F	3	19	2006	M	P	S	M	C	Two influent gravity sewer connections
Newland	R	S	G	F	3	19	2006(7)	M	P	S	M,W,T	FRP	
Oak Hill	R	S	G(6,8)	F	5	16	2009	M	F	S(8)	M,R,T	C	Valve pit lock frozen; UPS unit not functioning
Old Pike	R,C,I	S	G	F	5	14	2011	L	F	S(8)	CB		Panel shorted out, wiring has been replaced
Paddock	R	S	G	F	5	17	2008	M	F	S	M	FRP	Two influent gravity sewer connections
Rollingwood	R	S	G	G	5	15	2010(7)	L	F	M(4)	CB,T	FRP	Pump 1 off line - capacitors/starter
Whitney	R	S	G	F	3	10	2015	M	G	S(8)	CB,T	FRP	BAMS air controller; Added heat for air line
Woodridge	R	S	G(6)	F	3	15	2010	M	F	M(4)	M	C	

Footnotes:
(1) - Chain link site fence provided
(2) - Staining evidence of apparent water infiltration at precast section ring joint
(3) - Staining evidence of apparent water infiltration at pipe penetration
(4) - Pump Controller malfunction
(5) - Air compressor controller malfunction
(6) - Separate discharge valve chamber
(7) - One pump out of service, repairs required
(8) - See Comments column

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Civil & Environmental Engineering Partners, Inc.

Technical Memorandum #2

Town of Lincoln Wastewater Facilities Plan
C&E Project No. J0506

Date: August 26, 2005
To: N. Kim Wiegand, P.E., Town Engineer

Subject: Existing Pump Stations Evaluation
Wet Well / Dry Well Pump Stations

Introduction

C&E Engineering Partners, Inc. (C&E) has completed an evaluation of the Town's thirty-one (31) existing wastewater pumping stations as described under Task 2 of Exhibit A to the Agreement dated June 16, 2005. The Town's existing pumping stations can be segregated into three (3) general types: Submersible Grinder Pump station, Wet Well / Dry Well Pump station, and Screw Pump station. Twenty-five (25) of the Town's pump stations are Submersible Grinder Pump type stations, five (5) stations are Wet Well / Dry Well type stations, and one (1) station is a Screw Pump type station.

C&E personnel conducted site visits to observe station conditions on July 13, 14, 27, and 28, 2005. Observations were limited to visual inspection of the facilities to establish the anticipated remaining useful service life for the pump stations so that this information can be incorporated into the wastewater facilities planning process. Detailed evaluation of the facilities and specific performance testing were not conducted. A Technical Memorandum prepared for each station type presents the conditions observed at the stations, and conditions reported by Sewer Department personnel, so that the requirements for maintaining these facilities for the 20-year planning period can be established and incorporated into the Wastewater Facilities Plan. The reference standard utilized as the basis for evaluating the pump stations is the 1998 Edition of the Guidelines for the Design of Wastewater Treatment Works Technical Report #16 (TR-16) as prepared by the New England Interstate Water Pollution Control Commission.

This Technical Memorandum #2 describes the general conditions observed at the Wet Well / Dry Well Pump stations. Specific conditions identified for individual stations are provided in the Wet Well / Dry Well Pump Station Condition Survey sheets prepared for each station and appended to the Technical Memorandum. Conditions observed at the Submersible Grinder Pump and Screw Pump stations are presented in Technical Memorandum #1 and #3, respectively.

General Description

As noted above, 5 of the Town's 31 wastewater pump stations are of the Wet Well / Dry Well type. These stations include: Angel Road North, Angel Road South, Great Road, Maria, and

Kirkbrae. TR-16 recommends wet well / dry well type stations as preferable and requires a minimum of two pumps for all stations, with each pump being capable of handling the peak design flows. Two pumps are provided at four of the five Wet Well / Dry Well pump stations and record documents provided by the Town indicate that each pump is capable of discharging the full design load at these stations. Three pumps are provided at the Great Road pump station. For stations with three (or more pumps), TR-16 requires that peak flows be handles with any one pump out of service. Record documents indicate that the capacity of the Great Road station with two pumps running exceeds the peak design flow. Based on this information, the existing station design and capacities generally conform to the current TR-16 capacity guidelines.

The Wet Well / Dry Well stations are constructed of precast concrete rectangular structures with the wet well and dry well chambers cast separately. The upper sections of the wet well and dry well chambers are exposed above grade, with the top slab general a few feet above the surrounding ground surface. Aluminum access hatches are provided in the top / roof slabs to provide entry to the chambers. Aluminum ladders are provided to allow access to the wet well operator platform and to the control level and pump level in the dry well. The Town has constructed wood framed building structures above the precast concrete chambers at three of the stations.

Influent flow enters the stations via gravity sewer connection and flows through a manually cleaned bar rack as it enters the wet well. The Great Road station has a divided wet well with slide gates to isolate the two sections, the other four stations have a single undivided wet well. All stations are equipped with centrifugal pumps with close-coupled vertically mounted 3-phase electric drive motors. Seal water systems are provided at two stations. There are no odor control systems at the stations. Each pump is connected to the wet well by individual suction piping with isolation gate valve. Each individual pump discharge is provided with a check valve and isolation gate valve prior to joining at a common force main and exiting the station. The pump suction and discharge piping is constructed of flanged ductile iron. The pumps and piping systems are located in the lower (pump) level of the dry well chamber. Wet wells were not accessed to observe suction piping / elbows and concrete surfaces below the water line because ventilation systems were inoperable.

The pump control system is based on changing level in the wet well. Similar to the Submersible Grinder Pump stations, all Wet Well / Dry Well stations are equipped with a compressed air bubbler level sensing system and a mercury level gauge / switch controls. Pump controls are segregated from other electrical equipment in a separate control panel enclosure(s) in the dry well upper level. Variable Frequency Drive equipment is provided at one station that changes the pump speed in response to changing wet well water level conditions in effort to match pumping rates to station influent. The pumps operate at constant speed, in response to pump "On" and "Off" wet well level controls at the other four stations.

The pump stations originally were equipped with a computer based monitoring system within a separate enclosure in the upper control level. An autodialer has been installed in the separate enclosure, replacing the computer based system, to transmit selected alarms to the Sewer Department (weekdays, working hours) and Police Department (nights / weekends). Abandoned

computer system hardware remains in the enclosure at some stations. An uninterruptible power supply (UPS) battery backup unit is provided for the autodialer.

Wet wells and dry wells are provided with separate mechanical ventilation systems, however, most of the ventilation equipment was not functional. Electric unit heaters are provided in the dry wells, no heating is provided to the wet wells. Dehumidifiers are provided at four stations. A sump pump is provided in the pump level of each station dry well. Sump pump discharge piping is provided with two check valves and an isolation gate valve prior to penetrating through the structure to discharge back into the wet well.

Electrical and control equipment generally is located in the upper (control) level of the dry well chamber. One notable exception to this generalization is the seal water control panel at the two stations equipped with such systems, where this panel is located in the lower pump level. Main electrical disconnects, distribution panels, automatic transfer switch, phase conversion equipment (where applicable), and pump controls are located in the upper level. The electric service meter socket is located on the exterior of the stations. A stationary emergency generator unit is provided at each station mounted on the top slab of the precast concrete chambers. The emergency generators are inside the building at stations where wood structures have been added.

Record documentation provided by the Town indicates that the pipelines and pump stations are designed to accommodate a future flow projected to the year 2035 and mechanical systems are designed for a 20 to 25 year service life. Construction of the Wet Well / Dry Well Pump stations occurred between 1986 and 1990. This information indicates that the mechanical systems at these facilities are approaching the end of their intended service life and may require replacement in the near future. The future flow design year is coincident with the end of the 20-year planning period for the current Plan and, as such, it is expected that the buried pipelines and pump station wet wells will serviceable and capable of accommodating flows to the end of the planning period.

Observations

C&E personnel visited each station, accompanied by Town Sewer Department personnel, to perform on-site observations. Observations and considerations to be incorporated into the Wastewater Facilities Plan are provided in the following narrative. Additional detail on specific items observed and conditions identified for individual locations are provided in the Wet Well / Dry Well Pump Station Condition Survey sheets prepared for each station and appended hereto. The individual station survey sheets are itemized into categories corresponding to the headings listed below.

Site

Site conditions generally are provided for informative purposes and are not significant wastewater management planning considerations unless specifically noted. Surrounding land use and site features observed at each station are noted. At grade construction consists of the precast Wet Well / Dry Well chambers, emergency generator unit, lighting fixtures, electric utility meter, site fencing, and wood framed building (at sites where constructed above the precast chambers). Gates were padlocked where site fencing encloses the entire station. Access

hatches are padlocked and buildings, where constructed, have locking doors. Paved bituminous access / parking drives occur at all stations. The Town has constructed an exterior sump at two stations so that ground water can be pumped away from the stations. The sites generally were clear of obstructions and stations accessible at all locations.

Building / Structure

As noted above, the station construction is comprised of precast concrete wet well and dry well chambers. The wet well and dry well chambers are completely separate, individual structures. Each chamber is comprised of several casting sections that are field assembled with the wet well and dry well chambers side by side. Exterior conditions were observed for above grade construction exposed to view. Dry well chambers were accessed to observe interior conditions of the upper control level and lower pump level. Wet well chambers were not accessed and interior conditions were observed through the wet well access hatch opening. Building additions were accessed and conditions observed where constructed.

Groundwater intrusion is a significant concern of the Town at several locations and evidence of prior leakage was observed at all locations. The joint between dry well upper and lower chambers at access and / or equipment openings between the upper and lower levels was a location of apparent leaking common to all stations. Groundwater apparently has penetrated between the upper chamber floor slab and lower chamber ceiling slab and has been able to enter into the stations at the cast openings in the slabs provided for access and piping between the upper and lower levels. Evidence of apparent prior groundwater intrusion also was observed at various pipe penetrations through the structures. Sewer Department personnel indicated that the station flooding had been experienced at the Angel Road South station, temporarily submerging various mechanical and electrical system components.

As noted above, the Town has constructed an exterior sump at two of the stations so that ground water can be pumped away from the station. These efforts are intended to reduce groundwater intrusion impacts on the stations and conditions reportedly have improved at Angel Road North where the sump is completed and pump operating. No active evidence of water intrusion was observed at the stations, but it should be noted that groundwater conditions are assumed to be at seasonal (summer) low levels at the time the observations were conducted.

A 90° conduit fitting was observed with a cracked body at the Angel Road North Station. Sewer Department personnel indicated that this condition is attributed to floatation. Investigation of station buoyancy and possible flotation is beyond the scope of this evaluation, however, record documentation includes a buoyancy analysis for this station that indicates groundwater levels to four feet below the top slab will not result in flotation. If actual groundwater conditions have exceeded this level, buoyancy and partial flotation may have resulted.

The precast concrete structures appear to be in generally sound condition at all stations and no substantial deteriorated conditions were observed. Satisfactory service is expected for all locations for the 20-year planning period. However, impacts due to groundwater should be monitored and corrective measures implemented if acceptable station operation is interrupted or jeopardized. Corrective measures also should be considered and included to the extent practical in projects where major mechanical equipment and systems are to be repaired or replaced.

Access hatches were functional at all stations and the covers and frames exposed to view in good condition. Little or no surface corrosion was observed at the interior side of dry well access hatches. The spring / piston assembly and its cover on the interior side of wet well hatches exhibits signs of corrosion similar to the Submersible Grinder stations. Aluminum ladders for accessing the dry well chambers appear to be in good condition and are functional. Aluminum ladders and handrails in the wet well chambers appeared to be in functional condition at all stations with minor surface corrosion. Some stations are equipped with ladder extensions to facilitate their use; handrail and safety chain are provided at the access opening in the upper control level floor to the lower pump level. Satisfactory service is expected from the access hatches and interior ladders for the planning period. Conditions of wet well hatches, ladders and handrails should be monitored for deterioration. The hatch spring / piston assemblies should be replaced as needed to maintain proper operation and anchors securing ladders and handrails replaced if deficient conditions are observed. The Town should also consider installing ladder extension devices at all locations. Angel Road South was equipped with a short aluminum ladder to access the exterior roof slab an aluminum handrail at the perimeter of the roof slab for fall protection. The handrail appeared to be in functional condition. The grab bar at one side of the ladder was broken at its base plate and should be repaired. With necessary repairs, satisfactory service for the planning period can be expected.

Wood framed building additions were constructed on top of the precast concrete chambers at three stations. Two station additions are single story structures. The Great Road station has a two-story addition and the Sewer Department utilizes this station for storage of spare parts and maintenance supplies. The interiors of these additions are unfinished. No degraded conditions were noted or observed for exposed 2x framing, interior side of sheathing, or plywood decking (where provided). The exterior of the additions appear to be in good to fair condition. Fading or peeling surface coatings were observed and the exterior siding and trim appear to need recoating. Some deterioration of exterior wood trim was observed at the Maria Street station which should be repaired / replaced when the siding is recoated. Exterior wood stairs at Kirkbrae appear to be in good condition and are functional. Exterior concrete stairs at Great Road are functional, but have been damaged and require replacement. The age of the additions was not identified during the site visits. Satisfactory service is expected for the planning period with proper maintenance.

Mechanical / Process

Mechanical process systems for these stations include pumps, piping, valves, and appurtenances. The pumps were not operated specifically to perform detailed operational evaluations. Wet wells were not accessed to observe suction piping, bar racks, or slide gates at Great Road. Specific operating conditions noted for these items are based on reported information from Sewer Department personnel unless noted otherwise.

Four stations are equipped with two pumps and one station with three pumps. All pumps were reported to be operational except for Pump No. 1 at Kirkbrae which was awaiting a service call to troubleshoot and repair rattling observed by Sewer Department personnel during operation. Pump ratings and motor sizes are provided in the Wet Well / Dry Well Pump Station Condition Survey sheets. Two stations were equipped with separate seal water systems and controls. Sewer Department personnel indicated that seal water system at Angel Road South is not

operational due to damage from temporary submergence of the control panel. Pumps, motors, and local disconnect switches also were subjected to temporary submergence when the station flooded, but the pumps are both operational. Assuming that Kirkbrae Pump No. 1 can be returned to service with minor repairs, continued satisfactory service can be expected for all stations except Angel Road South. Continued satisfactory service for that station for extended periods cannot be expected due to the impact of temporary submergence of the pumps and motors.

Based on our observations, the anticipated service life of the pumps, and the Town's description of the pump operations, the Wastewater Facilities Plan should include general provisions for replacing pumps upon reaching twenty years in service. Replacement evaluations and decisions for specific units would be based upon observations of individual performance as the scheduled replacement milestone is approached. Additionally, the Wastewater Facilities Plan should recommend that replacement of the Angel Road South pumps be prioritized due to the deteriorated conditions at that station.

Suction and discharge piping is constructed of flanged ductile iron pipe. Piping and valves observed in the dry wells appear to be in serviceable condition with minor surface rusting observed. Piping should be cleaned and recoated when pumps are replaced. Discharge check valves also should be replaced in conjunction with replacing the pumps. Gravity influent piping was not observed at the stations and Sewer Department personnel did not identify any operational problems or deteriorated conditions for the wet well bar racks at any station or the Great Road station slide gates. Based on this information, continued satisfactory performance can be expected without replacement during the Planning period. However, it should be noted that the buoyancy and flotation conditions reported for at the Angel Road North station could impact the piping system. The wet well and dry well are separate structures with different resistance to floatation due to the water volume contained in the wet well. If the station is subjected elevated groundwater levels such that floatation results, the dry well would be expected to be more buoyant and damage to the suction piping possibly could be experienced due to uneven movement between the two station chambers.

