SECTION 8

WASTEWATER MANAGEMENT ALTERNATIVES ANALYSIS

8.1 INTRODUCTION

This section outlines possible wastewater management alternatives that may be considered to address the town's wastewater needs and goals. The Town's wastewater system goals are to:

- Improve surface and ground water quality
- Provide long-term cost-effective and sustainable option(s) for wastewater treatment and disposal
- Allow community to provide services to maintain existing and future commercial/industrial base
- Address water quality impairments

In Section 7, the Town's specific wastewater needs were determined. Areas where existing conditions may cause a risk to public health, environmental resources, or specific financial burden were identified. Wastewater flows from areas determined to have a high need were also calculated.

In order to determine wastewater needs, risk factors were established and a risk score was calculated for each property in town. This risk score serves to compare lots relative to the likelihood of pollution to the environment as well as difficulties in siting an on-site wastewater disposal system due to factors such as soil conditions, depth to groundwater, small lot size, and proximity to environmental resources. The Town was then broken into 16 Need Study Areas based on similarities in geography, risk profile, and land use. A potential wastewater flow was developed for the four high need areas, which was based on the highest average risk points per lot. An estimated wastewater flow of 0.5 MGD for this area was determined based primarily on historic water use, a safety factor, and I/I. The following section looks at possible wastewater management alternatives capable of handling the projected flow, while weighing financial and environmental risks and benefits.

The ENF states that the following wastewater disposal alternatives should be considered:

1) No-Build Alternative (status quo) — the DEIR should evaluate a No-Build Alternative that assesses impacts associated with maintaining the current wastewater disposal mechanisms (e.g., septic systems) to treat current and future demand for a period of approximately 20 years;
2) In-Basin Alternatives — the DEIR should evaluate the use of the following wastewater management technologies located within the Ipswich River Basin to meet current and future demand:
    a. decentralized facilities (including but not limited to conventional on-site systems, tight tanks (off-site treatment and disposal), Innovative/Alternative (I/A) systems, and cluster (shared) systems);

b. satellite facilities (i.e., groundwater discharge facilities capable of treating an average design flow of up to 150,000 gpd); and

c. centralized facility (groundwater or surface water discharge) capable of treating an average design flow in excess of 150,000 gpd.

3) Out-of-Basin Alternatives — the DEIR should evaluate regional facilities located outside the Ipswich River Basin capable of treating wastewater generated by the Town to meet current and future demand; and

4) Water Reuse Alternatives — the DEIR should evaluate opportunities for use of reclaimed treated wastewater effluent as a means to offset Town water demand.

8.1.1 Evaluation Methodology

Each feasible alternative will be evaluated in relation to its ability to address the wastewater needs developed in this report, the environmental impacts, and the economic impacts anticipated.

Each alternative is reviewed to determine how well it addresses the wastewater needs including: the ability to serve customers in the designated needs area, the ability to improve water quality in the Ipswich River Basin, the ability to improve water quality in Martin’s Pond, and its ability to address the downtown needs when feasible.

Each alternative is also evaluated for its impacts on the environment including resource area impacts, storm water impacts, temporary construction impacts, and Green House Gas (GHG) impacts. More weight will be given to impacts that are long-term or permanent.

8.2 NO-BUILD

8.2.1 Introduction

As requested in the ENF certificate, a no build scenario was analyzed. This scenario assumed that over the planning period – the next 20 years - the existing condition would largely remain unchanged. As discussed in Section 6, nearly all residents and commercial users have onsite wastewater disposal systems. Most of these systems consist of a septic system, but there are a limited number of wastewater treatment facilities that serve larger users in town.

The no build option consists of all residential and commercial customers maintaining their current form of on-site wastewater management system. Upgrades and replacements would occur aligned with change of ownership and known, observable failures that are mandated by the Board of Health to complete upgrades and/or repairs.

8.2.2 Ability to Meet Needs

The no build alternative requires maintaining the status quo; therefore, the goals and objectives of the Town as well as the identified needs established in this report are left unaddressed. Since property owners remain responsible for their system, there would be limited improvement to water quality. Existing partially and under-preforming systems would remain as such and continued impacts to water quality would occur from the documented challenges with existing septic system failures and GWDP violations.

The septic systems in town will continue to observe a pattern of replacement, maintenance and failure. In addition, the treatment plants will continue to discharge effluent in inconsistent compliance with their permits. Typically, municipally owned systems reduce pollution better than privately owned systems. Privately owned system will continue to age and will require substantial capital investment to renew throughout the planning period.

While development is not a specific goal of this project, growth/redevelopment is anticipated in the community. Currently businesses are not able to have their needs met from the Town and will likely look elsewhere. During the windshield survey, we noted several properties that were under-utilized or closed. In areas where development can take place the increased onsite wastewater management will continue to impact groundwater and potentially surface water resources. A municipal system will not be in place to mitigate risks. Or conversely development/redevelopment may be impeded resulting in the loss of future opportunities for the Town.

The no build alternative would leave the Ipswich River Basin water balance largely unchanged as all wastewater discharge will remain in town; however, if water is imported into the basin under the water alternatives, the balance in the Ipswich could change. A project goal is to maintain the existing balance. A net increase of flow into the basin could also have negative effects as evidenced by the Sustainable Water Management Initiative (SWMI) programs. An increase in basin flows as a result could result in effects in the fish populations. The increased management of wastewater provided by a municipally derived wastewater system would offset and provide reductions in the overall mass of pollutants discharged in the basin.

8.2.3 Environmental Impacts

The largest environmental impact of the no build alternative is the continued deterioration of water quality in the basin. Failed septic systems and aging systems will continue to contribute pollutants to the impaired waters in Town. This impact is a long term concern and the impacts can persist. As presented in Section 7, septic systems have been tied to the deterioration of water quality in Martin's Pond, and the Ipswich River including its river basin. Further pollution to these resource areas is in direct conflict with the needs established in the report.

The status quo also does not help mitigate the lots where use or development is restricted by the lot's ability to effectively dispose of wastewater. For example, lots with tight tanks, or lots with restrictions, such as lot size or nearby resource area, will continue to be unable to accommodate properly sized septic systems. These lots will continue to pose a threat to the environment.

The no build scenario also presents an opportunity cost. By maintaining the status quo, the opportunity is lost to replace old systems and technologies with technologies known to provide reductions in pollutant mass discharges, superior effluent quality, and efficiency.