The Great Road and Angel Road South stations are equipped with seal water systems to provide clean water to the sewage pump seals. The system at Great Road is functional, but one of two seal water pumps reportedly is out of service awaiting repairs. The seal water system is not functional at Angel Road South due to control panel damage from temporary flooding. Sewer Department personnel indicated that a constant flow (trickle) of water is directed to the pumps in effort to provide water to the seal. New seal water systems should be provided at both stations if the replacement pumps require such systems.

Sewer Department personnel indicated that odor complaints have occurred at the stations generally due to their proximity to adjacent residential areas but did not identify any specific concerns for excessive odors or complaints. Provisions for odor controls at these stations are limited and could be impractical due to the size and configuration of the station and available space for additional equipment installation. Odor emissions for each station will be discussed coordinated further with the Town during planning process to determine if any odor controls

appear to be needed and considerations for odor controls included in the Wastewater Facilities Plan as may be applicable.

TR-16 recommends that fully valved connections be provided to allow the use of portable pumps to facilitate temporary pumping around pump stations the in the event of equipment malfunction. Currently, no such provisions exist at the Town's pump stations. In addition to emergency operations, portable pump connections can be utilized during scheduled maintenance, replacement, and rehabilitation activities. The Wastewater Facilities Plan should include considerations for temporary pump connections to the pump station discharge force mains prior to the replacement of the pumping equipment at each station.

Instrumentation & Control

The instrumentation and control systems for the pump stations include the pump controls, process monitors, and alarms. The pump controls at four of the Wet Well / Dry Well Pump stations, all except Great Road, basically are the same as the Submersible Grinder Pump station controls (i.e. compressed air bubbler level sensing system and mercury level gauge / switch controls). The proprietary ATC-10 compressed air system controller, Electrogage mercury level gauge, and pump controller all by EG Pump Controls of Jacksonville, FL are provided at three stations. The mercury gauge responds to back pressure on the bubbler system from the wet well level and provides a visual indication of the water level in the wet well. Pump control and alarm wiring is connected to the level gauge and the changing mercury level opens and closes circuits to operate the pumps and activate alarms. Control and alarm set points are adjustable through a series of wiring contact stud connections at the level gauge.

The same Electrogage level gauge and pump controller are provided at Kirkbrae, but the compressed air bubbler system consists of a duplex (lead, lag) air compressor system and air receiver tank. The compressors transfers air to the receiver tank, which supplies air to the bubbler tube to the wet well. Pressure switches monitor receiver tank pressure and activate compressor operation to maintain proper pressure. The lead compressor handles normal operating requirements, the lag compressor is provided in case of lead compressor malfunction.

The control strategy for these four stations also is the same as the Submersible Grinder stations. The pump station control system operates the pumps automatically in response to changing wet well levels with the pump selector switch in the "Auto" position or manually with the switch in the "Hand" position. Lead / Lag pumps can be selected manually or to alternate between the two pumps. The lead pump is intended to handle station flows under normal operating conditions and the lag pump "On" level set point occurs above high wet well alarm level. High and low wet well levels also are monitored by the bubbler system and activated via the level gauge / controller. The stations also are equipped with a float switches to indicate dry well and wet well flood alarm conditions in addition to the pump control system alarms.

The pump controls at these four stations are functional and appear to be in serviceable condition. Sewer Department personnel did not identify any specific operational problems for the bubbler or pump control systems, but performance similar to that described for the Submersible Grinder stations would be expected. As such, the pump controls are expected to remain in serviceable condition for the 20-year planning period, but, replacement of the air compressor control systems

may be necessary by the time these systems reach twenty years in service. The Wastewater Facilities Plan should include general provisions for replacing bubbler system controllers upon reaching twenty years in service. However, replacing the pump controls at the time other major equipment items are scheduled for replacement may be warranted and also will be considered.

The pump controls at the Great Road station also utilize the Electrogage mercury level gauge / switch, but employ Variable Frequency Drive (VFD) equipment to control pump operation and speed in response to changing wet well levels. Two VFD units are provided to operate the three station pumps. One unit operates Pump No. 1 and No. 2; the other unit operates Pump No. 2 and No. 3. A back up pump control system is provided in case of bubbler air / mercury gauge system malfunction. Pumps operate at full speed in response to float switches located in the wet well via 'across the line' (ACL) motor starters that bypass the VFD units. Separate run time meters are provided for VFD and ACL operation for each pump. Sewer Department personnel indicated that the VFDs were not the original units and had been installed 3 or 4 years ago and also indicated that the Town has plans to replace the remainder of the pump control systems in the near future.

Each station was constructed with provisions for sensing and indication of pump suction and discharge pressure. Gauges were operational at some stations but have failed and / or been removed at other locations. Pressure gauges are not required by TR-16, but can be useful in monitoring pump operation and performance and evaluating deficient or degraded operating conditions. New pressure gauges should be provided as part of pump replacement projects.

The alarms systems for the stations include local indicating lights, silence, and reset buttons, and remote transmission of selected alarm conditions by autodialer to the Sewer Department (weekday working hours) or Police Department (nights / weekends). The stations transmit the following alarms: high wet well level, low wet well level, power fail, low air pressure (bubbler system), dry well flooding, wet well flooding, generator running, and generator fail. The alarms transmission autodialer systems have been installed recently by the Town at all stations and are reported to be operating satisfactorily. As the this equipment has recently been replaced and is reported to be in proper operating condition, satisfactory performance is expected for the twenty year planning period.

There are no provisions for direct flow metering or totalizing at any station. An approximation of total flow can be derived from run time meters at constant speed pump stations, but no information on daily flow patterns can be determined from run time only, and there is no meaningful correlation between VFD operation and run time in regard to station flow. TR-16 recommends that a flow measuring device be provided at large pump stations. The Wastewater Facilities Plan should include provisions for flow meters to be installed at each station in conjunction with the pump and / or control systems replacements.

No provisions for combustible and hazardous gas detection were observed at any station. TR-16 requires combustible and hazardous gas detection systems for medium to large pumping stations. The Wastewater Facilities Plan should include provisions for a combustible and hazardous gas monitoring and alarm system to be installed at each station as part of the pump and / or control systems replacements.

HVAC

The HVAC systems observed at the stations include ventilation fans and ducts/pipes, electric unit heaters, and dehumidifiers. Separate exhaust and supply vent pipes are provided for the wet wells and dry wells, ventilation fans are provided on the exhaust system only. Sewer Department personnel indicated that portable ventilation equipment is necessary when wet well ventilation is needed for maintenance access because the wet well fans have failed at all stations and are not operating at any location. Dry well fans also were reported or observed as not operational at most stations. Operational ventilation equipment was observed only at Angel Road North, where intermittent ventilation is provided for the dry pit with the exhaust fan operation interlocked with the light switch for the lower pump level. Sewer Department personnel indicated that the other station dry well ventilation systems, and the wet well ventilation systems, had similar lighting interlocked controls when the systems were operational.

Additional ventilation equipment and motorized shutters interlocked with the emergency generator are provided for where buildings were constructed above the pump stations. The vent piping at the Maria station was not ducted to the louvers in the building addition and the wet well exhaust vent was plugged in effort to reduce odor emissions. A supply fan was retrofit to the wet well supply duct pipe but this equipment was not functional according to Sewer Department personnel.

TR-16 requires forced ventilation of both wet wells and dry wells. Ventilation ducts should be continuous to outside of all building structures. Intermittent ventilation systems should be interlocked with switches that are accessible from outside of the structure so that fans can be activated before personnel entry. The ventilation systems at all stations require repairs to be fully functional and the Wastewater Facilities Plan will include replacement of the ventilation systems and equipment. The ventilation systems should be designed in accordance with TR-16 requirements as well as applicable mechanical and electrical code requirements.

Electric unit heaters are provided at all station dry wells. Dehumidifiers are provided at some station dry wells. No heating is provided at the wet wells. Sewer Department personnel indicated that the unit heaters were functional at all stations. Dehumidifiers were observed to be or are reported to be in satisfactory operating condition at all stations. The service life of electric heating and dehumidification equipment usually is not expected to exceed that of major mechanical equipment items. As such, replacement of these elements usually occurs in conjunction with replacement of major mechanical equipment items. The Wastewater Facilities Plan will include replacement of the electric unit heaters and dehumidifiers with major mechanical rehabilitation work, accordingly.

Plumbing

Plumbing systems include a sump pump at all stations and public water supply service at two stations. The sump pumps are located in the dry well lower level and discharge accumulated water to the station wet well. Each sump discharge pipe is provided with an isolation gate valve and two check valves to prevent backflow from the wet well. The sump pumps were operational at all locations and satisfactory continued operation can be expected. In general, sump pumps would be expected to provide useful service for approximately the same length of time as the

other mechanical systems. Based upon this condition, the sump pumps also should be replaced at the same time as the main sewage pumps are replaced. It should be noted that concerns for possible damage of the sump pump discharge pipe due to potential differential structural movement at the Angel Road North station are similar to those described above for the mechanical process suction piping.

Public water supply service is provided to the Great Road and Angel Road South stations that are equipped with seal water systems for the pumps. A water use meter and backflow prevention device are provided at the service entrance into each station. Exposed water piping appeared to be in generally serviceable condition, with some surface corrosion evident on piping near the seal water tank at Great Road. Satisfactory service is expected for the planning period.

Electrical

The electrical systems include conduit, wiring, enclosures, and devices. The descriptions presented here are based upon observations by C&E and are limited generally to the physical appearance of electrical system components and to conditions described by Sewer Department personnel. No observations or inspections were performed by an Electrical Engineer as such inspection is beyond the scope of this project. Explosion-proof equipment is required in sewage pump station wet wells. Record documents indicate the use of explosion proof equipment in the station wet wells, but detailed evaluation by an Electrical Engineer would be necessary to determine if the components (that remain functional) are in proper operating condition.

The utility power services varied from 230-volt single phase to 460-volt three phase depending on station location. Stations with single phase utility service are equipped with a phase conversion unit to provide three phase power as required for the pump motors. Sewer Department personnel indicated that the phase conversion equipment at Kirkbrae has experience malfunction and failure that the Town attributes to utility power variations and surges. The utility power feed to the site is buried at all but one station. Sewer Department personnel indicated that the Maria utility feed was switched to overhead wiring due to excessive water intrusion through the conduit entrance. The telephone service entrance reportedly experiences similar intrusion and installation of an overhead feed is pending.

Each station is equipped with a skid mounted diesel generator for emergency power. Automatic transfer switches are located in the upper level of the dry well, and two transfer switches are provided at stations with phase conversion equipment. Burnt out / missing indicating lights were observed at the transfer switch enclosure panel at several stations. Sewer Department personnel indicated that the generators and automatic transfer equipment were operational at all locations. No replacement of the emergency generators would be recommended provided that the units are in serviceable condition and of adequate size to handle future station loads.

Electrical and control equipment enclosures for the most part are located in the dry well upper level. Observations on the control equipment are provided above under Instrumentation & Controls. Incandescent lighting systems are provided with the upper and lower levels on separate circuits. Convenience receptacles are provided at various locations. Electrical enclosures, boxes and conduit appeared to be in satisfactory condition except where subjected to flooding or groundwater intrusion. The Wastewater Facilities Plan should include provisions for

repair or replacement of damaged electrical systems as part of major mechanical or control systems replacement.

Wet wells were not accessed to observe the electrical systems therein. Operational lighting was observed only at the Great Road station. Sewer Department personnel indicated that the general condition of the conduit, wiring, and lighting systems in all stations was poor. Based upon this information, the Wastewater Facilities Plan should include considerations for replacement of the wet well electrical systems for all stations. The electrical systems should conform to TR-16 recommendations as applicable electrical code conditions as required.

Above grade exterior lighting was functional at the Angel Road North and South stations. No observations were made of the electrical systems of the upper building additions.

Each station is provided with a single telephone line. The alarms autodialer is connected permanently to the phone line, and a standard telephone jack with handset for personnel dial out also is provided. Using the phone line to dial out temporarily interrupts the ability for the autodialer to transmit any alarms. Satisfactory performance is expected for the planning period for these electrical components.

Conclusions

No major replacement of existing pump station structures are expected to be necessary during the twenty year Wastewater Facilities Planning period. Normal maintenance and replacement of minor components as the need arises should provide for continued satisfactory operation for the foreseeable future. The stations with wood framed buildings constructed above the precast concrete chambers require additional building maintenance for normal upkeep. The Town has implemented efforts to reduce the impact of groundwater at some locations, however, further consideration of possible remedies should be included in any substantial projects planned for each station.

The pumps at all stations are expected to require replacement within the 20-year planning period. The pump control systems are expected to be remain serviceable for the planning period, however, the replacement of the air compressor controls within the pump control system are expected to be necessary within the planning period. The control systems at most of the stations employs dated technology by current industry standards. Replacing only components that exhibit substandard performance or replacing the entire control systems will need to be considered in conjunction with pump replacement requirements to determine the best course of action to pursue.

The station ventilation systems generally exhibit a reduced level of performance at all stations. Dehumidifiers and unit heaters are reportedly operational but replacement is expected to be necessary within the planning period. Replacement of HVAC systems should be included in projects to replace the sewage pumps and / or controls systems. Plumbing systems are expected to provide satisfactory service for the planning period, however, renovation of these systems as needed to support new mechanical equipment and processes and should be included in such projects as necessary.

In general, the dry well electrical systems are expected to provide satisfactory service during the planning period, however, specific portions of these systems that have been subjected to and experienced water damage and require repairs or replacement. Additionally, portions of the electrical installations are associated specifically with the pumps or controls systems and likely would be replaced upon replacing those items. The wet well electrical systems are for the most part not operational and will require repairs or replacement during the planning period.

C&E Engineering Partners, Inc.
Wet Well / Dry Well Pump Station Condition Survey

GENERAL

Owner: Town of Lincoln, RI
Station Name: Angel Road North
Location: Angel Road

Date of Observations: 7/14/05

Survey Performed By: Jonathan S. Gerhard, P.E.
Attended By: Joe Amaral, Lincoln Sewer Department

Year Built / Approximate Age: 1990 / 15 years

SITE

Station is located in residential area and adjacent to existing utililty power easement. A paved driveway is provided from the street to the station. A 6-foot high chain link fence is provided around the station. Fencing is provided with padlocked double leaf access gate. Fencing appears to be in fair to good condition, some areas of damaged chain link fabric were observed. Site is partially screened from street by privacy hedges. At grade construction consists of top of precast wet well and dry well chambers and chamber mounted items, including site lighting, emergency generator, station ventilation piping and the electric utility meter. A sump has been installed by the Town outside the dry well in effort to alleviate groundwater impact on the station.

BUILDING / STRUCTURE

Building structure consists of rectangular precast concrete sections. Wet well and dry well are cast as separate structures and placed side by side. Exposed above grade portions of the precast concrete chambers appear to be in generally good condition. Rust staining was observed at roof slabs at the emergency generator support skid frame. A cracked conduit fitting was observed at the telephone service entrance to the building where the conduit comes up from below grade and penetrates the building. Town Operator indicated that the cracked conduit is attributed to station movement under high groundwater conditions.

Wet Well - Concrete inside wet well appears to be generally in good condition. Gasket material was visible at points along the horizontal joint between precast sections, but no evidence of prior leakage was observed at these points. Town Operator did not identify any areas of concern regarding the wet well interior structure. Some surface corrosion was observed on the wet well access hatch, ladder, and handrails; these items appear to be in functional condition. Overall, the wet well structure appears to be in good condition.

Dry Well - Upper level of dry well appears to be generally in good condition. Minor cracks observed in concrete ceiling at mid-span and at corners of hatch openings. Staining evidence of prior water intrusion between the bottom of the upper level / floor casting and the top of the lower level / ceiling casting and damage to wall surface coatings in lower level were observed near the access opening and ladder. Town Operator indicated that exterior sump and pump installed has resolved water infiltration problem to a great extent. Gasket material was visible at various points of the horizontal joint in the lower / pump level between precast sections, but no evidence of prior leakage was observed at this joint. Staining evidence of prior groundwater intrusion was observed at the wall penetration of the sump

pump discharge piping in the lower / pump level. Dry well access ladders, hatches, handrails, and gratings appear to be in good condition and fully functional. Overall, the dry well structure appears to be in good condition.

MECHANICAL / PROCESS

Pumps: Two (2) Yeomans Model 312 non-clog pumps rated for 290 GPM @ 53' TDH
Motors: 230 volt, 3-phase, 15 HP, vertical close-coupled

Station flow is received by gravity influent sewer piping. Influent flow is screened by manually cleaned bar rack. The Town Operator did not indicate any deficient conditions for the bar rack.

Pumps and motors are located in the lower level of the dry well. Each pump is connected to the wet well by an individual suction pipe with isolation gate valve. Each pump discharge is provided with a check valve and isolation gate valve prior to joining the other pump discharge in a common force main and exiting the station. Suction and discharge piping is flanged ductile iron pipe. Pump suction and discharge piping and station discharge force main are 6-inch diameter. Pressure indicating gauges are provided on the suction and discharge piping of each pump. Both pumps are apparently in satisfactory operating condition. Some minor rusting was evident on the pumps and piping surfaces. A small weep was observed in the Pump No. 1 discharge piping at the 90° fitting where the discharge turns toward the Pump No. 2 discharge / force main header. Pumps and piping appear to be in serviceable condition and are reported to be in satisfactory operating condition.

INSTRUMENTATION & CONTROL

The pump controls consist of an "Electrogage" mercury level indicating gauge / level switch, duplex pump controller, and "ATC-10" duplex air compressor bubbler system controller. All control system components are manufactured by EG Controls of Jacksonville, FL. The pump controls are segregated in a separate control panel enclosure in the dry well upper level. Lead pump operates by level set point from the Electrogage. Lag pump set point is above the high wet well level alarm. Controls and strategy are basically same as other duplex wet well / dry well stations and submersible grinder stations.

Station alarms are transmitted by autodialer to the Sewer Department during the workday and to the Police Department on nights / weekends. Transmitted alarms include: power failure, generator run, generator failure, low wet well level, high wet well level, low air pressure, dry well flooding, and wet well flooding. The autodialer is permanently connected to the telephone service line and is located within a separate enclosure inside the main electrical cabinet that originally contained a computer based control and telemetry system that has been abandoned. A battery backup UPS is provided for the autodialer to enable alarms to be transmitted in the event that both utility power and generator power fail.

Instrumentation and controls are reportedly in satisfactory operating condition and no deficient conditions or malfunctions were observed.

HVAC

The wet well and dry well are both configured for forced exhaust ventilation and gravity supply intake ventilation. The dry well ventilation was operational, the exhaust fan is interlocked with the lighting switch for the lower level. The Town Operator reported that the wet well exhaust fan is not operational.

C&E Engineering Partners, Inc.
Wet Well / Dry Well Pump Station Condition Survey

A dehumidifier was located in the dry well upper level and observed to be in operating condition. An electric unit heater is provided in the dry well lower level and is reportedly in operating condition.

PLUMBING

A sump pump is provided in the dry well lower level to transfer accumulated water to the wet well. Sump discharge piping is fitted with double check valve and isolation gate valve. Sump pump appears to be in satisfactory operating condition. No public water service is provided to the station.

ELECTRICAL

The electrical service to the site is single-phase 115/230 Volt 60 Hertz service. The station is equipped with a phase converter to provide three phase power to the pump motors. A 240 V single phase 50 kW emergency generator is provided in the event of utility power failure. Two automatic transfer switches are provided, one is dedicated to the pumps and the other to the rest of the station loads. The generator and transfer switches are manufactured by Generac. Town Operator indicated that generator and transfer switches are operational. Town Operator indicated that the Town attributes a station malfunction that resulted in a flooded wet well condition to failure of a nearby utility transformer.

Exterior lighting was observed to be operational. Dry well lighting systems were observed to be operational. Dry well electrical enclosures, conduit and fittings appear to be in good condition with exception of conduit and fittings near the access ladder to the lower level where rusting conditions were observed. Evidence of prior groundwater intrusion in this area is apparent. Duplex receptacles are provided in the upper and lower levels. Dry well electrical systems are reportedly operational.

Surface corrosion of the conduit and boxes in the wet well were observed. The Town Operator indicated that the conditions of electrical components are generally deteriorated and the electrical system is not operational in the wet well.

A single line telephone service is provided to the station and is permanently connected to the alarm system autodialer. A telephone handset also is provided in dry well upper level that allows for dial out over the single line. Alarms cannot be transmitted when the handset is in use.

SUMMARY COMMENTS

Pumps and controls are operational are expected to have an additional 5 to 10 years service based upon approximate age of station and anticipated useful service life of 20 to 25 years. Wet well electrical and HVAC systems are not operational. Possible buoyancy of station reported by Town Operator is of concern. Additional investigations may be warranted to determine if flotation conditions need to be addressed.

C&E Engineering Partners, Inc.
Wet Well / Dry Well Pump Station Condition Survey

GENERAL

Owner: Town of Lincoln, RI
Station Name: Angel Road South
Location: Angel Road

Date of Observations: 7/27/05

Survey Performed By: Jonathan S. Gerhard, P.E.
Attended By: Joe Amaral, Lincoln Sewer Department

Year Built / Approximate Age: 1989 / 16 years

SITE

Station is located in residential area. A paved driveway is provided from the street to the station. A 6-foot high chain link fence is provided around the station. Fencing is provided with padlocked double leaf access gate. Fencing appears to be in fair to good condition. At grade construction consists of top of precast wet well and dry well chambers and chamber mounted items, including aluminum ladder and handrails, site lighting, emergency generator, station exhaust ventilation piping and the electric utility meter. A sump is being installed by the Town outside the dry well in effort to alleviate groundwater impact on the station.

BUILDING / STRUCTURE

Building structure consists of rectangular precast concrete sections. Wet well and dry well are cast as separate structures and placed side by side. Exposed above grade portions of the precast concrete chambers appear to be in generally good condition. Rust staining was observed at roof slabs at the emergency generator support skid frame. Small misalignment of wall faces at joint between wet and dry well chambers was observed. Town Operator indicated that this condition is not new and likely has existed since original construction. Grab rail at one side of the access ladder to station roof slab was broken at the base. Aluminum handrail at top slab appears to be in satisfactory condition.

Wet Well - Concrete inside wet well appears to be generally in good condition as observed from access hatch opening. Some minor spalling was observed on the wet well platform at the base of the access ladder. Town Operator did not identify any areas of concern regarding the wet well interior structure. Wet well access hatch, ladder, and handrails appear to be in functional condition with minor surface corrosion. Overall, the wet well structure appears to be in good condition.

Dry Well - Upper level of dry well appears to be generally in good condition. Staining evidence of prior water intrusion between the bottom of the upper level / floor casting and the top of the lower level / ceiling casting was observed at slab openings and damaged peeling dry well wall surface coatings were observed. Aluminum hatches, ladders and handrails in dry well appear to be in good condition. Town Operator indicated that lower level had experienced flooding to approximately 8' above the floor and exterior sump is being installed in effort to address water infiltration problem. Overall, the dry well structure appears to be in good condition, however the station evidently is susceptible to significant groundwater intrusion.

C&E Engineering Partners, Inc.
Wet Well / Dry Well Pump Station Condition Survey

MECHANICAL / PROCESS

Pumps: Two (2) Yeomans Model 6312 non-clog pumps rated for 950 GPM @ 146' TDH
Motors: 460 volt, 3-phase, 60 HP, vertical close-coupled

Station flow is received by gravity influent sewer piping. Influent flow is screened by manually cleaned bar rack. The Town Operator indicated that the bar rack is in generally satisfactory operating condition.

Pumps and motors are located in the lower level of the dry well. Pumps are provided with a separate seal water system. Each pump is connected to the wet well by an individual suction pipe with isolation gate valve. Each pump discharge is provided with a check valve and isolation gate valve prior to joining the other pump discharge in a common force main and exiting the station. Some weeping was observed at the check valve stems. Suction and discharge piping is flanged ductile iron pipe. Pump suction and discharge piping and station discharge force main are 6-inch diameter. Pressure indicating gauges are provided on the suction and discharge piping of each pump. Some minor rusting was evident on the pumps and piping surfaces. Piping appears to be in serviceable condition. Town Operator indicated that the pump motors and disconnects, and the seal water control panel were temporarily submerged when the dry well flooded. Sewage pumps are reported to be operational. Seal water pumps are not operational and water is left on to trickle feed continuously in effort to provide clean water to seals.

INSTRUMENTATION & CONTROL

The pump controls consist of an "Electrogage" mercury level indicating gauge / level switch, duplex pump controller, and "ATC-10" duplex air compressor bubbler system controller. All control system components are manufactured by EG Controls of Jacksonville, FL. The pump controls are segregated in a separate control panel enclosure. Lead pump operates by level set point from the Electrogage. Lag pump set point is above the high wet well level alarm. Controls and strategy are basically same as other duplex wet well / dry well stations and submersible grinder stations. The seal water control panel is located in the dry well lower level. The panel was submerged when the station flooded and is no longer operational.

Station alarms are transmitted by autodialer to the Sewer Department during the workday and to the Police Department on nights / weekends. Transmitted alarms include: power failure, generator failure, low wet well level, high wet well level, low air pressure, dry well flooding, and wet well flooding. The autodialer is permanently connected to the telephone service line and is located within a separate enclosure inside the main electrical cabinet that originally contained a computer based control and telemetry system that has been abandoned. A battery backup UPS is provided for the autodialer to enable alarms to be transmitted in the event that both utility power and generator power fail.

With exception of the seal water system, instrumentation and controls are reportedly in satisfactory operating condition and no deficient conditions or malfunctions were observed.

HVAC

The wet well and dry well are both configured for forced exhaust ventilation and gravity supply intake ventilation. The dry well exhaust fan was not operational and the Town Operator reported that the wet well exhaust fan is not operational. Two dehumidifiers are provided one located in the dry well upper

level and one in the lower level. Both units were reported to be in operating condition. An electric unit heater is provided in the dry well lower level and is reportedly in operating condition.

PLUMBING

A sump pump is provided to transfer accumulated water to the wet well. Sump discharge piping is fitted with double check valve and isolation gate valve. Sump pump appears to be in satisfactory operating condition. Public water service is provided to the station for use in the seal water system. The utility meter and backflow prevention device are located in the dry well lower level approximately 10' above the floor. Town Operator indicated that the backflow preventer was not submerged during the station flood.

ELECTRICAL

The electrical service to the site is three phase 480 Volt 60 Hertz service. A 480 V three phase 150 kW emergency generator and automatic transfer switch are provided the event of utility power failure. The generator and transfer switch are manufactured by Caterpillar. The "Normal" power position indicating light at the transfer switch panel was burnt out. Town Operator indicated that generator and transfer switch are operational.

Exterior lighting was observed to be operational. Dry well lighting systems were observed to be operational. Dry well electrical enclosures, conduit and fittings appear to be in good condition in the upper level. Condition of electrical system components in the lower level is deteriorated due to flooding condition. Dry well upper level electrical systems are reportedly operational, lower level electrical system generally are not utilized due to concern for flood related damage. Lighting system is above the flood level and remains operational.

Surface corrosion of the conduit and boxes in the wet well were observed. The Town Operator indicated that the conditions of electrical components are generally deteriorated and the electrical system is not operational in the wet well.

A single line telephone service is provided to the station and is permanently connected to the alarm system autodialer. A telephone handset also is provided in dry well upper level that allows for dial out over the single line. Alarms cannot be transmitted when the handset is in use.

SUMMARY COMMENTS

Pumps and seal water system were damaged due to flooding and continued satisfactory pump service cannot be expected for extended periods. Controls are operational are expected to have an additional 4 to 9 years service based upon approximate age of station and anticipated useful service life of 20 to 25 years. Wet well electrical and HVAC systems reportedly are not operational. Dry well ventilation system reportedly is not operational and lower level electrical system is only partially operational. Replacement of pumps and rehabilitation of electrical and ventilation systems should be prioritized for this station.

C&E Engineering Partners, Inc.
Wet Well / Dry Well Pump Station Condition Survey

GENERAL

Owner: Town of Lincoln, RI
Station Name: Great Road
Location: Great Road

Date of Observations: 7/27/05

Survey Performed By: Jonathan S. Gerhard, P.E.
Attended By: Joe Amaral, Lincoln Sewer Department

Year Built / Approximate Age: 1989 / 16 years

SITE

Station is located in residential / commercial area next to a church building. A paved driveway is provided from the street to the station, station located well off street. No site fence is provided. Station is partially screened from adjacent property by privacy hedges. At grade construction consists of wood building superstructure constructed on top of precast wet well and dry well chambers.

BUILDING / STRUCTURE

Pump station structure consists of rectangular precast concrete sections. Wet well and dry well are cast as separate structures and placed side by side. A 2-story wood framed building with wood siding and asphalt shingle roofing was constructed on top of the precast station chambers.

Superstructure- Building addition and exposed above grade portions of the precast concrete chambers appear to be in generally good condition. Paint on wood siding is peeling and fading. Concrete steps up to building addition / station top slab require replacement due to damage from being hit by a motor vehicle.

Wet Well - Concrete inside wet well appears to be generally in good condition as observed from the access hatch opening. Town Operator did not identify any areas of concern regarding the wet well interior structure. Wet well access hatch and ladder appear to be in functional condition with minor surface corrosion. Overall, the wet well structure appears to be in good condition.

Dry Well - Upper and lower levels of dry well appear to be generally in good condition. Staining evidence of prior water intrusion between the bottom of the upper level / floor casting and the top of the lower level / ceiling casting was observed at the access ladder opening, some pump removal access openings, and at the exhaust vent penetration. Staining evidence of prior water intrusion also was observed at station discharge force main wall penetration. Town Operator did not indicate any excessive water intrusion concerns for this location. Ladders and handrails in dry well appear to be in satisfactory and functional condition. The safety chain is broken at the access opening to the lower level. Overall, the station structure is in good condition. Overall, the dry well structure appears to be in good condition.

C&E Engineering Partners, Inc.
Wet Well / Dry Well Pump Station Condition Survey

MECHANICAL / PROCESS

Pumps: Three (3) Yeomans Model 6312 non-clog pumps rated for 1600 GPM @ 88' TDH
Motors: 480 volt, 3-phase, 60 HP, vertical close-coupled

Station flow is received by gravity influent sewer piping. Influent flow is screened by manually cleaned bar rack. Wet well has multiple dividable chambers separated by aluminum slide gates and plates. The Town Operator did not indicate any deficient conditions for the bar rack, slide gates and plates.

Pumps and motors are located in the lower level of the dry well. Each pump is connected to the wet well by an individual suction pipe with isolation gate valve. Each pump discharge is provided with a check valve and isolation gate valve prior to joining the other pump discharge in a common force main and exiting the station. Suction and discharge piping is flanged ductile iron pipe. Pump suction and discharge piping are 8-inch diameter. Station discharge force main is 10-inch diameter. Pressure indicating gauges were not observed on the discharge piping of each pump. Some minor surface corrosion was evident on the pump motor housings apparently due to dripping water from openings in ceiling slab above. Pumps are reportedly in satisfactory operating condition. Piping appears to be in serviceable condition with minor surface corrosion. Seal water system is reportedly operational, but Town Operator indicated that one seal water pump is out of service awaiting repairs so seal water system is operating with one pump only. Seal water piping was observed with some surface corrosion.