This alternative includes temporary construction impacts such as water runoff, diesel exhaust, wetlands disturbance, etc. caused by the repair or replacement of old and failing systems. These impacts are considered negligible since in most cases the project duration will only be a few weeks, and the impacts can be easily mitigated using common Best Management Practices (BMPs) under the jurisdiction of local agencies.

Although, septic systems are not generally thought of as contributing Greenhouse Gas (GHG) to the environment, it has been shown that septic systems release a significant amount of fugitive methane which as a GHG can be 30 times as detrimental to the environment as CO_2. In addition, the ordinary management of these systems - pumping, transport and treatment of septic contents - also contributes to GHG emission.

A thorough analysis of GHG generation including the process used to calculate the amount of GHG generated under each scenario is included in Section 9. A summary of the results is included in this section for a comparison between alternatives. Table 8-1 presents the GHG created by all existing treatment facilities in town. For detailed information on how these values were calculated, please refer to Section 9.

TABLE 8-1
SEPTIC SYSTEM GHG EMISSIONS

Source	**lbs CO_2 per day**
Fugitive Methane (CO2e)	17610.11
Pump Out Transportation Emissions	727.34
Septic Waste Treatment Electricity	10.06
Biological treatment	47.59
Total	**18,395.28**

While septic systems account for the majority of users in town, emissions from the treatment systems in town were also considered. Table 8-2 identifies the additional greenhouse gases emitted from these treatment systems.

TABLE 8-2
NO BUILD EMISSIONS SUMMARY

Emission Source	Emission Type (lbs./day)				Total (lbs./day)
	Treatment Electricity	From Biological Treatment Processes	Hauling Fuel	Methane in CO_2e	
Septic Systems	10.06	47.59	727.33	17,610.12	18,395.28
High School Treatment Facility	121.70	9.85	-	-	131.56
Private Treatment Facilities	183.77	86.96	-	-	270.74
				Total	**18,797.58**

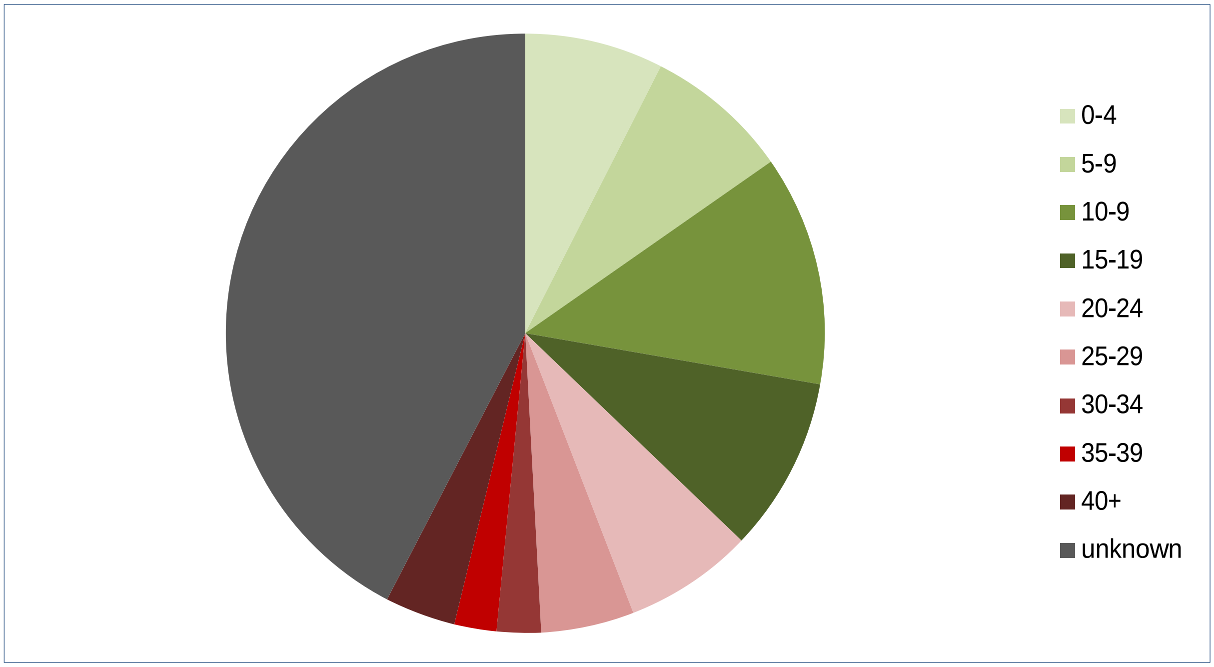
8.2.4 Economics

The burden of cost for wastewater management would remain on the individual property owners. Anticipated costs include capital costs and O&M costs. Capital costs include replacement of systems that have reached the end of their useful lives or that have failed. O&M costs include typical maintenance for a system.

Septic systems with concrete tanks have an estimated life span of 40 years, where metal and plastic tanks typically have a life span of only 20 years. Since concrete tanks are the standard in New England for this analysis it is assumed all tanks in North Reading are concrete. Given a lifespan of 40 years, it is likely that at least half of the septic systems in town will need to be replaced during the 20 year analysis period.

A review of septic system age in North Reading confirms this assumption. As seen in Figure 8-1 below, only 37% of the septic systems in town are known to be less than 20 years old. Lots with an unknown age are most likely old since newer systems have data available through the BOH permitting programs; therefore, it is likely that more than 50% of the septic systems should be replaced in the next 20 years.

Figure 8-1
Septic System Age



The economic impacts will consider all capital and operation and maintenance (O&M) costs over a 20 year span. The 2010 study conducted by the Barnstable County Wastewater Cost Task Force titled "Comparison of Costs for Wastewater Management Systems Applicable to Cape Cod" was used as a cost basis for several of the cost estimates used in this section. A copy of this study is presented in Appendix G. While the study was originally intended for use by communities on Cape Cod, the data used to create the study was taken from many local communities and not exclusively Cape Cod communities. Conditions on Cape Cod do not differ significantly from the conditions in North Reading. While Cape Cod has some considerations specific to coastal conditions, they also benefit from soils that are typically favorable. The costs have been adjusted for 2016 based on the ENR Construction Cost Index (CCI). The ENR CCI is a value published by Engineering News-Record (ENR) which uses labor rate data to determine a baseline labor cost which can be compared to past labor costs to determine positive and negative trend in labor costs over time. Relating the ENR CCI in 2010, to the ENR CCI in 2016 allows us to scale the costs for change in labor costs over that time frame. Cost data from planning projects and recently constructed, publically bid projects designed by Wright-Pierce was also used in the development of the cost evaluations.