INSTRUMENTATION & CONTROL

The pump controls consist of an "Electrogage" mercury level indicating gauge / switch, triplex pump control system, and duplex air compressor bubbler system controller. These components are manufactured by EG Controls of Jacksonville, FL. Variable Frequency Drive (VFD) units are provided to allow pump output speed to vary in response to changing wet well level. The pump controls and VFDs for all three pumps are segregated in a separate control panel enclosure in the dry well upper level. Lead and lag pumps operate by level set point from the Electrogage. In addition to pump "On" and "Off" levels, the control system varies pump(s) speed based upon rising / falling wet well level via the Electrogage set points. The third pump serves as standby in the event of lead or lag pump failure. Two VFD units are provided, one serves Pumps No. 1 and No. 2 and one serves Pumps No. 2 and No. 3. Backup float switch level controls provide for constant speed On/Off "across the line" pumping bypassing the VFDs in the event of Electrogage failure. Pumps can be operated in either constant or variable speed from the Hand position. The Town Operator indicated that the VFDs had been replaced with new units approximately 3 or 4 years ago and that the entire pump controls system was planned for replacement in near future.

Station alarms are transmitted by autodialer to the Sewer Department during the workday and to the Police Department on nights / weekends. Transmitted alarms include: power failure, generator run, generator fail, low wet well level, high wet well level, low air pressure, dry pit flooding and wet pit flooding. The autodialer is permanently connected to the telephone service line and is located within a separate enclosure inside the main electrical cabinet that originally contained a computer based control and telemetry system that has been abandoned. A battery backup UPS is provided for the autodialer to enable alarms to be transmitted in the event that both utility power and generator power fail.

Instrumentation and controls are reportedly in satisfactory operating condition and no deficient conditions or malfunctions were observed.

C&E Engineering Partners, Inc.
Wet Well / Dry Well Pump Station Condition Survey

HVAC

The wet well and dry well are both configured for forced exhaust ventilation and gravity supply intake ventilation. Town Operator reported that both the dry well and wet well exhaust fans are not operational. Supply and exhaust vent piping above the precast station top slab was retrofit with aluminum ductwork and hard piped to louvers in the side walls of the building addition. Fan and dampers in the building addition for emergency generator operation are reportedly operational. No dehumidifier is provided at this station. Electric unit heat is provided in the dry well and is reportedly in operating condition.

PLUMBING

A sump pump is provided in the dry well lower level to transfer accumulated water to the wet well. Sump discharge piping is fitted with double check valve and isolation gate valve. Sump pump appears to be in satisfactory operating condition. Public water service is provided to the station for use in the seal water system. The utility meter and backflow prevention device are located in the dry well upper chamber.

ELECTRICAL

The electrical service to the site is three phase 480 Volt 60 Hertz service. The utility service meter is mounted to the exterior of the pump station. Town Operator indicated that conduit / service drop for the station was damaged by motor vehicle collision into utility pole. A 480 V three phase 150 kW. emergency generator and automatic transfer switch are provided the event of utility power failure. The generator and transfer switches are manufactured by Caterpillar. "Normal" indicating lamp was burnt out / missing from automatic transfer switch panel. Town Operator indicated that generator and transfer switches are operational.

Dry well lighting systems were observed to be operational. Dry well electrical enclosures, conduit and fittings appear to be in good condition. Dry well electrical systems are reportedly operational.

Wet well lighting was observed to be operational but the Town Operator indicated that the conditions of electrical components are generally deteriorated and the electrical system is not operational in the wet well. Town Operator also indicated that some control wiring in the wet well was recently replaced due to deficient conditions.

A single line telephone service is provided to the station and is permanently connected to the alarm system autodialer.

SUMMARY COMMENTS

Pumps and controls are operational and are expected to have an additional 4 to 9 years service based upon approximate age of station and anticipated useful service life of 20 to 25 years. VFD equipment is only 3 to 4 years old. Wet well HVAC system reportedly is not operational and electrical systems in poor condition. Dry well ventilation system was not operational. Control wiring repairs should be reviewed to confirm explosion-proof installation.

C&E Engineering Partners, Inc.
Wet Well / Dry Well Pump Station Condition Survey

GENERAL

Owner: Town of Lincoln, RI
Station Name: Kirkbrae
Location: Timberland Drive

Date of Observations: 7/28/05

Survey Performed By: Jonathan S. Gerhard, P.E.
Attended By: Joe Amaral, Lincoln Sewer Department

Year Built / Approximate Age: 1986 / 19 years

SITE

Station is located in residential area. A paved driveway is provided from the street to the station, station located well off street. A 4-foot high chain link fence is provided around the station, there is no gate at the access drive. Fencing appears to be in fair to good condition, some sections of chain link fabric were missing. Site is partially screened from adjacent properties by privacy hedges. At grade construction consists of wood building superstructure constructed on top of precast wet well and dry well chambers.

BUILDING / STRUCTURE

Pump station structure consists of rectangular precast concrete sections. Wet well and dry well are cast as separate structures and placed side by side. A wood framed building with wood siding and asphalt shingle roofing was constructed on top of the precast station chambers. Building / station top slab are accessed by exterior wooden stairway.

Superstructure – Wood building addition, stairs, and exposed above grade portions of the precast concrete chambers appear to be in generally good condition. Spalling concrete was observed at the top slab at the wet well chamber access hatch. Town Operator indicated that this is not a new condition and little or no deterioration has been noted.

Wet Well - Concrete inside wet well appears to be generally in good condition as observed from the access hatch opening. Town Operator did not identify any areas of concern regarding the wet well interior structure. Wet well access hatch and ladder appear to be in functional condition with minor surface corrosion. Overall, the wet well structure appears to be in good condition.

Dry Well - Upper level of dry well appears to be generally in good condition. Minor staining evidence of prior water intrusion between the bottom of the upper level / floor casting and the top of the lower level / ceiling casting was observed at access openings. Staining evidence of prior water intrusion also was observed in the dry well lower level at the wall penetrations for the suction piping to Pump No. 2 and sump pump discharge piping. Some moisture and / or dampness was observed at the dry well lower level floor slab. Town Operator did not indicate any excessive water intrusion concerns for this location. Ladders and handrails in dry well appear to be in satisfactory and functional condition. Overall, the dry well structure appears to be in good condition.

C&E Engineering Partners, Inc.
Wet Well / Dry Well Pump Station Condition Survey

MECHANICAL / PROCESS

Pumps: Two (2) Yeomans Model 4315 non-clog pumps rated for 470 GPM @ 82' TDH
Motors: 230 volt, 3-phase, 20 HP, vertical close-coupled

Station flow is received by gravity influent sewer piping. Influent flow is screened by manually cleaned bar rack. The Town Operator did not indicate any deficient conditions for the bar rack.

Pumps and motors are located in the lower level of the dry well. Each pump is connected to the wet well by an individual suction pipe with isolation gate valve. Each pump discharge is provided with a check valve and isolation gate valve prior to joining the other pump discharge in a common force main and exiting the station. Suction and discharge piping is flanged ductile iron pipe. Pump suction and discharge piping and station discharge force main are 6-inch diameter. Pressure indicating gauges are provided on the suction piping of each pump. Town Operator indicated that Pump No. 1 is off line waiting for service call to investigate slight rattle. Pump No. 2 is reportedly in satisfactory operating condition. Some minor rusting was evident on the pump casing bolts. Piping appears to be in serviceable condition.

INSTRUMENTATION & CONTROL

The pump controls consist of an "Electrogage" mercury level indicating gauge / level switch, duplex pump controller, and duplex air compressor bubbler system controller. All control system components are manufactured by EG Controls of Jacksonville, FL. The pump controls are segregated in a separate control panel enclosure. Lead pump operates by level set point from the Electrogage. Lag pump set point is above the high wet well level alarm. The bubbler air compressor system consists of two air compressors and a single air receiver tank all mounted external to the control panel. Controls and strategy are basically same as other duplex wet well dry well stations and submersible grinder stations, except that bubbler system incorporates air receiver tank and compressors do not operate continuously at this station.

Station alarms are transmitted by autodialer to the Sewer Department during the workday and to the Police Department on nights / weekends. Transmitted alarms include: power failure, generator run, low wet well level, high wet well level, and low air pressure. The autodialer is permanently connected to the telephone service line and is located within a separate enclosure inside the main electrical cabinet that originally contained a computer based control and telemetry system that has been abandoned. A battery backup UPS is provided for the autodialer to enable alarms to be transmitted in the event that both utility power and generator power fail.

Instrumentation and controls are reportedly in satisfactory operating condition and no deficient conditions or malfunctions were observed.

HVAC

The wet well and dry well are both configured for forced exhaust ventilation and gravity supply intake ventilation. The dry well exhaust fan was not operational and the Town Operator reported that the wet well exhaust fan is not operational. Dampers in the building addition for emergency generator operation are reportedly operational. A dehumidifier was located in the dry well lower level and is reportedly in operating condition. An electric unit heater is provided in the dry well lower level and is reportedly in operating condition.

C&E Engineering Partners, Inc.
Wet Well / Dry Well Pump Station Condition Survey

PLUMBING

A sump pump is provided in the dry well lower level to transfer accumulated water to the wet well. Sump discharge piping is fitted with double check valve and isolation gate valve. Sump pump appears to be in satisfactory operating condition. No public water service is provided to the station.

ELECTRICAL

The electrical service to the site is single-phase 115/230 Volt 60 Hertz service. The station is equipped with a phase converter to provide three phase power to the pump motors. A 240 V single phase 50 kW emergency generator is provided in the event of utility power failure. Two automatic transfer switches are provided, one is dedicated to the pumps and the other to the rest of the station loads. The generator and transfer switches are manufactured by Generac. Town Operator indicated that generator and transfer switches are operational. Town Operator indicated that the phase converter is a new unit; old converter failed due to damage attributed to utility power surges.

Dry well lighting systems were observed to be operational. Dry well electrical enclosures, conduit and fittings appear to be in good condition. Dry well electrical systems are reportedly operational.

The Town Operator indicated that the conditions of electrical components are generally deteriorated and the electrical system is not operational in the wet well.

A single line telephone service is provided to the station and is permanently connected to the alarm system autodialer. A telephone handset also is provided in dry well upper level that allows for dial out over the single line. Alarms cannot be transmitted when the handset is in use.

SUMMARY COMMENTS

Pumps and controls are operational and are expected to have an additional 1 to 6 years service based upon approximate age of station and anticipated useful service life of 20 to 25 years. Wet well electrical and HVAC systems reportedly are not operational. Dry well ventilation system reportedly is not operational.

C&E Engineering Partners, Inc.
Wet Well / Dry Well Pump Station Condition Survey

GENERAL

Owner: Town of Lincoln, RI
Station Name: Maria
Location: Maria Street

Date of Observations: 7/28/05

Survey Performed By: Jonathan S. Gerhard, P.E.
Attended By: Joe Amaral, Lincoln Sewer Department

Year Built / Approximate Age: 1988 / 17 years

SITE

Station is located in residential area. A paved driveway is provided from the street to the station, station located well off street. A 6-foot high chain link fence is provided around the station, there are two double leaf gates. Fencing appears to be in fair to good condition, with some pealing paint observed. Site is partially screened from street by pine trees. At grade construction consists of wood building superstructure constructed on top of precast wet well and dry well chambers.

BUILDING / STRUCTURE

Pump station structure consists of rectangular precast concrete sections. Wet well and dry well are cast as separate structures and placed side by side. A wood framed building with wood siding and asphalt shingle roofing was constructed on top of the precast station chambers.

Superstructure- Wood building addition and exposed above grade portions of the precast concrete chambers appear to be in generally good condition. Paint on wood siding is peeling and some of the trim show signs of water damage / rot. Spalling concrete was observed at the top slab at the wet well chamber access hatch.

Wet Well - Concrete inside wet well appears to be generally in good condition as observed from the access hatch opening. Town Operator did not identify any areas of concern regarding the wet well interior structure. Wet well access hatch and ladder appear to be in functional condition with minor surface corrosion. Overall, the wet well structure appears to be in good condition.

Dry Well - Upper level of dry well appears to be generally in good condition. Minor staining evidence of prior water intrusion between the bottom of the upper level / floor casting and the top of the lower level / ceiling casting was observed at pump removal access opening. Minor staining evidence of prior water intrusion also was observed at horizontal section joint in upper dry well level. Town Operator did not indicate any excessive water intrusion concerns for this location. Ladders and handrails in dry well appear to be in satisfactory and functional condition. Overall, the dry well structure appears to be in good condition.

C&E Engineering Partners, Inc.
Wet Well / Dry Well Pump Station Condition Survey

MECHANICAL / PROCESS

Pumps: Two (2) Yeomans Model 4312 non-clog pumps rated for 570 GPM @ 117' TDH
Motors: 480 volt, 3-phase, 40 HP, vertical close-coupled

Station flow is received by gravity influent sewer piping. Influent flow is screened by manually cleaned bar rack. The Town Operator did not indicate any deficient conditions for the bar rack.

Pumps and motors are located in the lower level of the dry well. Each pump is connected to the wet well by an individual suction pipe with isolation gate valve. Each pump discharge is provided with a check valve and isolation gate valve prior to joining the other pump discharge in a common force main and exiting the station. Suction and discharge piping is flanged ductile iron pipe. Pump suction and discharge piping are 6-inch diameter. Station discharge force main is 8-inch diameter. Pressure indicating gauges are provided on the suction and discharge piping of each pump. Some minor rusting was evident on the pumps and piping at connecting bolts and at the pump pedestals. Pumps are reportedly in satisfactory operating condition. Piping appears to be in serviceable condition.

INSTRUMENTATION & CONTROL

The pump controls consist of an "Electrogage" mercury level indicating gauge / level switch, duplex pump controller, and "ATC-10" duplex air compressor bubbler system controller. All control system components are manufactured by EG Controls of Jacksonville, FL. The pump controls are segregated in a separate control panel enclosure. Lead pump operates by level set point from the Electrogage. Lag pump set point is above the high wet well level alarm. Controls and strategy are basically same as other duplex wet well / dry well stations and submersible grinder stations.

Station alarms are transmitted by autodialer to the Sewer Department during the workday and to the Police Department on nights / weekends. Transmitted alarms include: power failure, generator run, low wet well level, high wet well level, low air pressure, and wet pit flooding. The autodialer is permanently connected to the telephone service line and is located within a separate enclosure inside the main electrical cabinet that originally contained a computer based control and telemetry system that has been abandoned. A battery backup UPS is provided for the autodialer to enable alarms to be transmitted in the event that both utility power and generator power fail.

Instrumentation and controls are reportedly in satisfactory operating condition and no deficient conditions or malfunctions were observed.

HVAC

The wet well and dry well are both configured for forced exhaust ventilation and gravity supply intake ventilation. The dry well exhaust fan was not operational and the Town Operator reported that the wet well exhaust fan is not operational. Dry well supply and exhaust vent piping above the precast station top slab was directed toward the louvers in the side walls of the building addition, but was not hard piped / ducted to provide positive connection to outside atmosphere. Wet well exhaust vent piping was plugged reportedly to reduce odors. A fan / blower unit was retrofit the wet well supply vent piping, but this unit is no longer operational according to Town Operator. Fan and dampers in the building addition for emergency generator operation are reportedly operational. A dehumidifier was located in the dry well lower level and is reportedly in operating condition. An electric unit heater is provided in the dry well lower level and is reportedly in operating condition.

C&E Engineering Partners, Inc.
Wet Well / Dry Well Pump Station Condition Survey

PLUMBING

A sump pump is provided in the dry well lower level to transfer accumulated water to the wet well. Sump discharge piping is fitted with double check valve and isolation gate valve. Sump pump appears to be in satisfactory operating condition. No public water service is provided to the station.

ELECTRICAL

The electrical service to the site is three phase 480 Volt 60 Hertz service. Utility power is via overhead service at this station. Town Operator indicated that service was revised to overhead feed due to water intrusion though the original underground feed conduit. A 480 V three phase 60 kW emergency generator and automatic transfer switch are provided the event of utility power failure. The generator and transfer switches are manufactured by Generac. Town Operator indicated that generator and transfer switches are operational. 90° bend fitting on a conduit mounted to / through the exterior wall of the dry well concrete chamber was observed to be missing its back cover.

Dry well lighting systems were observed to be operational. Dry well electrical enclosures, conduit and fittings appear to be in good condition. Dry well electrical systems are reportedly operational.

The Town Operator indicated that the conditions of electrical components are generally deteriorated and the electrical system is not operational in the wet well.

A single line telephone service is provided to the station and is permanently connected to the alarm system autodialer. Town Operator indicated that the telephone service also is to be revised to overhead feed due to concern for water intrusion similar to old electric feed. A telephone handset also is provided in dry well upper level that allows for dial out over the single line. Alarms cannot be transmitted when the handset is in use.

SUMMARY COMMENTS

Pumps and controls are operational and are expected to have an additional 3 to 8 years service based upon approximate age of station and anticipated useful service life of 20 to 25 years. Wet well electrical and HVAC systems reportedly are not operational. Dry well ventilation system was not operational. Vent piping should be continuously ducted to outside of building addition.

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Civil & Environmental Engineering Partners, Inc.

Technical Memorandum #3

Town of Lincoln Wastewater Facilities Plan
C&E Project No. J0506

Date: August 26, 2005
To: N. Kim Wiegand, P.E., Town Engineer

Subject: Existing Pump Stations Evaluation
Lower River Road Screw Pump Station

Introduction

C&E Engineering Partners, Inc. (C&E) has completed an evaluation of the Town's thirty-one (31) existing wastewater pumping stations as described under Task 2 of Exhibit A to the Agreement dated June 16, 2005. The Town's existing pumping stations can be segregated into three (3) general types: Submersible Grinder Pump station, Wet Well / Dry Well Pump station, and Screw Pump station. Twenty-five (25) of the Town's pump stations are Submersible Grinder Pump type stations, five (5) stations are Wet Well / Dry Well type stations, and one (1) station is a Screw Pump type station.

C&E personnel conducted site visits to observe station conditions on July 13, 14, 27, and 28, 2005. Observations were limited to visual inspection of the facilities to establish the anticipated remaining useful service life for the pump stations so that this information can be incorporated into the wastewater facilities planning process. Detailed evaluation of the facilities and specific performance testing were not conducted. A Technical Memorandum prepared for each station type presents the conditions observed at the stations, and conditions reported by Sewer Department personnel, so that the requirements for maintaining these facilities for the 20-year planning period can be established and incorporated into the Wastewater Facilities Plan. The reference standard utilized as the basis for evaluating the pump station is the 1998 Edition of the Guidelines for the Design of Wastewater Treatment Works Technical Report #16 (TR-16) as prepared by the New England Interstate Water Pollution Control Commission.

This Technical Memorandum #3 describes the conditions observed at the Lower River Road Pump Station, which employs screw type sewage pumps. Conditions observed at the Submersible Grinder Pump and Wet Well / Dry Well type stations are presented in Technical Memorandum #1 and #2, respectively.

General Description

As noted above, one (1) of the Town's 31 wastewater pump stations is of the Screw Pump type. TR-16 recommends wet well / dry well type stations as preferable but allows for other types of stations under certain circumstances. TR-16 requires a minimum of two pumps, with each pump being capable of handling the peak design flow. Two screw pumps are provided at the Lower

River Road station and record documents provided by the Town indicate that each pump is capable of discharging the full design load. As such, the existing station design and capacity generally conforms to the current TR-16 capacity guidelines. Record documents indicate each pump is rated for a peak design flow of 300 gallons per minute at 12 feet total dynamic head.

Screw pumps are well suited to low lift pumping applications and have the advantage of providing variable output from constant speed pumps. Pump output matches station influent and varies based upon the wet well sump level. As a result, simple controls systems are inherent in the design of screw pumps. Because there essentially is only one component that requires maintenance (pump / motor) and the simplicity of the controls, system operators find screw pump stations easy to operate and maintain. However, screw pumps require an open system that operates at atmospheric pressure and can be the source of odor complaints due to turbulent and / or septic conditions.

Observations and Evaluation

C&E personnel visited the station on July 28, 2005, accompanied by Town Sewer Department personnel, to perform on-site observations. The following narrative describes specific items and conditions observed and identified. This narrative is itemized into categories in a format similar to that provided for the Submersible Grinder type station in Technical Memorandum #1.

Site (Land Use / Access)
The station site is located in a predominantly Residential area. At grade construction consists of chain link fence, concrete chamber, aluminum handrails at the upper end top slab, vent pipe at the lower end top slab, and the main electrical cabinet enclosure. Fence gate, access hatch and the main electrical cabinet are secured by padlock. The station is screened from the street by privacy hedges. The station site is located immediately adjacent to the public roadway and abuts the Blackstone River canal on the opposite side. No paved access drive is provided.

Building / Structure
The pump station is constructed of precast concrete. The station is assembled as a single overall chamber in which the influent channel, pumps, and effluent channel all are located. There are two top / roof slab levels, the upper level slab is above the effluent end of the station and the pumps, and the lower level slab over the influent end of the station. The exterior of the concrete chamber appeared to be in generally satisfactory condition with no specific deterioration noted or observed. A partial aluminum handrail system is installed on the upper level top slab. Sewer Department personnel indicated that no handrail had been provided for the station until the Town recently installed the current system. Additional railing would be necessary to fully surround the upper level slab perimeter. An aluminum ladder provides access to the upper level top slab. An aluminum hatch is cast into the upper level top slab to provide access to the station interior. The vent piping at the lower level top slab has been modified. Sewer Department personnel indicated that the additional piping was installed to facilitate connecting portable ventilation equipment to supply air to the chamber during maintenance access. The vent pipe is capped / plugged when the station is not occupied.

The interior of the station was not accessed because ventilation is not operable and observations were conducted from outside the chamber through the access hatch and louver opening. The

station access is located at the upper / effluent end and an aluminum ladder with safety extension provides access to the upper level. Interior stairs between the two pump screw columns are provided to access the lower / influent level. Sewer Department personnel did not identify any specific conditions of concern for the interior concrete structure and aluminum grating components.

Satisfactory service is expected for the pump station concrete structure, handrails, vent piping, access hatch and gratings for 20-year planning period. However, all metals should be monitored for deterioration and repaired or replaced as needed to maintain proper function if deficient conditions are observed.

Mechanical / Process

Mechanical process systems for this consists of the tube mounted screw pumps manufactured by Schreiber Corporation of Trussville, AL. Each pump is equipped with a 1.5 HP electric motor and is rated for a peak design flow of 300 gallons per minute at 12 feet total dynamic head. Influent flow enters the wet well via gravity sewer connection and enters the pumps at the lower end of the station. Wastewater is conveyed by the screw flights to the top of the tube and discharged to the effluent channel and exits the station by gravity flow. The station was not accessed to perform a detailed inspection of the pumps, but corrosion was evident on the pump motor housings when viewed from the access hatch opening. Sewer Department personnel indicated that pump operation is satisfactory and did not identify any specific concerns other than the deterioration due to corrosion observed at the pump motors.

Sewer Department personnel indicated that odor complaints have occurred at the station generally due to the proximity to adjacent residential areas but did not indicate a specific concern for excessive odors or complaints. Provisions for odor controls at this station are limited and could be impractical due to the size and configuration of the station and available space for additional equipment installation. Odor emissions will be discussed coordinated further with the Town during planning process to determine if any odor controls appear to be needed and considerations for odor controls included in the Wastewater Facilities Plan as may be applicable.

Record documentation provided by the Town indicates that the pipelines and pump stations are designed to accommodate a future flow projected to the year 2035 and mechanical systems are designed for a 20 to 25 year service life. The fabrication date inside the control panel indicates that this station was constructed in 1988, so the approximate age of the station is 17 years and the mechanical systems are approaching the end of their intended service life. Satisfactory continued performance is expected based upon the conditions observed and reported for this station, but the pumps and motors will require replacement in the near future. The future flow design year is coincident with the end of the 20-year planning period for the current Plan and, as such, it is expected that the buried pipelines and station influent and effluent channels will be serviceable and capable of accommodating flows to the end of the planning period.

Instrumentation & Control

The pumps are constant speed and operate without any level sensing input. The control panel includes a Hand-Off-Auto switch and run time meter for each pump and a pump alternating timer. With each pump in the Auto position, the timer selects and alternates operation between

the two pumps. One pump is operating at all times. If one pump is down for service or otherwise, the other pump can be operated continuously in the Hand mode. Sewer Department personnel indicated the pump controls were operational. Based upon this information, continued satisfactory service is expected for the Planning period. However, replacement of the controls could be necessary in conjunction with mechanical equipment replacements.

An alarms autodialer has been installed in the telemetry panel inside the main electrical enclosure replacing the original computer based system. The autodialer transmits alarms to the Sewer Department (weekdays, working hours) and Police Department (nights / weekends). An uninterruptible power supply (UPS) battery backup unit is provided for the autodialer. The only alarm condition monitored is wet well flood level. Sewer Department personnel indicated that the controls and alarms were operational. Based upon this information, continued satisfactory service is expected for the Planning period.

There are no provisions for direct flow metering or totalizing at the station. TR-16 recommends that a flow measuring device be provided at large pump stations. The Town does not need flow metering for billing purposes and incorporating a gravity flow measuring device into the existing station or on the effluent sewer line likely would be cost prohibitive. No provisions for flow metering at this station are proposed to be included in the Wastewater Facilities Plan.

There are no provisions for combustible and hazardous gas detection at the station. TR-16 requires combustible and hazardous gas detection systems for medium to large pumping stations. The Wastewater Facilities Plan should include provisions for a combustible and hazardous gas monitoring and alarm system to be installed as part of the mechanical and / or control systems replacements.

HVAC

Record documents indicate that the ventilation system consisted of an exhaust fan connected to the lower level vent pipe and gravity supply air intake. The air intake louver is located in the wall of effluent end of the upper level of the chamber. As noted above, the vent piping at the lower level top slab has been modified to facilitate connecting portable ventilation equipment to supply air to the chamber during maintenance access. The vent pipe is capped / plugged when the station is not occupied; the upper level louver provides passive ventilation during unoccupied periods. TR-16 requires forced ventilation for wet wells where fixed equipment requires operation and maintenance personnel access. The Wastewater Facilities Plan should include provisions for forced ventilation system to be installed as part of other mechanical and / or control systems replacement projects.

Electrical

The electrical systems include conduit, wiring, enclosures, and devices. The descriptions presented here are based upon observations by C&E and are limited generally to the physical appearance of electrical system components and to conditions described by Sewer Department personnel. The station chamber was not accessed to perform inspections and no observations or inspections were performed by an Electrical Engineer as such inspection is beyond the scope of this project. Explosion-proof equipment is required in sewage pump station wet wells. Record documents indicate the use of explosion proof equipment in the station wet wells, but detailed

evaluation by an Electrical Engineer would be necessary to determine if the components (that remain functional) are in proper operating condition.

The utility power service to the station is 115 / 230 volt single-phase service. A pad mounted, metallic enclosure cabinet that houses all electrical and control equipment is provided similar to the Submersible Grinder stations. The utility meter and a receptacle for connecting a portable generator for emergency power are mounted to the side of the main electrical enclosure. A manual transfer switch is provided to select Utility or Generator power source. The equipment and main electrical enclosure appeared to be in satisfactory condition. Sewer Department personnel did not identify any specific operating concerns for these items. Based upon this information, continued satisfactory performance is expected.

Interior lighting was operational. Surface corrosion was observed from the access hatch on conduit and junction boxes in the wet well. Sewer Department personnel indicated that conduit and wiring in the remainder of the station interior was in similar condition. Satisfactory continued service cannot be expected for extended periods. The Wastewater Facilities Plan should include replacement of the wet well electrical systems in conjunction with mechanical equipment replacement.

Conclusions

No major repairs to or replacement of the existing pump station structure is expected to be necessary during the 20-year Wastewater Facilities Planning period. Normal maintenance and replacement of minor components as the need arises should provide for continued satisfactory operation for the foreseeable future.

The pumps are expected to require replacement within the 20-year planning period. The pump control systems are expected remain serviceable for the planning period, however, replacement may be necessary to accommodate new pumping equipment. Ventilation equipment and combustible gas monitoring system should be provided when pumps are replaced.

Electrical systems inside the station are expected to require replacement during the planning period. TR-16 and electrical code compliance should be incorporated into any major renovations. Replacing the existing enclosure cabinets could be considered if the majority of the components housed in the enclosure are being replaced.

APPENDIX C

Sanitary Sewer Management Program

TOWN OF LINCOLN
DEPARTMENT OF PUBLIC WORKS

SANITARY SEWER MANAGEMENT PROGRAM

NOVEMBER 2003

Revised January 2004

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Appendix B: Standard Operation Procedure for Sanitary Sewer Priority Response
- Sanitary Sewer Priority List
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Appendix C: Standard Operation Procedure for Television Inspection of Sanitary Sewer Lines

Appendix D: Standard Operation Procedure for Sewer System Troubleshooting Guide

Appendix E: Standard Operation Procedure for Response to Sewer Blockages
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Appendix F: Standard Operation Procedure for Pumping Station Controls and Maintenance
- List of Pumping Stations and Design Loads
- Pumping Station Condition Report
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Appendix G: Standard Operation Procedure for Testing Pumping Station Alarms

Appendix H: Standard Operation Procedures for
- Emergency Generator Maintenance
- Emergency Response Plans
- Emergency Telephone Numbers

The purpose of this Management Program is to document the standard operations procedures and actions to be taken by the Town of Lincoln in order to eliminate the occurrence of sewer backups and pumping stations failures. This is a compilation of all the Town's Standard Operation Procedures related to the operation and maintenance of the sanitary sewer collection system.

I. Sewer Inspections and Repairs

The Town of Lincoln Department of Public Works Sewer Division is responsible for the operation and maintenance of the Town's sanitary sewer collection system.

The collection system comprises approximately 100 miles of sanitary sewer lines and thirty (30) pumping stations. The system includes a diversity of laterals: from the 150 year old vitreous clay pipes in the older mill villages to polyvinyl chloride pipe in the more recent sewer construction projects. The majority of the sewer system is less than 25 years old.

Sewer inspections and preventative maintenance measures are conducted on a daily basis by Sewer Division staff. Preventative maintenance measures consist of sewer main jetting using high-pressure water. Root and debris cutting is conducted using a rooting tool. This is effective in cleaning and removing grease, sand, gravel, grit and debris buildup.

In general, preventative maintenance is an on-going task. The maintenance work proceeds at a rate such that the entire Town sewer system is inspected about every ten (10) years.

Sewer Division staff use log books and report forms to track and document the collection system maintenance work and to determine future work requirements. A sewer department report is made each month. The report notes the specific section of sewer and pumping stations that are inspected, cleaned and repaired each month.

Appendix A contains the report forms utilized for sewer and pumping stations maintenance and repairs.

Through routine maintenance and inspections, a history of priority areas has been developed. The Sewer Division maintains a list of these sections of line and pumping stations that are inspected and tracked on a monthly or more frequent basis. The priority areas are where past blockages or failures have occurred. Upon inspection, if a buildup or blockage is found, it is cleared immediately. The Town intends to pursue Community Development Block Grant funding to perform engineering studies and sanitary sewer rehabilitation projects in the eligible areas of the Town that experience chronic priority sanitary sewer problems.

Appendix B contains the Standard Operating Procedure for sanitary sewer system priority location inspections and the Priority Area List.

During the routine inspection process, sewer manholes are inspected for defects and repairs are made as needed. Certain manholes and pumping stations that are susceptible to blockages or failure are identified in the Priority Area List.

The Sewer Division makes sewer repairs as required. The Town is able to make routine repairs to eliminate blockages within the sewer main and in the sewer at the property line from house laterals to the main. If the work is beyond the scope of the Town's ability to repair, utility contractors are utilized. If the blockage is found to be within sewers belonging to the Narragansett Bay Commission, the Commission is notified.