Based on the study conducted by the Barnstable County Wastewater Cost Task Force the average cost for a septic system ranges from $9,500 for new systems on an ideal new lot to $17,500 for existing lots with challenging conditions. Assuming an average replacement cost of $14,000, the capital costs to replace half of the septic systems in town over the next 20 years will be approximately $29,000,000. This assumes that I/A systems and tight tanks will not be implemented as part of the normal replacement. It is likely that this will occur in many instances, which can increase the system cost as well as the O&M substantially.

Septic systems also require maintenance. The largest cost component to the O&M of a septic system is the septic tank pumping and hauling. MassDEP recommends pumping out the septic tank every 3 to 5 years. Assuming an average pump out rate of every 4 years and an average pumping/hauling cost of $350, it will cost over $7,000,000 to maintain all septic tanks in town over the next 20 years.

Treatment facilities are often designed with a 20-25 year lifespan in mind; however, facility upgrades are often conducted to extend the life of these facilities. Since an evaluation of these facilities was not conducted, it is difficult to predict what costs will be incurred over the next 20 years. The six systems have design flows that range from 16,000 gpd to 40,000 gpd. Based on the Wastewater Management Systems cost study, facilities of this size may cost as much as $70 per gpd of design flow to replace, which equates to a replacement cost of $1,200,000 to $2,800,000 per system.

Using a similar process, the O&M costs for these systems can be estimated. Based on the Wastewater Management Systems cost study facilities of this size incur O&M costs of approximately $13 per year per gpd of actual flow. With a combined flow of approximately 110,000 gpd, the O&M costs are approximately $1,430,000.

8.3 IN-TOWN ALTERNATIVES

8.3.1 Centralized Wastewater Collection System with NPDES Discharge

As discussed in Section 7, a needs network was developed to capture lots with the greatest needs. This network was used to provide a basic concept of the configuration of the system and assist in evaluating the alternatives. The final configuration of the collection system will depend on a number of factors, including the specific location of the required infrastructure, topography, the elevation of the properties served, sub-surface conditions (bedrock), condition of the roadway and other existing infrastructure, as well as other considerations. It is anticipated the collection system will be largely constructed within the public rights-of way. The configuration of the collection system used for this analysis is based on MassGIS contour data and a review of environmental and historic resources.

As presented in Figure 8-2, the proposed collection system consists of:

- Approximately 5 Miles 12” Gravity Sewer
- Approximately 16 Miles of 8” Gravity Sewer
- A limited number of properties served by low pressure sewers (LPS)
- Approximately 3 Miles of 6” Force Main
- Approximately 2 Miles of 4” Force Main
- One 503,000 gpd Central Pump Station
- Up to five smaller distributed pump stations

The needs of the Town have been estimated at 503,000 gpd on an average daily flow basis. A surface water discharge permit of this volume to the Ipswich River is infeasible. The issuance of a new National Pollutant Discharge Elimination System (NPDES) permit for a new discharge in Massachusetts represents an impossible scenario. The levels of treatment required, the anti-degradation requirements, and the lack of available dilution in the Ipswich River (and any other surface water in the Town) as well as other criteria cannot be developed at this time.


Base data obtained from The Town of North Reading and the Massachusetts Office of Geographic Information
Map produced by Wright-Pierce, 2016
Size and Type
4" FM
6" FM
Pump Stations
Proposed Sewer
8
12
Martin's Pond Area: 8" Gravity Sewer with Isolated Residential Grinder Pump Stations
12" Gravity Interceptor Approx 20' Deep
Lowell Road Area: 8" Gravity Sewer
Abbott Road Area: 8" Gravity Sewer with Small Residential Pump Station
Southwick Road Area: 8" Gravity Sewer with Two Small Residential Pump Stations
6" Forcemain
503,000 gpd Pump Station and Central Distribution Center
Park Street Area: 8" Gravity Sewer with Residential & Commercial Pump Station
Concord Street Area: 8" Gravity Sewer with Residential & Commercial Pump Station
N
0
950
1,900
3,800
Feet
Proposed Collection System
PROJ NO: 12820
DATE: 2/26/2016
FIGURE: 8-2
WRIGHT-PIERCE
Engineering a Better Environment

8.3.2 Centralized Wastewater Collection System with Groundwater Discharge Permit

As there is no feasible method for a surface water discharge in the Town, the second methodology considered is the centralized treatment and disposal of groundwater through a groundwater discharge permit (GWDP) issued by the MassDEP.

The first broad analysis conducted to determine viable ground water discharge sites identified large town-owned and privately owned parcels rated as low risk (GW risk level moderate or below). Since many of the factors used in the risk analysis are not relevant to municipal GW discharge, the risk scoring system was altered to provide a GW discharge risk score which focused on factors specific to effluent disposal systems such as soil and groundwater characteristics. Although a site cannot be accurately assessed for its ability to handle GW flows without extensive testing, an estimation of a minimum lot size was determined for the projected wastewater flows. Typical application rates for traditional technologies as well as higher infiltration rates for more modern systems were compared to establish an estimated range of lot sizes. The following tables summarize the minimum lot size required.

Table 8-3
GW DISCHARGE ANALYSIS - TYPICAL INFILTRATION

Parameter	Value
Needs Network	
Wastewater Discharge(gpd)	352,230
Safety Factor	1.1
Subtotal (gpd)	387,453
I/I Allowance (gpd)	114,800
Total (gpd)	502,253
Application rate (gpd/ft2)	0.5
Area Needed (ft2)	1,004,506
Reserve Area Needed (ft2)	502,253
Area Lost to Setback, etc (ft2)	150,675.90
Total Area Needed (ft2)	1,657,435
Area Needed (acres)	38

Table 8-4
GW DISCHARGE ANALYSIS - RAPID INFILTRATION

Parameter	Value
Needs Network	
Wastewater Discharge (gpd)	352,230
Safety Factor	1.10
Subtotal (gpd)	387,453
I/I Allowance (gpd)	114,800
Total (gpd)	502,253
Application rate (gpd/ft2)	1.5
Area Needed (ft2)	334,835
Reserve Area Needed (ft2)	167,418
Area Lost to Setback, etc (ft2)	50,225
Total Area Needed (ft2)	552,478
Area Needed(acres)	13

Based on this analysis, lots will likely have to be 13-38 acres or larger to accommodate the flows for a centralized discharge. It is important to note that this area estimates application rates, mandatory setbacks and reserve areas which cannot be specifically determined without extensive field exploration and groundwater modeling.