Television inspection of sewer is conducted to identify problems and to provide information. When blockages are suspected, a TV camera is employed to ascertain the exact location and the nature of the blockage. Once located, the blockage is removed. The Town owns and operates the television inspection equipment that is a small video unit with a push cable camera.

Appendix C contains the Standard Operating Procedure for Television Inspection of Sanitary Sewer Lines. The forms used to record and report the results of TV inspections are found in Appendix A.

A general trouble-shooting guide for the collection system is provided in Appendix D.

II. Documentation of Sewer Backups

The Sewer Division documents sewer backup and pumping station problems using field logs, onsite logs and the report forms in Appendix A. The Standard Operating Procedure for responding to sewer blockages is found in Appendix E.

For incidents that require notifying Rhode Island Department of Environmental Management (RIDEM), the RIDEM form in Appendix A is used. The Town is required to immediately notify the RIDEM in the event of any by pass or failure in the sewer system, either collection system or pumping stations, that may result in non-compliance with the RI Pollutant Discharge Elimination System regulations. Events that require notification are releases to the environment. The RIDEM must be notified by telephone as soon as possible, but within twenty-four (24) hours. The RIDEM Operations and Maintenance Section must be contacted at 222-4700. Should the incident occur during non-business hours, contact RIDEM Enforcement at 222-3070. The Town must identify the system, explain what happened, and inform the Enforcement personnel that this should be reported to the Office of Water Resources personnel.

Also, a written report must be provided to RIDEM within five (5) days of the time that the Town becomes aware of the incident. The filled out RIDEM form in Appendix A will be used for the written report.

III. Pumping Station Maintenance

The Town operates and maintains thirty (30) pumping stations as a part of its collection system. The age of these pumping stations varies. The majority of the stations contain duplex submersible grinder type pumps manufactured by the ABS Company. There is one station with a screw type pump and five stations with centrifugal pumps. Specific information regarding the pumping stations is contained in the List of Pumping Stations and Design Loads and Survey of Pumping Station Information, both in Appendix F.

The Standard Operating Procedure for Pumping Station Maintenance is found in Appendix F. The Standard Operating Procedure for Testing Pumping Station Alarm is found in Appendix G.

IV. Safety and Emergency Conditions

Safety Considerations

a. Responsibility for Safety

It is the obligation of the administrators of the Public Works Department to provide safe working conditions. Many of the factors contributing to the occurrences of injury or its prevention are largely in the hands of management, since they provide the work environment, maintain the work facilities, and hire workers. It must be stressed that all employees have a joint responsibility to work safely.

b. Response to Emergencies

It is imperative that carefully prepared plans be made regarding actions to be taken in case of emergencies. These plans include the continued operation of the facility and any necessary equipment bypassing, and a listing of contact people and telephone numbers of various emergency agencies (fire, police, ambulance, etc.) Specific rules should be posted explaining the required actions to be taken and ensure that all employees are aware of these procedures. A list of contacts is given in Appendix H.

c. Training of Personnel

Since the mental aptitude and physical health requirements are different for each classification of work, it is necessary that employees be assigned and trained for tasks that are commensurate with their particular capabilities. The more hazardous duties should be performed at the beginning of each work shift when the workers are more alert and less prone to accidents that can occur due to carelessness or tiredness. The basic skills required to maintain and operate the equipment was relayed to selected

Town personnel during the initial start-up and testing of the facility at the time of construction. Should training of additional employees become necessary, arrangements can be made with the manufacturer or the local representative for such instruction.

d. Visitors

When visiting servicemen are called to the facility, they should be asked whether their work would, in itself, create a hazard or effect the operation of the station. The operator, if required, should offer assistance, so that the work may proceed smoothly and safely.

When non-technical visitors are expected at the facility, the supervisor must require that:

- There is adequate supervision of the group or party
- The normal operating routine is not interrupted

e. Protection Against Mechanical and Physical Hazards

Care must be taken when repairing or performing maintenance on automatic or remote-controlled equipment to ensure that power is shut off so that equipment cannot be started or energized. Local or remote switches should be labeled with a red tag indicating that the switch is to remain in the off position.

Insofar as practicable, lubricating or equipment adjustments should not be made on machinery in operation. If such work is required, then a second workman should be stationed at the closest shut-off switch.

Ladder safety belts, if provided, must be kept in working order and stored in a location of easy access.

Personnel working in areas where tools or other heavy items may be dropped should wear hard hats.

All personnel should become familiar with correct lifting techniques.

f. Prevention of Infections

Workers who come in contact with wastewater could be exposed to waterborne diseases such as typhoid, amoebic dysentery, infectious hepatitis and others. Protective clothing and barrier creams are available for purchase and should be used. An adequate inoculation program to protect employees should be developed by the supervising staff.

g. Protection Against Electrical Hazards

In working around electrical equipment, the following steps to reduce accidents caused by contact with electricity should be taken:

1. Avoid personnel grounding themselves in water or on pipes when working around electricity
2. Only authorized and qualified personnel should work on electrical equipment or wiring. Only licensed, qualified electricians should perform major electrical repairs and maintenance.

3. Consider all electrical circuits to be dangerous.

h. Entering Confined Areas

A good rule to observe is to NEVER go alone into a hazardous location. Someone should be present who can watch the worker's condition and who is equipped to give all necessary assistance in case of emergency.

Personnel should be familiar with the use of oxygen deficiency detectors, a combustible gas detector, and safety belts. The air in the confined space should be tested at frequent intervals.

Prior to entering the wet well, the cover should be opened and the space allowed venting for a minimum of 20 minutes. The air should be tested with the equipment listed above prior to entering the well.

i. First Aid

The recommended minimum requirements for pumping stations is that a person qualified in first aid be available at all times. The American Red Cross offers first-aid courses throughout the region, and such instruction should be used. The most common accidents requiring first-aid procedures are as follows:

- Electrical Shock - Shut off the current or cautiously remove contact from the victim using an insulated or non-conductive item. Follow first-aid procedures obtained from the instructional courses.

- Moving the Injured - Do not move an injured person before a physician or experienced paramedic arrives, unless there is real danger of further injury at the accident site. Follow first-aid procedures obtained from the instructional courses.

Remember—a standard telephone set is installed at each pump station site to be used in case of such emergencies.

General Emergency Conditions

During the normal operation of the pumping station facilities, emergency situations—either natural or mechanical—are likely to occur which will disrupt the daily routine of operation. The purpose of this section is to outline the basic emergencies that may occur and to provide the operator with a planned response with appropriate corrective steps to be used in restoring the pumping station operation to normal.

In general, the following is a recommended pattern of response that the operator should follow regardless of the type of emergency:

- Early Warning Report - The purpose of this report is to advise supervisory personnel of impending danger or of an emergency situation.

- Investigation - Steps should be taken to investigate and evaluate the problem. A determination should be made if a danger to the safety of personnel exists or is imminent.

- Response Course of Action - The proper course of action should be decided upon and implemented.

- Notify the Proper Authorities - Depending upon the scale of the problem, the operator should advise the appropriate local authorities of the situation.

Specific emergency measures are given in Appendix H.

APPENDIX A

Standard Operation Procedure for Sanitary Sewer Maintenance

TOWN OF LINCOLN

SEWER DIVISION

Standard Operating Procedure for Sanitary Sewer Maintenance

Maintenance Task: Jetting

Description of Task: Utilizing the truck-mounted high velocity jet/vac. clean and remove any buildup of grease, sand, gravel, and debris. Break-up solids found within manholes. Wash and clean manhole structure.

Equipment: (1) FMC sewer jet flush truck

Schedule and Frequency: Daily, as needed

Special Considerations: Follow proper traffic routing and confined space entry procedures.

Reporting: Report work completed on Monthly Maintenance Report.

Monthly Maintenance Report

Monthly Maintenance Report for the Month of: _____

The following sewer system maintenance was completed:

Sewer pipe jetted_____ sections (approximately _____ L. F.)

Locations:

Sanitary manholes cleaned:

Locations:

APPENDIX B

Standard Operating Procedure for Sanitary Sewer Priority Location Inspections

Priority Area List

The following are the areas that are susceptible to blockage and/or failure. (Dated 11/03)

Area number	Location/ type of structure	Condition/ problem
1.	AP 6 Lots 196, 197 line from Seventh Day Adventists' Church/ old clay pipe line in back yards	Church connection blocks up, line has blockage
2.	AP 7 Lots 70- 76, south of Ballou Ave./ old clay pipe line in back yards	Line blocks up occasionally
3.	AP 4 Lot 70 and AP 5 Lots 17, 19, 20 21 in Lonsdale, in back of houses/ old clay pipe	Flat line, SMH in poor condition, occasional blockage
4.	School Street in Albion from Kennedy Blvd. To NBC interceptor/ old clay pipe	Line in poor condition, suspected storm water connections
5.	AP 3 Lot 34 to Industrial Drive/ old clay pipe	Line is flat, in poor condition, occasional blockage
6.	AP 37 Lots 90,91,92,113,114,115, Post office parking lot and back of houses along Spring Street/ old clay pipe	Line is in poor condition, occasional blockage
7.	AP 35 Lots 7, 9, 10, in back of lots/ old clay pipe	Line is in poor condition, occasional blockage
8.	Woodland Court/ sewer lines	Suspected infiltration, storm water connections

TOWN OF LINCOLN

Standard Operating Procedure for Sanitary Sewer System Priority Location Inspections

Maintenance Task: Inspection of and cleaning (as needed) of known priority sanitary sewer locations.

Description of Task: At the locations noted on the priority area list, the inspection crew will open the manhole covers to check the flow in the channel. Observe flow status and condition of manhole. Remove and clean blockages as needed. Record findings on the report form.

Schedule and Frequency: Bi-weekly

Special Considerations: Follow proper traffic routing and confined space entry procedures.

Reporting: Report work completed on Sewer Inspection of Priority Area Inspection Forms.

SEWER DIVISION

Priority Area Inspection Form

Date:

Time:

Location:

Personnel responding:

Observations:

Actions taken:

APPENDIX C

Standard Operating Procedure for Television Inspection of Sanitary Sewer Lines

TOWN OF LINCOLN

Standard Operating Procedure for Television Inspections of Sanitary Sewer Lines

Maintenance Task: Television inspection of sanitary sewer lines.

Description of Task: Television inspection may be used for inspection work to examine work completed by a contractor, examine the location of installed taps, and locate illegal taps. Television inspection is also used for maintenance purposes to examine the condition of sewer lines, locate problem areas such as pipe of joint rupture, condition of service connections, obstructions in the line, corrosion, pipe alignment, infiltration through joints and inflow from illegal connections.

Equipment:: Portable T. V. inspection camera

Schedule and Frequency: As needed

Special Considerations: Follow proper traffic routing and confined space entry procedures.

Reporting: Report work completed and service Monthly Maintenance Report found in Appendix A.

APPENDIX D

Troubleshooting Guide for Sewer System

TABLE 12-10 SEWER SYSTEM TROUBLESHOOTING GUIDE

Identification of Problem	Source or Cause	Solution Method	Comments
1. Stoppages—Emergency	1a. Grease	High-velocity cleaner	A high-velocity cleaner will open most grease stoppage
a. Manhole overflowing		Hand rods, power rudder	Rod from downstream manhole with a 4-inch auger into stoppage. When clear, then run 6-inch or larger auger through restricted area. Initiate work order to clean with high-velocity cleaner or ball line as soon as possible. Hand rods and power rodders will usually unplug most grease stoppage.
b. Flooding of residences or businesses	1b. Roots	High-Velocity Cleaner	High-velocity cleaner will usually open stoppage and restore service. Schedule TV inspection and chemical treatment. If unable to clean roots with high-velocity cleaner, power rodder may be necessary.
		Hand Rods	Rod from downstream manhole with 4-inch auger or saw. Be cautious in opening stoppages if there is a high head on the upstream manhole. Remove as much of the root mass as possible. Request TV inspection for root concentration; schedule power rodding to open line and chemically treat to control future root growth. Hand rods are effective 90 percent of the time.
		Power Rodder	If cannot clear roots with hand rods, power rodder may be necessary.
	1c. Debris stoppage such as		Power rod line to clear stoppage. Schedule TV check cleaning, and chemical treatment.

	rocks, lumber	High-velocity cleaner Power Rodder	Caused by broken lines, open manholes, vandalism. Clean line with high-velocity cleaner. Use caution. May jam tool in line requiring a dig up to clean line and remove broken rod and tool
2. Grease a. Stoppage causes grease buildup b. TV report on routine inspection c. Observe buildup on side walls of sewer d. Past records	a. Restaurant on blocked segment of sewer b. Low velocity allowing grease buildup from home deposal unit. Problems often develop where high velocities are suddenly slowed down.	a. High-Velocity Cleaner b. Balling (or tire) c. Scooter (or kite) d. Power Rodder e. Chem-icals e. Bac-teria Cultures f. Bacteria Cultures a. Clean	High-velocity cleaner is an effective tool in removing grease buildups in line sizes up to 15 inches. High-velocity cleaner becomes ineffective in larger diameter pipes. Balling will remove grease deposits from pie walls, but will not clean as effectively as properly used high-velocity cleaner. More effective than high-velocity cleaner in lines above 18-inch diameter. Extensively used, but not as effective in grease removal as high-velocity cleaner and balling; usually ineffective lines above 10-inch diameter. Be sure to insist on a performance contract. Do not pay until the chemical or material performs as claimed. Specific cultures are required for collection system maintenance. Specific cultures are required for collection system maintenance. A regular maintenance program must be

e. Grease trap		trap regul-arly b. Bacteria Cultures	established and continued. Specific cultures are required for collection system maintenance.
3. Roots a. TV report b. Poor joints or damaged pipe allow root entry c. Past Records	a. Trees and Shrubs d. Repairs	b. Chem-icals c. Power Rodder d. High-Velocity Cleaner	For long-term control, chemical treatment provides the best solution with up to three years between applications. Personnel applying root control chemicals may need to be certified and must take all recommended safety precautions when using chemicals. Best suited for opening pipe with root obstruction. If rodding is the only method used, special tools are required to cut roots to the pipe walls and periodic cleaning will be required. Special root cutters are available. If TV report shows only one section of broken line or a few bad joints, dig up and repair. If a great number of defects are observed, consider pressure sealing or relining the pipe by insertion of a liner.
4. Sand, Grit, Debris a. TV report b. Grit settles during low flows c. Grit sticks to grease or slimes	a. Eggshells, coffee grounds, bones from residential disposal units b. Broken china, bones, and glass from	a. High-Velocity Cleaner b. Balling (or tire) c. Scooters and Kites	For light concentrations of grit in small lines; not effective cleaner in lines above 15-inch diameter. The workhorse for cleaning. Large volumes can be removed at a reasonable cost. Requires careful control in shallow lines. More effective in larger lines. Removes some dangers of flooding in shallow lines that balling may create if not

d. Routine inspection e. Past records	restaurant disposal units c. Sand, silt from poor joints and broken lines d. Lines with low flows or velocities permitting deposition of solids	d. Bucket Mach-ines	roperly controlled. Used where extreme concentrations of grit and sand have loaded the line to extent that above methods are ineffective due to cost and handling of material to be removed.
5. H2S and Odor Control a. Odor complaints b. Manhole inspection reveals line deter-ioration	a. Force mains b. Low flows & velocity c. Offset joints d. Bellies in line e. Drop man-holes f. Manhole where trucks dump septic tank contents	a. High-Velocity Cleaner b. Bailing b. Scooter c. Flushing d. Plug lifting and vent holes in manhole cover	Fast cleaning of slimes in lines up to 15-inches diameter. Best for sewers with bellies and offset joints, but expensive operation for odor control only. Fast for larger lines. Small lines. Usually not effective for more than one week. Roofing cement makes a satisfactory hole sealer. Specially made plugs are avilable from vendors.
6. System Inspection	Detects problem areas and permits	a. Closed Circuit TV	Permits through inspection of system. Pinpoints damaged areas such as broken pipe segments, offset joints,

	realistic scheduling of preventive maintenance program		lines not to grade, collapsed pipes, protruding service taps, root intrusion, deterioration of lines, and grease deposits. Informs you of required cleaning and the effectiveness of the cleaning method. If a stoppage reoccurs or you are curious regarding cause of problem, TV the line. The most useful tool in collection system maintenance.
		b. Air and water testing	Detection of sources of infiltration and exfiltration.
		c.Smoke Testing	Locates leaks when groundwater table is below sewer. Also used to determine if buildings and residences are properly connected to collection system and to identify illegal connections.
		d.Dye testing	Identification of illegal connections and location of overflowing or leaking manholes and sewers.
		e, Pipeline Lamping	Inspection of sewers for condition, including alignment and obstructions
		f. Visual	Lift manhole covers and observe conditions.

APPENDIX E

Standard Operating Procedure for Response to Sewer Blockages

Standard Operating Procedure Response to Sewer Blockages

1. Upon notification of problem, obtain name, address, and phone number of the person reporting the problem.

2. Immediately contact the complainant for detailed information regarding the problem. If a plumber or rooter contractor is at the property, try to speak directly to him about the problem. If a response is necessary, inform the complainant of your expected time of arrival.

3. Upon arrival, inspect the Town sewer main. Inspect manholes upstream and downstream from the property to insure the Town main is flowing properly.

4. If the Town main is blocked, call in a crew to clean the main. Go to Step No. 10.

5. If blockage is in the property service lateral to street, you must try to identify the cause and the location of the blockage as this will determine the party responsible for correcting the problem in accordance with the Town ordinance.

Assess the property and adjoining properties for the possible impact of town and/or private trees on the lateral. The Town sidewalk easement is, as a rule, 8' wide for a 24' wide street and 10' wide for a 30' wide street. Check also for any depressions in the roadway that could be the result of a cracked or broken pipe.

6. If the owner has not yet contacted a sewer rooter company, advise him to do so. Inform the owner that if the problem is found to be the responsibility of the Town, a claim can be filed for reimbursement of cleaning costs.

7. Provide owner with your telephone and beeper numbers so that you can be apprised of the outcome. If the block is successfully cleared and roots were the cause of the problem, schedule an appointment for the next business day to televise the lateral to determine the location and responsibility of the block.

8. If the rooter contractor cannot clear the blockage and it is possible that Town tree roots or a broken pipe in the Town street causes the blockage, a Town work crew should be called in to install a clean-out. At that time, the lateral can be televised to determine the exact location of the problem. If the problem falls under Town responsibility in the Town right-of-way, the crew

will proceed to correct it. If the problem is the Town's responsibility but lies on private property or is too deep for the Town crew to excavate, notify your supervisor or the Public Works Director.

9. If any damage to the property has occurred due to the backup, the Director of Public Works will contact the Interlocal Risk Management Trust to have a claims administrator review the damage.

10. Complete a Sewer Incident Report. Provide as much detail as needed to fully record the incident.

SEWER INCIDENT REPORT

TIME NOTIFIED: _____

BY WHOM: _____

PERSONNEL RESPONDED: _____ _____

_____ _____

_____

LOCATION OF TROUBLE: _____

_____

_____

ACTION TAKEN:

Summary of situation:

Actions taken:

Town of Lincoln Pump Station/Collection System Bypass Report

1. Location of bypass: _____

2. Who notified municipality? _____

3. Time and date of above notification: _____

4. Date/time bypass started: _____ bypass ended: _____

5. Cause of failure: _____

6. Amount bypassed: _____

8. Was bypass treated with emergency chlorination? _____ Time chlorination started: _____ Amount of chlorine used: _____

9. What waterbody did the bypass discharge to? _____

10. Detail chronology of events leading to failure/bypass:

_____

_____

_____

11. Detail chronology of response indicating all steps taken to minimize the amount bypassed:

_____

_____

12. If applicable, were septage haulers and/or emergency generators used to minimize the amount bypassed? (If use was possible but not implemented, why not?)

_____

_____

_____

13. What actions are being taken to mitigate and/or prevent further occurrences?

_____

_____

14. Notification of RIDEM (during business hours #; 222-4700; 24-hour emergency #: 222-3070)

Person notified _____ Date/Time: _____

By _____

APPENDIX F

Standard Operation Procedure for Pumping Station Controls and Maintenance

Standard Operating Procedure for Pump Station Maintenance

Maintenance Task: Preventative maintenance of pump stations

Description of Tasks: All pump stations and equipment must be inspected on a weekly basis at a minimum. Pump station inspection and maintenance consists of the following tasks:

- Check of wet well and record levels where available
- Bleed compressors
- Check operation of bubble system
- Check dehumidifier, heaters, fans, lighting
- Check operation of sump pumps
- Check generator fluid levels and batteries
- Check and test pumps
  - -record: lapse time, cycles, pump hours
  - -check motors, couplings, drive shafts
  - -watch operation of check valves
  - -check seal water operation
- Check comminuters
- Check recirculators
- Change chart paper
- Record all necessary information on the Pump Station Condition Report form

Crew Size: Two

Schedule and Frequency: Weekly

PUMP STATION OPERATION AND CONTROLS

OPERATION

A. Sewage Pumps

The majority of sewage pumps are the submersible grinder pumps manufactured by the ABS Company. The major pump components and their maintenance are given below:

1. Lifting rail: Each station is equipped with a lifting rail system for each pump unit to aid in the removal of the pump for either routine or emergency maintenance. Due to the weight of the pumps--approximately 150 pounds--it is recommended that a hoist be used to lift the units. The guide rail facilitates easy lift out as well as to center the pump unit on the base during pump installation. Scum buildup around the bottom of the rail pipe, which generally occurs at normal water levels, should not interfere with proper operation.

2. Base: Each pump is secured to the bottom of the well by a cast iron base, which is bolted to the floor of the concrete manhole. The base is likewise attached to the lifting rail system mentioned above and the discharge piping which connects to the force main.

3. Check Valve: Each pump is equipped with a check valve to prevent the back flow of sewage through the pump and into the well. The valve is attached to the pump unit near the base and is removed with the pump.

4. Grinder/Cutter: The grinder assembly of the pumping unit is composed of a plate and cutter that grinds the waste much like a household kitchen garbage disposal. These parts do wear and need occasional adjustment and routine replacement.

5. Motor: The pump motors are the submersible type 240-volt single phase for the 3 horsepower and the 5 horsepower unit. Each motor is equipped with a seal failure probe that will activate an alarm if the electrical connection chamber is contaminated with water.

B. Pump Controller System

The pump controller system is manufactured by E. G. Pump Controls. The major components and their function are:

1. Air Pump: Each controller cabinet is equipped with two diaphragm type air compressors that supply the control air through the bubbler tube. The backpressure on the air as it exits the tube causes the mercury level gauge to

react. With an increase in backpressure, the mercury level increases, thereby indicating a higher water level in the well. The reverse is likewise true. The compressors are connected to an alternator switch that changes the start mode causing a different unit to start on successive cycles. Each compressor supplies approximately 4 pounds per square inch of air.

2. Air Flow Gauge: The airflow gauge regulates the amount of free air entering the bubbler tube. Adjustments are made by rotation of the needle valve located immediately below the gauge. Generally, the normal setting of the gauge is 5 CFPH.

3. Mercury Level Gauge: The mercury level gauge indicates the water level in the well in both feet and in inches. Graduations are in 3-inch intervals. As the mercury level rises, an electrical contact is made with the screw heads that are visible through the sight glass. Pump control and alarm conditions are activated by such contacts. Adjustments in the settings can be made by connecting the respective wire to the desired screw shaft accessible in the back of the gauge unit. Note: a factory supplied socket tool is attached to the back of the gauge for such adjustments.

Wire leads from the controller components to the gauge connections are labeled as follows:

Low-level alarm
Stop lead pump
Stop lag pump
Start lead pump
High-level alarm
Start lag pump

The contractor makes initial settings of the gauge during facility start-up. These settings should be modified or adjusted during the operational life of the station, since loading conditions change over time. However, as a guideline, there should be minimum distances between settings. For example:

Low level alarm:	6 – 12" above the floor
Stop lead pump:	6 – 12" above low level alarm
Stop lag pump:	6 – 12" above stop lead pump
Start lead pump:	1 – 3 ft. above stop lead pump to obtain pump cycle of 3-5 minutes
High level alarm	6 – 12" above start lead pump
Start lag pump	6 – 12" above start lag pump

4. Local Alarm and Status Annunciate: The front panel of the controller panel indicates the following information concerning the status of the facility:

- Odometer for each pump which indicates the elapsed running time in hours and tenths for that unit
- Pump on light (one for each unit)
- Wet well low level alarm light
- Wet well high level alarm light
- Pump motor seal failure light (one for each unit)

5. Heater Unit: An electrical strip heater of approximately 750 to 1000 watts is located near the bottom of the cabinet to help keep a proper environment for the electronic components. A thermostat, located near the unit, controls the temperature setting. Generally, this setting should be between 40 to 45 degrees Fahrenheit.

C. Valves

The stations are equipped with two different types of valves:

1. Check valves, as stated earlier, are factory-supplied equipment attached to the pump units. Their function is to prevent the draining of the force main.

2. A gate valve for each pump unit is located in the discharge piping manifold. The purpose of this valve is to isolate the pump from the force main, thereby preventing the main from emptying whenever the pump unit is removed.

D. Gauges

Pressure gauges are installed in each pump manifold to determine the actual discharge pressure, thereby aiding in the determination of proper pump performance. The gauges are calibrated in pounds per square inch (psi). The operator should occasionally monitor the readings and compare them with the design total head values itemized in the manufacturers specifications.

E. Hatch

An aluminum hatch provides the operator access to the wet well and allows easy removal of the pump units. A padlock prevents unauthorized access to the facility.

F. Ventilation

A gravity system of ventilation is provided in the form of a 4-inch diameter ductile iron pipe. The facility is NOT classified as a working area; and, therefore, a forced system of ventilation is not required. However, if it is necessary for any reason to enter the wet well, certain precautions must be adhered to.

- Open the hatch and allow the facility to vent for at least 30 minutes.
- Always have a worker standby the facility in case of emergency.

G. Electrical Systems

Electrical power to the facilities, as stated earlier, is either 120/ 240 volt single depending on the station horsepower requirements. A distribution panel contains the breakers that isolate the various circuits.

A duplex outlet provides power for small hand tools or portable lights.

The utility meter is located outside of the main cabinet and is monitored by the National Grid Corp.

Each station is equipped with an exterior electrical weatherproof fitting for a portable generator. These generators provide temporary power during periods of utility company power outages. The pump stations are designed so as to provide a holding capacity of 40 minutes of flow at peak periods above the high level alarm setting in order to give the operator sufficient time to react to the loss of power condition.

H. Records

It is essential that the station operator maintain an adequate record keeping system. Well-maintained record keeping will aid the operator in the scheduling of routine preventative maintenance as well as to provide a written history profile of all work performed on each piece of equipment.

MAINTENANCE

The lifeline of any mechanical system is the maintenance program established. Therefore, it is of prime importance that the operator adheres to the following maintenance schedule in order to ensure continued and safe operation of the mechanical equipment provided. In the following table, "A P M S" refers to *As Per Manufacturer's Specifications.*

A. Preventive Maintenance Schedule

Equipment	Action	Period
Sewage Pumps	Inspect	6 months
	Change cutters	A P M S
Generator	Change oil/filters	A P M S
Gauges	Record reading	Monthly

Controller Panel	Inspect	Weekly
Pump start/stops	Review	Monthly
Air Bubbler Line	Manual blowoff	Bi-monthly or as required
Computer Equipment	Professionally clean	Twice yearly

The pump start/stop cycle information is obtained from the report section of the computer system. Frequent cycle operation (4 starts per hour per pump unit) is not recommended. Adjustment of the mercury gauge settings for pump on/off will allow the operator to modify pump cycle operation. Likewise, should the detention time of the sewage in the well be excessive (4 – 6 hours), a septic condition can develop. Again, the solution is to adjust the settings for the mercury gauge.

B. General Housekeeping Schedule

Action	Period
Cut grass	As required
Remove snow	As required
Paint Control Cabinet and vent	As required

C. Supplies and Tools

The following supplies and tools should be kept on hand for routine maintenance:

Lubricating oils
Rags and cleaning solutions
Spare parts required for the facilities
Metric and American Standard socket sets
Assorted small tools like screwdrivers, pliers, etc.
Power drill and assorted drill bits
Rubber gloves
Rubber boots

The following spare parts were supplied under the sewage program construction contract:

Pump cutters - 1 set
3 hp pump units - 2
Telemetry system remote microprocessor - 1

D. Trouble-Shooting Chart

Symptom	Possible Cause	Action/Remedy
High level alarm	Clogged pump	Remove and clean cutter
	Increased flow to station	Inspect system for infiltration
	Loss of control air	Inspect compressor units & air flow gauge
No flow when pumps operate	Clogged pump	Remove and inspect
	Clogged check valve	Remove and inspect
Low level alarm	Mercury gauge malfunction	Inspect contact setting
Noisy pump operation	Cutter assembly	Inspect and repair
Loss of communication	Telephone unit not on hook	Inspect and correct
	Faulty modem	Call for repair
Improper pump operation	Control settings	Inspect for good connection
	Clogged air line	Perform manual blowoff

E. Utilities

The following public utilities are provided at each pump station site:

- Electric: 120/ 240 volt service from the National Grid Co.
- Telephone: Standard dial-up tone lines are installed at each station from the NYNEX Company.

Due to the special requirements needed to accommodate a public water service in a pump station facility, this utility was not provided. Should flushing water be necessary, it is recommended that arrangements be made with the Lincoln Water Commission for connection to the nearest hydrant.