Not all lots that meet the minimum size criteria represent a feasible site. The lots selected for further investigation include those sites that met all of the following criteria: minimum lot size, town owned, undeveloped or under developed, GW risk level moderate or below. These locations were cross referenced with the sites identified in the CWMP to prepare a complete list of potential sites. Figure 8-3 shows the results of the site screening process. There were no sites suitable to treat 503,000 gpd. Since no sites were found to be feasible, the search was expanded to include privately owned properties. Acquisition of private lots, especially through eminent domain, is not preferred due to cost, logistics, and impact to residents. Even when expanded to private lots, the analysis did not reveal any feasible sites.

8.3.3 Satellite Wastewater Collection System

Since no suitable site was found for a centralized treatment facility capable of managing the entirety of the Town's wastewater needs, satellite treatment facilities were considered. A similar approach was taken to determine what sites may be feasible, but this time a lower flow rate was used to determine a minimum lot size. It was determined that any more than ten individual treatment facilities would be excessive and not economical. Assuming 10 or fewer facilities and a flow of 503,000 gpd, the minimum flow for a satellite system would be 50,000 gpd. Again a minimum lot size was determined as shown in **Table 8-5.**

Table 8-5
GW DISCHARGE ANALYSIS – SATELLITE SYSTEM

Parameter	Value
Needs Network	
Wastewater Discharge (gpd)	50,000
Safety Factor	1.1
Subtotal (gpd)	55,000
I/I Allowance (gpd)	11,480
Total (gpd)	66,480
Application rate (gpd/ft2)	0.5
Area Needed (ft2)	132,960
Reserve Area Needed (ft2)	66,480
Area Lost to Setback, etc (ft2)	33,240
Total Area Needed (ft2)	232,680
Area Needed (acres)	5

As shown in Figure 8-3, only one site was determined to be feasible, the DPW site. Since ten feasible sites were not found, a system of satellite treatment facilities is not a feasible solution as a stand-alone alternative; however, the DPW site was further evaluated as part of an approach that could be applied in some portion to another alternative to create a blended approach.

A satellite treatment facility on the DPW site would consist of a small treatment facility capable of a high level of treatment, such as a package MBR, and a SAS. The capacity of the facility will be dictated by the Soils Absorption System (SAS) since groundwater discharge require a large footprint.

As presented in the draft CWMP, subsurface exploration was conducted on the DPW site. A Preliminary Hydrogeological Assessment report was completed by Weston & Sampson in 2000 which estimated the site could accommodate 125,000 – 175,000 gpd based on preliminary testing and modeling of a 15 to 20 acre portion of the site. This results in a maximum application rate of approximately 0.3 gallons per sqft. An excerpt of the Preliminary Hydrogeological Assessment report is included in Appendix H.

Upon review of the site, Wright-Pierce estimated the available area for effluent discharge to be only 420,000 square foot (9.5 acres) once wetlands and flood plain setbacks are taking into account. Based on an application rate of 0.3 gallons per sqft, the site may be able to accommodate up to 125,000 gpd. It should be noted that the application rate is based on an average of values presented in the Preliminary report, the true capacity of the site cannot be determined without further exploration and ground water modeling. The capacity also assumes that the SAS's reserve area can be located on an adjacent site. This DPW site layout is presented in Figure 8-4.

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8.3.3.1 Ability to Meet Needs

As the DPW site can likely accommodate only 125,000 gpd, the majority of the flow from the needs area would still need to be addressed in other ways. The portion of flow treated at the DPW facility would benefit from advanced tertiary treatment and disinfection which would significantly improve the water quality including BOD and solids removal, nutrient removal and deactivation of bacteria and viruses such as E. coli which is cited in the TMDLs for the surface waters in North Reading.

The DPW facility would be operated by the Town which would improve reliability when compared to privately owned and operated residential and commercial systems. The DPW facility would add complexity to the wastewater management system compared to current conditions. The treatment facility would require a licensed operator, or contract with a wastewater services company. The facility would also include the purchase and coordination of chemicals.

8.3.3.2 Environmental Impacts

As discussed above, the DPW treatment facility would benefit the environment through improved water quality. Construction and operation of the treatment facility does present some environmental challenges. The site is immediately adjacent to the Ipswich River, wetland resources and a floodplain. Temporary construction impacts to the nearby resources would be coordinated during design and mitigated during construction utilizing BMPs such as erosion control devices.

The project would also face significant stormwater challenges. The treatment facility and access roads required for deliveries would represent an increase in impervious area. On site mitigation of stormwater will be difficult due to shallow groundwater and nearby flood plain. Compensatory storage above the floodplain elevation would decrease the area available to subsurface disposal, reducing the sites capacity. Also modification of the area to be served by the SAS would impact existing natural stormwater systems (forested land) and additional facilities would be required to be constructed to mitigate these impacts, further reducing the land available for effluent infiltration.

The proposed location of the SAS is currently forested. To accommodate the SAS, over 9 acres of trees and vegetation will be cleared. The location can be seeded, but the SAS cannot accommodate trees and will require to remain in a cleared condition.

The GHG impacts of this option are favorable compared to the No build scenario, but are detrimental compared to treatment at a larger regional facility. Larger facilities experience increased efficiency and thus have a smaller carbon footprint per gallon of wastewater treated. The greenhouse gas issue is exacerbated by the fact that over 9 acres of trees which were mitigating greenhouse gas by sequestering are permanently lost.

A thorough analysis of GHG generation including the process used to calculate to amount of GHG generated under each scenario is included in Section 9. A summary of the results is included in this section for a comparison between alternatives.

Thus the DPW treatment facility would create approximately 1351.46 lbs of CO_2 per day from its treatment process. In addition, due to the clearing of trees 66 pounds of CO_2 per day would not be sequestered, therefore it can be consider equal to additional CO_2 creation, resulting in approximately 1,417.46 pounds per day of CO_2. The DPW facility will result in higher GHG emissions overall when compared transporting and treating the same wastewater at a regional facility such as GLSD. The GHG generated by the DPW facility is summarized in Table 8-6.

TABLE 8-6
DPW FACILITY GHG SUMMARY

Emission Type	(lbs/day)
Process	1351.46
Lost Sequestering	66
Total	1,417.46

8.3.3.3 Economics

Treatment facility costs are subject to economy of scale. The DPW facility has an estimated design capacity of 125,000 gpd. This system will be economically beneficial compared to smaller systems such as clusters systems or Innovative/Alternate (I/A) systems, and economically disadvantaged compared to centralized or regional treatment facilities. This is evidenced by the cost per gpd established in the Wastewater Management Systems Cost study:

Design Flow	Cost
10,000 gpd:	$70 per gpd of design flow
100,000 gpd:	$35 per gpd of design flow
1,000,000 gpd:	$17 per gpd of design flow

Based on this cost data, the DPW treatment facility with a design flow of 125,000 gpd, would have a construction cost of approximately $4,375,000.

The same is true of O&M costs:

Design Flow	Cost
10,000 gpd	$13 per year per gpd of actual flow
100,000 gpd	$ 5 per year per gpd of actual flow
1,000,000 gpd	$ 2 per year per gpd of actual flow

Based on this cost data, the DPW treatment facility with a design flow of 125,000 gpd, would have an annual cost of approximately $625,000 and a 20 year cost of $12,500,000. The same flow at a regional facility would cost half as much to treat.

8.3.4 Individual and Shared/Decentralized Treatment Facilities

The last in-town option to be analyzed is the decentralized small system, which can take the form of Innovative/Alternative (I/A) systems. I/A systems refer to a variety of technologies which can provide additional treatment or installation flexibility compared to traditional septic systems. These systems include residential nitrification removal individual systems, alternate SAS technologies, as well as a variety of commercial systems such as Bioclere systems, Biofilters, and FAST systems. These systems are discussed in more detail in Section 6 of this report. These systems provide a higher level of treatment than conventional systems and could reduce pollutant loads to the basin as well as improve water quality in areas that they could be implemented.

As I/A systems are constructed and operated on a similar scale to conventional septic systems, information derived in Section 8.2 is incorporated herein. The most common system in North Reading is the septic system with a leach field which was determined to not adequately address water quality concerns.

As discussed in Section 6, these systems are typically only used when traditional septic systems are not adequate, such as in nitrogen sensitive areas. North Reading does not have any locations subject to nitrogen loading limitations. Some I/A technologies provide limited relief in SAS sizing under Title 5. These provisions may help some lots that are on the threshold as far as lot size limitations to be upgraded to provide for onsite wastewater management. These are typically incorporated on a case by case basis and not in an area-wide fashion.

In addition, I/A systems on average cost 150% to 200% of the cost of traditional septic systems. Assuming an average cost of $28,000 per I/A system, if the costs described in the No Build analysis were revised to include I/A systems in lieu of traditional systems, the 20 year capital costs could increase from $29,000,000 to over $55,000,000 according to the Wastewater Management System Cost Study when adjusted for inflation.

In addition, O&M costs for I/A systems can be as much as twenty times those of traditional systems. According to the Wastewater Management System Cost Study an I/A system can cost $1,400 to $2,000 per year to maintain. The 20 year O&M costs would increase dramatically from $7,000,000 to as much as $80,000,000 compared to traditional systems.

Although these technologies provide better improved water quality, mainly through nitrogen removal, it should be noted that the treatment level do not reach the levels provided by municipally operated treatment facilities.

Cluster/decentralized systems, like satellite treatment facilities serve multiple properties. Unlike satellite facilities, the cluster systems often treat lower volumes of wastewater, typically less than 10,000 gpd. These systems are typically installed to serve neighborhoods, or commercial properties. These systems can outperform individual systems in both water quality and cost effectiveness; however, these systems are typically only applicable to specific situations. For example cluster systems work well for new subdivision developments, but are difficult to retrofit to existing neighborhoods due to siting and cost sharing issues and often require the creation of Home Owner Associations or similar agreements which can be difficult to implement in the context of the format discussed here.

As a point of reference, Wastewater Management System Cost Study indicates that such a cluster system designed to treat 8,800 gpd could cost $250,000 to over $415,000 when adjusted for inflation. Such a system could accommodate 20 four bedroom homes; therefore the per-home cost could be more than $20,000 and is comparable to individual septic systems. Cluster systems designed for more or less homes could see a decreased or increased cost per home, respectively.

North Reading has existing private treatment plants which operate much like cluster systems. These systems are located at various condominium and apartment complexes in town. As indicated in information provided by MassDEP, these systems have had inconsistent ability to meet water quality requirements set forth in their discharge permits.

Ultimately it was concluded that private systems cannot provide the level of treatment or consistency of quality that municipally run systems can. I/A and cluster systems are great solutions for specific sites, but they do not represent a town wide solution to the needs established in this study. Since the needs area does not encompass the entire town, these systems remain a core part of North Reading's town wide wastewater management solution and will therefore be included in the recommended plan.

8.4 OUT OF TOWN ALTERNATIVES

8.4.1 Regional WWTF Options

Regional plants represent the greatest opportunity for meeting North Reading's wastewater needs outside of town. Typically options within the same drainage basin would be preferred; however, there are no regional or other sizable wastewater treatment facilities that discharge to the Ipswich River watershed. All regional plants in the area discharge to the ocean or to other drainage basins.

An analysis of the regional options was conducted to determine those that were feasible. After feasibility was determined, a subsequent analysis was completed to identify the appropriate conveyance method and location.

Greater Lawrence Sanitary District

The Greater Lawrence Sanitary District treats and disposes of wastewater from six communities: Lawrence, Methuen, Andover, North Andover, Dracut, and Salem, NH. The facility has a design capacity of 52 mgd, but currently treats an average of 30 mgd.

North Reading wrote a letter to GLSD requesting confirmation that GLSD had capacity and would be amenable to adding North Reading as a customer. GLSD responded in a telephone call from Cheri Cousens, PE on January 21, 2106, confirming that there is capacity.

South Essex Sewerage District

The South Essex Sewerage District (SESD) treats an average of 30 mgd of wastewater per day at its facility in Salem, MA. The SESD WWTF services the following communities: Salem, Peabody, Marblehead, Beverly, and Danvers with small portions of Wenham and Middleton included in the service area. They also accept septage from communities within the District service area.

A potential connection point to the SESD system would be a sewer located along an abandoned railroad track near Russell Street in Peabody. Since Peabody does not border North Reading, a small section of the collection system sewers will be installed in Middleton. At this time, it is estimated that four miles of new proposed sewer pipes will be installed from the end of the existing sewer in Peabody to the Town's proposed collection system connection point.

Wright-Pierce discussed the potential for wastewater discharge to the SESD with Alan F. Taubert, Jr, P.E., SESD Project and Energy Manager on March 15, 2012. He identified two significant concerns associated with accepting additional wastewater at the facility. The first concern is regarding the hydraulic capacity of the SESD Peabody/Salem interceptor (from downtown Peabody to the SESD WWTP) as it does not appear that the interceptor sewer has capacity to receive additional flows at this time.

Preliminary studies to increase the capacity would have to be considered before progressing further with this option. The second is the secondary treatment plant addition completed in the late 1990s that was designed to provide a capacity of 29.71 million gallons per day (mgd). This represented a reduction from the original primary treatment plant capacity of 41 mgd and was implemented to reduce the size and cost of the federally mandated secondary treatment process.

The current flows to the facility are at its current hydraulic capacity (29.71 mgd), and there are no identified changes in the future, such as inflow/infiltration (I/I) mitigation projects or usage reductions, that will reduce flows to provide available capacity for North Reading. In order to provide the additional capacity required to treat wastewater from North Reading, Mr. Taubert indicated that a fifth secondary treatment train will be required. With of the lack of available land on the property and the large quantity of shallow bedrock in the area, this represents a significant and extremely expensive solution. Other elements of the plant will have to be equally upsized and the plant will require a modification of its National Pollution Discharge Elimination System (NPDES) permit.

This option is deemed infeasible given the cost, legal, permitting and other challenges required to implement the option.

MWRA

The MWRA wastewater system services over two million Massachusetts residents within 43 communities including Wilmington and Reading. The MWRA treats and disposes of an average of 350 mgd of wastewater at its Deer Island Wastewater Treatment Plant.

The proposed North Reading connection to the MWRA collection system could be accommodated through Wilmington or Reading.

For the Wilmington alternative, the proposed connection point to the MWRA system will require the construction of a sewer pipe along Concord Street to the Wilmington border. The wastewater will then flow through Wilmington along Woburn Street into the MWRA's Woburn collection system. At this time, it is estimated that 3.1 miles of new and/or upgraded sewer pipes will be installed within the towns of Wilmington and Woburn.

For the Reading alternative, North Reading will extend its collection system south along Route 28 to the Reading town line. At this time, it is estimated that two miles of proposed new and/or upgraded sewer pipes will be installed along Route 28.

The location and hydraulic capacity of the existing Wilmington and Woburn MWRA sewer lines are not known at this time. In 2009 the Town, through Weston & Sampson, contacted personnel at the MWRA. Weston & Sampson developed a letter memo that discussed the MWRA requirements for a sewer connection; O.P.-11, Admission of New Community to MWRA Sewer System and Other Requests for Sewer Service to Locations Outside the MWRA Sewer Service Area. Wright-Pierce is also familiar with the OP-11 requirements and attended a meeting given by Pam Heidell, Policy and Planning Manager of the MWRA Executive Office on January 6, 2012. One key requirement is that the MWRA will require the Town to remove 4 gpd of <u>Inflow</u> for every 1 gpd of wastewater added to its system. The removal would occur within the existing MWRA system or member community sewer systems contributing flow to the MWRA interceptor system that will be used by the new connection. The MWRA will also likely require the Town to construct flow equalization tanks to retain wastewater under high flow conditions in the MWRA interceptor system. Approximately three days of storage, greater than one million gallons of tankage, would be needed as well as associated odor control facilities to meet this requirement. The configuration of the proposed North Reading collection system would require modification to allow the diversion of the wastewater to the storage facility.

This alternative was investigated further in 2015 within the scope of this DEIR. MWRA indicated that they are not actively adding communities to their collection system. Once again, MWRA indicated that their collection system cannot accommodate additional flows without considerable mitigation and offsets to the new flow.

Based on the lack of capacity in the MWRA collection system, an MRWA connection is not feasible at this time.

Lynn Water and Sewer Commission
The last Out-of-Basin alternative examined was the Lynn Regional WWTF. Although, none of the communities reviewed discharge to this facility, due to its relative proximity it warrants

consideration. The WWTF treats and disposes of wastewater from four communities: Lynn, Saugus, Swampscott, and Nahant. The facility has a design capacity of 27.7 mgd.

The proposed connection point to the Lynn wastewater system will require the construction of a sewer south along Chestnut Street through Lynnfield to Route 129 in the northeast corner of Lynn. At this time, it is estimated that the 10.3 miles of proposed new and/or upgraded sewer pipes will be installed. Of this proposed total pipe length, 8.3 miles would be required to reach the Lynn border.

At this time, the hydraulic capacity of the Lynn Interceptor system is not known. North Reading will need to negotiate an IMA with Lynn for transporting wastewater. In 2012 Wright-Pierce contacted Mr. Waite, the Chief Operator at the Lynn WWTF. He stated there is no excess capacity at the WWTF at this time. To create capacity, the Town will have to pay to remove combined sewer overflows (CSOs) from the collection system.

Based on the lack of capacity in the Lynn WWTF, a connection is not feasible at this time.

8.4.2 Out of Town Options

Based upon the regional analysis in Section 8.4.1, the GLSD option represents the most feasible out of Town option. There are two likely communities that could provide capacity for North Reading to convey the wastewater to GLSD. North Andover and Andover are both intermediate to GLSD and North Reading. They are also both members of GLSD.

Andover:
Andover is a community with a population of approximately 35,000 people, many of which are served by the sewer collection system in Town. The sewer collection system in Town discharges to the GLSD regional treatment facility. The Andover Sewer Division maintains the Town's sewer infrastructure including the collection system, eleven current neighborhood sewer-pumping stations, Shawsheen Village Pumping Station, the force main and gravity line through Lawrence to the treatment plant in North Andover, and the a member of GLSD for the treatment and disposal of wastewater. The feasibility of discharging to GLSD through Andover is discussed below in the Regional WWTF options discussion.

The proposed connection point to the GLSD system would require the construction of a sewer pipe north along Route 28 into Andover. Wright-Pierce estimates that 2.2 miles of proposed new and/or upgraded sewer pipes will be required along Route 28 to the intersection of Wildwood Road. Discussions with Chris Cronin of the Andover DPW on November 12, 2015 also indicated that pump station upgrades may be required as well.

In order to transport and treat wastewater at an existing regional facility, the Town will need to complete various infrastructure, regulatory, permitting, and legal requirements. In 2008, the Town of Dracut entered into an agreement with Methuen and GLSD to transport, treat, and dispose an average daily flow of 0.5 mgd. This Dracut-Methuen connection may serve as a model for the North Reading connection. A copy of the Dracut-Methuen IMA is included in Appendix I.

A summary of the key requirements are:

1. Construction of Sewer Collection system in North Reading
2. Inter-Municipal Agreement (IMA) with Andover to convey wastewater through the Andover system.
3. An agreement with the GLSD to treat North Reading's wastewater.
4. Modification of the GLSD's service area to include North Reading through Massachusetts legislation.
5. Concurrence by the GLSD to allow the connection.

North Andover:
North Andover is a community with a population of 28,352 people with 5,475 houses connected to the sewer collection system. The North Andover collection system includes over 88 miles of sewer within three drainage areas: The East Side Drainage Area, the West Side Drainage Area, and the Central Drainage Area. All wastewater is conveyed to GLSD. The nearest point of connection to the North Reading needs area is more than 4 miles away. Additionally, the North Andover system is configured without an ability to provide sizable flows without considerable system upgrades. A connection to the North Andover system is less desirable and should only be pursued if an Andover connection becomes more infeasible.

8.5 GLSD ALTERNATIVE

In the screening described above, wastewater discharge to GLSD was found to be the most feasible out of town solution. This alternative would require a sewer collection system to collect and convey the wastewater generated within the needs network.

The collection system used for this analysis is based on MassGIS contour data and a review of environmental and historic resources.

As shown in Figure 8-2, the proposed collection system consists of:

- Approximately 5 Miles 12” Gravity Sewer
- Approximately 16 Miles of 8” Gravity Sewer
- A limited number of in-home grinder pump stations with LPS(i.e. E-One)
- Approximately 3 Miles of 6” FM
- Approximately 2 Miles of 4” FM
- One 503,000 gpd Central Pump Station
- Five Small Residential Pump Stations

The collection system will collect wastewater for the entire needs area and, where possible, flow by gravity to a central pump station. The pump station will then pump the wastewater to a connection point to the Andover system.

The actual size and location of collection system infrastructure will be determined in a subsequent preliminary design phase.

As discussed above, wastewater leaving North Reading must be conveyed to GLSD via the Andover collection system. Use of the Andover system will require an IMA. Discussions with Andover in November of 2015 indicated that Andover is generally amenable to an IMA. Such an IMA could be modeled after the Dracut-Methuen IMA; however specific requirements must be agreed upon by North Reading and Andover. The IMA will likely consist of two major elements: improvements to Andover's infrastructure necessary to accommodate additional flows, and conveyance rates paid by North Reading to Andover for a portion of the O&M costs for the use of the Andover sewer system.

Mapping of the Andover wastewater collection was obtained and a desktop review of the system was performed to identify the likely configuration of the system as well as potential upgrades in the Andover system. This information was used to conduct a simplified capacity analysis to determine areas of the sewer collection system which may need improvements. A flow path through the Andover system was determined.

The North Reading force main will connect to the Andover system just downstream of the Morningside Drive pump station (PS-25). This location was selected since the area discharges to a main interceptor. Andover indicated that the Morningside Drive pump station would likely not have capacity to accommodate the North Reading flow, so the pump station is bypassed.

The flow path starts downstream of the Morningside Drive pump station (PS-25) and flows south to the final pump station (PS-5) located off of York Street via the main trunk line along Red Spring Road, North Main Street and along the Shawsheen River through Andover. While this flow path will convey 100% of the North Reading wastewater flow, much of the infrastructure in this corridor only conveys a portion of the Andover system's flow.

The major collection system catchments within the Andover system were determined and the point where each catchment discharged to the flow path corridor was determined. The wastewater generated within each catchment was estimated to be proportional to the percent of inch-diameter*miles of sewer located in each catchment. For example, if a given catchment contained 20% of the total inch-diameter*miles of sewer for the town, then it was assumed 20% of the total wastewater generated in Town is generated within that catchment.

TR-16 recommends that peak hour flow be used to design new sewers. While this approach is conservative for a capacity analysis of existing sewer, in lieu of conducting thorough hydraulic modeling, it will provide a reasonable estimate for planning purposes. Andover indicated that the current average discharge rate from Andover to GLSD is approximately 4.06 mgd. Using TR-16 this average daily flow (ADF) was peaked to 12.19 mgd for peak hour. Similarly, the 0.503 mgd ADF from North Reading was peaked to 2.06 mgd for peak hour.

Based on these flow rates, some portions of the flow path may require improvements to accommodate the North Reading flows. The north portion of the flow path, from the connection point to Woburn Road consists mainly of smaller diameter sewer that may need be to be replaced with larger diameter sewer to accommodate the larger flows.

The flow path from River Road to Red Spring Road consists of larger diameter sewer averaging 24-inch diameter. This portion of the system does not appear to have capacity issues. Isolated minor improvements in this portion of the system, such as pipe lining along the river, may be required.

The remaining portion of the system consists of parallel mains, most of which has adequate capacity. There is the potential for capacity issues as the flow path approaches the final pump station (PS-5). This portion of the system may require specific isolated improvements which will require further evaluation to identify. The final pump station (PS-5), will likely require improvements as well.

The exact nature of the improvements to the Andover system must be discussed and agreed upon by Andover and North Reading during the negotiation of the IMA. In addition to these potential infrastructure improvements, Andover may require additional work or funding to aid in the removal of Infiltration and Inflow to the Andover system. Figure 8-5 presents the proposed flow path through the Andover system including areas where improvements may be required.

Ultimately, the North Reading wastewater flow will be discharged to the GLSD treatment facility along with Andover's wastewater flow. GLSD will require a connection agreement and fee to join the GLSD service area. GLSD will also require compensation on a cost per volume basis for the treatment of the wastewater. The conditions and fees related to the connection will be negotiated between GLSD and North Reading.


Legend
North Reading Flow Path
Potential Improvements
ANDOVER INFRASTRUCTURE LIKELY TO REQUIRE UPGRADES
ANDOVER INFRASTRUCTURE THAT MAY REQUIRE LINING OR MINOR IMPROVEMENTS
ANDOVER INFRASTRUCTURE WITH REDUNDANT MAINS. ISOLATED IMPROVEMENTS ONLY
PROPOSED FORCEMAIN FROM NORTH READING MAIN PUMP STATION
Sewer Pump Station
Sewer Manhole
Force Main
Gravity Main
N
ANDOVER INFRASTRUCTURE WITH REDUNDANT MAINS. ISOLATED IMPROVEMENTS ONLY
ANDOVER INFRASTRUCTURE THAT MAY REQUIRE LINING OR MINOR IMPROVEMENTS
ANDOVER INFRASTRUCTURE LIKELY TO REQUIRE UPGRADES
PROPOSED FORCEMAIN FROM NORTH READING MAIN PUMP STATION
Andover Sewer System
PROJ NO: 12820
DATE: 2/26/2016
FIGURE: 8-5
WRIGHT-PIERCE
Engineering a Better Environment

8.5.1 Ability to Meet Needs

Under this alternative the wastewater generated by the needs network for the needs area, is removed from the Ipswich River Basin. Unlike other alternatives discussed, this alternative is able to accommodate the entire volume of wastewater since GLSD has adequate capacity. This has the advantage of maximizing the amount of wastewater constituents removed from the Ipswich River Basin, rather than discharging them at the current source locations or moving them to another area of the Ipswich basin, such as a decentralized treatment facility SAS. This will provide maximum benefit to water quality.

This alternative also meets the desired criteria of system simplicity and reliability. North Reading will be responsible for maintaining a sewer collection system within its town lines, but the wastewater treatment will be conducted by others. The system is more complicated than the No Build scenario, but is less complex than operation and maintenance of treatment facility(ies), and is far less complex to the operation and maintenance of several decentralized treatment facilities.

8.5.2 Environmental Impacts

The collection system in North Reading and Andover are largely contained within existing public right-of-ways. Temporary construction impacts are anticipated, but will be coordinated with the local regulators and agencies during design and mitigated during construction. The new pump stations in North Reading may add impervious area, but since the structures are largely below grade, the impacted areas should be negligible. Stormwater BMPs will be used during the design and enforced during construction.

As discussed above, this alternative will improve water quality in the Ipswich River Basin. The wastewater constituents transported to GLSD will be treated to a high effluent quality. The GLSD treatment plant is a secondary activated sludge plant with disinfection. The disinfection will reduce the levels of E.coli cited in the North Reading surface water TMDL as the primary source of water quality degradation. The treatment plant will also result in improved BOD and nutrient removal reducing the pollution to the environment as a whole. The impact to the receiving water, the Merrimack River, should be minimal since North Reading’s flow will account for less than 2% of the GLSD facility’s average daily flow.

In addition to the water quality impacts to the Ipswich River Basin, there are base flow concerns. This alternative would export more water from the basin when compared to current conditions. The increase in water leaving the basin could negatively impact the low flow conditions of the basin. However, in this case the export is mitigated by the importation of water examined in earlier sections of this report. The final Ipswich River Basin flow balance is discussed in more detail in Section 9 of this report.

A thorough analysis of GHG generation including the process used to calculate to amount of GHG generated under each scenario is included in Section 9. A summary of the results is included in this section for a comparison between alternatives.

The treatment of 503,000 gpd at GLSD creates approximately 1247.22 lbs/day. This is significantly less that the GHG created by a smaller package plant such as the DPW facility discuss above.

In order to compare this alternative to the No Build alternative, the properties excluded from the needs area must be considered. The GHG created for the entire town under this alternative is summarized below. As shown, these alternative results in a GHG emissions reduction of approximately 20% compared to the No Build scenario.

TABLE 8-7
GLSD ALTERNATIVE GHG SUMMARY

Emission Source	Emission Type (lbs./day)					Total (lbs./day)
	Treatment Electricity	Operating Electricity	From Biological Treatment Processes	Fuel	Methane in CO_2e	
Septic Systems	7.04	-	33.32	509.25	12327.08	12,876.70
High School Treatment Facility	171.17	-	13.86	-	-	185.04
Pump Stations	-	645.5	-	-	-	645.5
GLSD	846.6	-	400.62	-	-	1247.22
Vehicle Fleet				70.5		70.5
					Total	**15,025.01**

8.5.3 Economics

The economics of this alternative are complicated and the specific values are not known until design and construction stakes place. Since North Reading should not enter formal negotiations with Andover or GLSD until completing project approval from MEPA, the exact nature of negotiations and resulting costs cannot be predicted accurately. To determine a planning level cost analysis, the Dracut-Methuen IMA was used as a model for this analysis. North Reading, Andover and GLSD acknowledged that this example is a good point of reference as it related to this report, but actual costs and conditions will change as the process progresses.

The collection system costs will likely be the most significant portion of the total alternative costs and could be as much as $56,000,000 to design and construct not including engineering and contingency which could be up to an additional 30-50% of the construction costs. North Reading would also incur O&M costs to maintain the collection system. The estimated annual O&M cost for the collection system is $550,000.

The capital costs for the Andover system are based on the capacity analysis described above. Assuming approximately 3 miles of sewer replacement, 2,500 feet of lining and significant improvements to the final pump station (PS-5). The approximate cost for these improvements is $8,000,000. This value seems reasonable when compared to the $7,600,000 agreed to in the Dracut-Methuen. At this point it is unclear what I/I removal if any will be needed within the Andover system since the capacity issues are being addressed through capital improvements for this analysis. For the purposes of this study, we will assume that the I/I removal costs are the same as those included in the Dracut-Methuen IMA which is $1,200,000.

Connection to GLSD will not require any capital improvements however, a buy-in fee is required. It is estimated that the buy in fee will be similar to Dracut's fee to GLSD which was approximately $1,500,000.

Finally, there are the rate based costs to Andover and GLSD. Based on the wastewater conveyance rate structure Dracut-Methuen IMA adjusted for inflation (3% increase each year) North Reading would pay Andover $0.28 per 100 cubic feet. This equates to an annual cost of approximately $70,000 per year.

The GLSD treatment cost has not yet been determined, but based on fiscal year 2014 operating budget, it is estimated that North Reading would have an annual treatment cost of $270,000 per year.

It should be noted that the transport and treatment costs per year, factoring Andover and GLSD costs, is less than the anticipated O&M costs for the DPW treatment facility discussed in the alternative above.

TABLE 8-8
APPROXIMATE COST SUMMARY