Pump Station Condition Report

Date:

Personnel:

PUMP	CONDITIONS OBSERVED	MAINTENANCE PERFORMED
Angell Road North		
Angell Road South		
Applewood		
Arlington		
Ashley		
Belmont		
Birchwood		
Cider Mill		
Davies		
Eagle Nest		
Edgehill		
Great Road South		
Great Road 116		
Heidi		
Hillside		
Jason		
Kirkbrae		
Lincoln Center		
Lori Ellen		
Lower Road		
Maria		
Middle		
Mount		
Newland		
Oakhill		
Old Pike		
Paddock		
Rollingwood		
Whitney		
Woodridge		

PUMPING STATION DESIGN AND EXISTING FLOWS

PUMP STATION	FEEDS	TOTAL LOTS	CONNECTED LOTS	DESIGN LOAD	CURRENT LOAD
Angell Road North+	Angell Road South	222	111	194	111
Angell Road South+	NBC*	576	220	596	331
Applewood	Maria	22	15	60	15
Arlington	NBC	50	36	60	36
Ashley	Maria	22	15	60	15
Belmont	Angell Road North	11	10	11	11
Birchwood	NBC	18	5	85	5
Cider Mill	Great Rd. South	13	12	60	12
Davies	NBC	80	55	85	55
Eagle Nest	Oakhill	41	21	85	21
Edgehill	NBC	27	17	60	17
Great Road South	NBC	831	405	925	451
Great Road 116	NBC	18	7	60	36
Heidi	Great Rd. South	19	5	85	5
Hillside	NBC	9	8	60	8
Jason	NBC	42	13	85	22
Kirkbrae	NBC	153	97	153	97
Lincoln Center	NBC	60	60	60	60
Lori Ellen	Angell Rd. South	37	19	85	19
Lower Road	NBC	91	44	91	50
Maria	NBC	219	120	258	140
Middle	NBC	23	15	60	15
Mount	NBC	42	24	60	24
Newland	NBC	6	5	60	5
Oakhill	NBC	20	13	85	34
Old Pike	Great Rd. South	25	9	85	9
Paddock	Jason	21	9	85	22
Rollingwood	Angell Rd. North	51	26	85	31
Whitney	Rollingwood	11	5	60	5
Woodridge	NBC	18	13	85	13

Loads dated from 1999? unless otherwise noted.
*NBC= Narragansett Bay Commission sewer system
+ updated 2/03

TOWN OF LINCOLN

Sewer Lift Pump Station Survey

Pump Station Address	Year Built	Emergency Generator KVA	Average Capacity GPM	Motor Size (HP)	Response Time	Description Mfg., Model, Type
Angell Rd. No., Angell Rd.	1991	KW40	290	15 HP (2)	2 hrs.	Yeoman-4312-Centrifugal
Angell Rd. So., Angell Rd.	1991	KW150	1600	60 HP (2)	1 hr.	Yeoman-6312-Centrifugal
Applewoood, Applewood Ln.	1989	no	115	3 HP (2)	6 hrs.	ABS-Piranha-Grinder Pumps
Arlington, Arlington Dr.	1988	no	115	3 HP (2)	6 hrs.	ABS-Piranha-Grinder Pumps
Ashley, Ashley Dr. **(old)**	1989	no	115	3 HP (2)	6 hrs.	ABS-Piranha-Grinder Pumps
Belmont Pump Station, Belmont Dr.	1998	no	115	3 HP (2)	8 hrs.	ABS-Piranha-Grinder Pumps
Birchwood, Birchwood Dr.	1990	no	160	5 HP (2)	6 hrs.	ABS-Piranha-Grinder Pumps
Butterfly, Ea. Butterfly Way **(old)**	1992	no	160	5 HP (2)	6 hrs.	ABS-Piranha-Grinder Pumps
Davies, Old Pike	1993	KW30	160	5 HP (2)	2 hrs.	ABS-Piranha-Grinder Pumps
Eagle Nest, Eagle Nest Dr.	1991	no	160	5 HP (2)	4 hrs.	ABS-Piranha-Grinder Pumps
Edgehill, Edgehill Ave. **(old)**	1987	no	115	3 HP (2)	8 hrs.	ABS-Piranha-Grinder Pumps
Great Road (116), Great Rd. **(old)**	1989	no	115	3 HP (2)	8 hrs.	ABS-Piranha-Grinder Pumps
Great Road South, Great Rd.	1990	KW150	1600	60 HP (3)	1 hr.	Yeomans-6312-Centrifugal
Cider Mill, Cider Mill Ln. **(old)**	1990	no	115	3 HP (2)	8 hrs.	ABS-Piranha-Grinder Pumps
Heidi, Heidi Road **(old)**	1992	no	160	5 HP (2)	6 hrs.	ABS-Piranha-Grinder Pumps
Hillside, Hillside Ave. **(old)**	1987	no	115	3 HP (2)	8 hrs.	ABS-Piranha-Grinder Pumps
Jason, Jason Drive	1989	no	160	5 HP (2)	4 hrs.	ABS-Piranha-Grinder Pumps
Kirkbrae, Timberland Drive	1988	KW40	470	20 HP (2)	2 hrs.	Yeoman-4315-Centrifugal
Lincoln Center, Lincoln Center Blvd.	1992	no	115	3 HP (2)	6 hrs.	ABS-Piranha-Grinder Pumps
Lori Ellen, Lori Ellen Dr.	1991	no	160	5 HP (2)	6 hrs.	ABS-Piranha-Grinder Pumps
Lower River, Lower River Rd.	1989	no	300	1 I/2 HP (2)	1/2 hr.	Schreiber-Screw Pump
				(Baldor Motor)		
Maria, Maria St.	1989	KW60	570	40 HP (2)	2 hrs.	Yeoman-4312-Centrifugal
Middle St., Middle Street	1987	no	115	3 HP (2)	8 hrs.	ABS-Piranha-Grinder Pumps
Mount Ave., Mount Avenue	1989	no	115	3 HP (2)	6 hrs.	ABS-Piranha-Grinder Pumps
Newland, Newland Ave. **(old)**	1987	no	115	3 HP (2)	8 hrs.	ABS-Piranha-Grinder Pumps

Pump Station Address	Year Built	Emergency Generator KVA	Average Capacity GPM	Motor Size (HP)	Response Time	Description Mfg., Model, Type
Oak Hill, Albion Road	1991	no	160	5 HP (2)	4 hrs.	ABS-Piranha-Grinder Pumps
Old Pike, Old Pike **(old)**	1992	no	160	5 HP (2)	6 hrs.	ABS-Piranha-Grinder Pumps
Paddock, Paddock Drive	1989	no	160	5 HP (2)	6 hrs.	ABS-Piranha-Grinder Pumps
Rollingwood, Wingate Road	1991	no	160	5 HP (2)	4 hrs.	ABS-Piranha-Grinder Pumps
Whitney, Whitney Dr. **(old)**	1995	no	115	3 HP (2)	8 hrs.	ABS-Piranha-Grinder Pumps
Woodridge, Barbette Drive	1991	no	160	5 HP (2)	8 hrs.	ABS-Piranha-Grinder Pumps

APPENDIX G

Standard Operating Procedure for Testing Pump Station Alarms

TOWN OF LINCOLN

Standard Operating Procedure for Testing Pump Station Alarms

Maintenance Task: Testing of all pump station alarms

Description of Task: Each pumping station is equipped with alarms. The pump station alarm signals are relayed to the Town's staff. One Sewer Division worker is on call via the Nextel at all times. The alarm testing consists of the following tasks:

Test pump room alarm (tip float)
Test wet well alarm (tip float)
Test air compressor (bleed and empty)
Check alarm panel at station
Inform supervisor on any alarm problems

Crew Size: One

Schedule and Frequency: Monthly

APPENDIX H

Standard Operating Procedure for:

- **Emergency Generator Maintenance**
- **Emergency Response Plans**
- **Emergency Numbers**

TOWN OF LINCOLN

Standard Operating Procedures for Generator Maintenance

Maintenance Task: Preventative maintenance of pump station emergency generators.

Description of Task:: All pump station emergency generators are inspected and tested. Emergency generator testing consists of the following tasks:

a) Before start-up, the following is checked:
belts
cooling system
block heater
air cleaner
engine crankcase (oil level)
governor (oil level)
fuel system
batteries
gauges
battery charger.

b) During test, on the generator data sheet, the following information is recorded:
start and stop time
oil pressure reading
temperature reading
other remarks.

b) After shut-down:
check fuel level
report any malfunctions to supervisor

Schedule and Frequency: Without load - Monthly
Tested Weekly

EMERGENCY OPERATING CONDITIONS AND RESPONSE PLANS

A. Natural Disasters

Flooding: None of the stations are within a flood hazard area. Therefore, emergencies resulting from storm water flooding should not occur.

Hurricanes: In this area, hurricanes are most likely to occur during the months of August, September and October. The term ***"Hurricane Watch"*** indicates that a hurricane may threaten the area within 24 hours. A ***"Hurricane Warning"*** indicates that a hurricane is expected to strike an area within 24 hours. All appropriate action including the testing of all emergency power plans should be taken.

B. Miscellaneous Emergency Situations

Fire: In case of fire, the operator must call the fire department and alert all supervisory personnel. Portable-type fire extinguishers (type ABC) should be carried in all department vehicles for such emergencies.

Power Failure: A loss of power by the utility company will be signaled to the base computer unit at Town Hall. The operator must respond to the emergency by delivering, connecting and starting the portable generator unit within the 40-minutes response time.

Equipment Breakdown: Vital equipment components, such as sewage pumps and air compressors, are designed with standby units to ensure continued operation in the event of equipment failure.

Labor Strikes: It is essential that the stations be maintained during periods of labor strikes in order to prevent a serious public health hazard. A shut-down of the station will cause backups in the collection piping system.

Explosions: Fires and explosions are closely related. Explosions are most likely to occur in enclosed areas such

as wet wells where explosive gases are apt to form. The most common explosive gas likely to be encountered is methane. When methane is present and when it constitutes between 5% -- 15% of the contained atmosphere, an explosive condition can exist. In the event of an explosion, the operator must administer first aid if required; call the fire department; alert supervisory personnel; and assess damage to the operational status of the facility.

Contamination of Potable Water: Since none of the facilities have a potable water service supply, a cross-connection to that system thereby causing contamination is not a possibility.

Spills of Hazardous Materials into Sewers: Any number of hazardous materials could be discharged into the sewage system. Industrial wastes may contain toxic materials or oils and other types of potentially hazardous materials. The responsibility of the operator is to prevent the formation of an explosive mixture. He should inspect the facilities immediately if a spill is suspected and check the operation of all ventilation equipment. Supervisory personnel should then be notified of the situation.

Failure of the Emergency Warning System: Problems with the electrical circuitry can result in no alarm sounding when in fact an emergency situation exists. Special care and periodic testing should be taken to assure the proper operation of circuitry and alarms. As an added precaution, a list of names and addresses of people qualified to work on the equipment should be posted so that they may easily be contacted for emergency repairs.

Other types of Emergency Situations: Although every effort has been made to note those major emergency situations that may occur at the various facilities, there are probably a number of other situations that may develop that could be considered an emergency. The operator must use good common sense in handling these situations.

The operator's first concern during any emergency should be to safeguard against injury to personnel. He should bring to the attention of the supervisor all situations that could result in a hazard.

RE: Work Schedule

The following work schedule is to be followed on a regular basis unless directed otherwise.

MONDAY:	Check and maintain all stations
TUESDAY:	Bar Racks - check stations
WEDNESDAY:	Check all generators and make sure they start. Every first Wednesday of the month, make sure all generators work under a load.
THURSDAY:	Check and maintain all stations
FRIDAY:	Bar Racks - check stations

While following this schedule, there will be times when things will alter this schedule somewhat. When you have to do inspections, clear a sewer blockage or any other emergency that may occur, you are to take care of the job at hand and then return to the regular work schedule.

When checking stations, one truck is to start at Birchwood Drive and the other at the North Providence end of Town. Both crews should then check station by station working toward the center of Town. This should help to respond much faster to any emergency that may occur.

PUBLIC WORKS

	HOME	NEXTEL
John MacQueen	333-0207	255-2716
Mike Gagnon	437-9807	255-2718

SEWER DEPARTMENT

Sewer Nextel	**255-2714(Call First)**	
Don D'Anjou	762-3008	255-2714
Eric Fox	475-1473	
Joe Amaral	725-5297	
Doug Fletcher	487-1057	
Sewer Beeper:	**938-9575**	

Autodialer alarm pin number: 1111

Emergency Numbers

SEWER DEPARTMENT

Don D'Anjou	**255-2714 (N)**	762-3008 (H)
Sewer Dept. Pager	**938-9575 (Pager)**	
Joe Amaral	725-5297 (H)	763-2426 (Pager)
Eric Fox	475-1473 (H)	255-1824 (cell)
Doug Fletcher	487-1057	

HIGHWAY

Mike Gagnon	**255-2718 (N)**	**938-1717 (Pager)**	**437-9807 (H)**
Bill Beauchemin	**255-3332 (N)**	**334-3739 (H)**	

POLICE **333-1111** **911 Emergency**

SEWER: (800) 370-5233 "Clean Care of N. E."
(After regular business hours)

NARRAGANSETT ELEC. **(800) 264-9096**

PLUMBER: **(508) 883-6010 (Giguere & Marchand—"Louise")**

RIDEM: 222-4700 Operations & Maintenance Section, business hours
222-3070 Enforcement (weekends & 4:30PM- 8:00AM weekdays)

SEWER DEPARTMENT

CONTROL CABINET:

Fred Wise (work)
(508) 520-7835
(508) 327-6581 (pager)

Fred Wise (Home)
(508) 359-4689
(508) 561-7879 (cell)

E. G. Pump Controls
(904) 292-0110

Techniflow
(508)359-2341

GRINDER PUMPS:

ABS Pumps
(203) 238-2700

ELECTRICAL:

MENARD ELEC. (Roger)
766-9563
1-800-202-1505

EMERGENCY:
Roger Menard
Pager: 763-1201

WELL PUMPING:

Schofield Sanitation
334-3339
Truck: 767-7278

Schofield Sanitation
Answering Service:
333-2228

RON CHUDY: **333-2368**
ERNIE LACOMBE: **463-2707** (Civil Defense Director—Emergency Preparedness)

APPENDIX D

Manhole Inspection Report

MANHOLE INSPECTION REPORT

DATE: _____

MANHOLE #: _____ STREET: _____

WEATHER: _____ INSPECTOR(S): _____

MANHOLE COVER

DIAMETER: _____ INCHES

NO. OF HOLES IN COVER: _____

CONDITION OF FIT: LOOSE ☐ TIGHT ☐

SEALED ☐ BOLTED ☐

EVIDENCE OF LEAKAGE: YES ☐ NO ☐

MANHOLE FRAME

CONDITION: SOUND ☐ BROKEN ☐

EVIDENCE OF LEAKAGE: YES ☐ NO ☐

CORBEL AND WALLS

CONSTRUCTION: PRECAST ☐ BRICK ☐

CONDITION: GOOD ☐ DETERIORATING ☐

EVIDENCE OF LEAKAGE: YES ☐ NO ☐

BENCH WALLS

CONDITION: GOOD ☐ DETERIORATING ☐

DEPOSITS: MUD ☐ DEBRIS ☐ SLUDGE ☐

DEPTH OF DEPOSITS: _____INCHES

STEPS

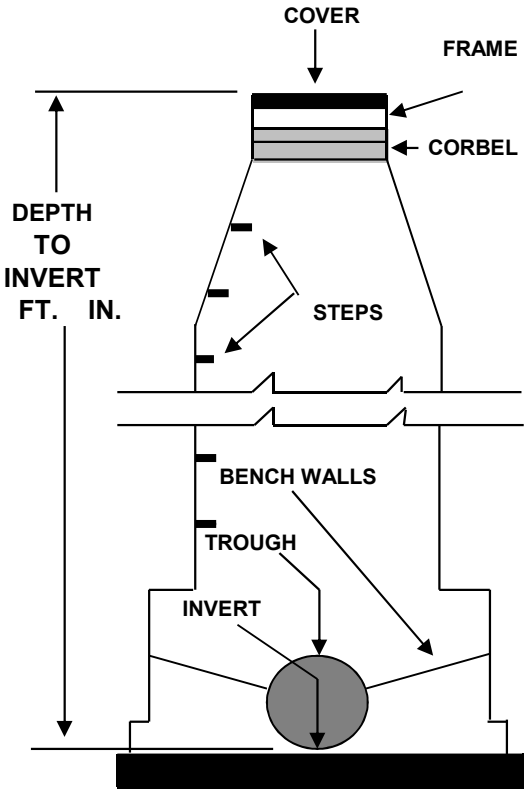
CONDITION: GOOD ☐ DETERIORATING ☐

EVIDENCE OF DEBRIS ON STEPS : YES ☐NO ☐

TROUGH

CONDITION: GOOD ☐ DETERIORATING ☐

EVIDENCE OF LEAKAGE: YES ☐ NO ☐



TYPICAL MANHOLE

INFLOW AND INFILTRATION

EVIDENCE OF INFLOW: YES ☐NO ☐ EVIDENCE OF SURCHARGING: YES ☐ NO ☐

INCHES ABOVE INVERT: _____ INCHES

EVIDENCE OF INFILTRATION: YES ☐NO ☐ ESTIMATED FLOW RATE: _____GPM

LOCATION/DESCRIPTION OF INFILTRATION: _____

PIPE ENTRANCE DATA	INCOMING LINES			OUTGOING LINE
	FROM MH # _____ DROP LINE ☐ DISTANCE _____ FT	FROM MH # _____ DROP LINE ☐ DISTANCE FT	FROM MH # _____ DROP LINE ☐ DISTANCE FT	TO MH # _____ DISTANCE FT
TYPE				
DIAMETER				
FLOW				

COMMENTS: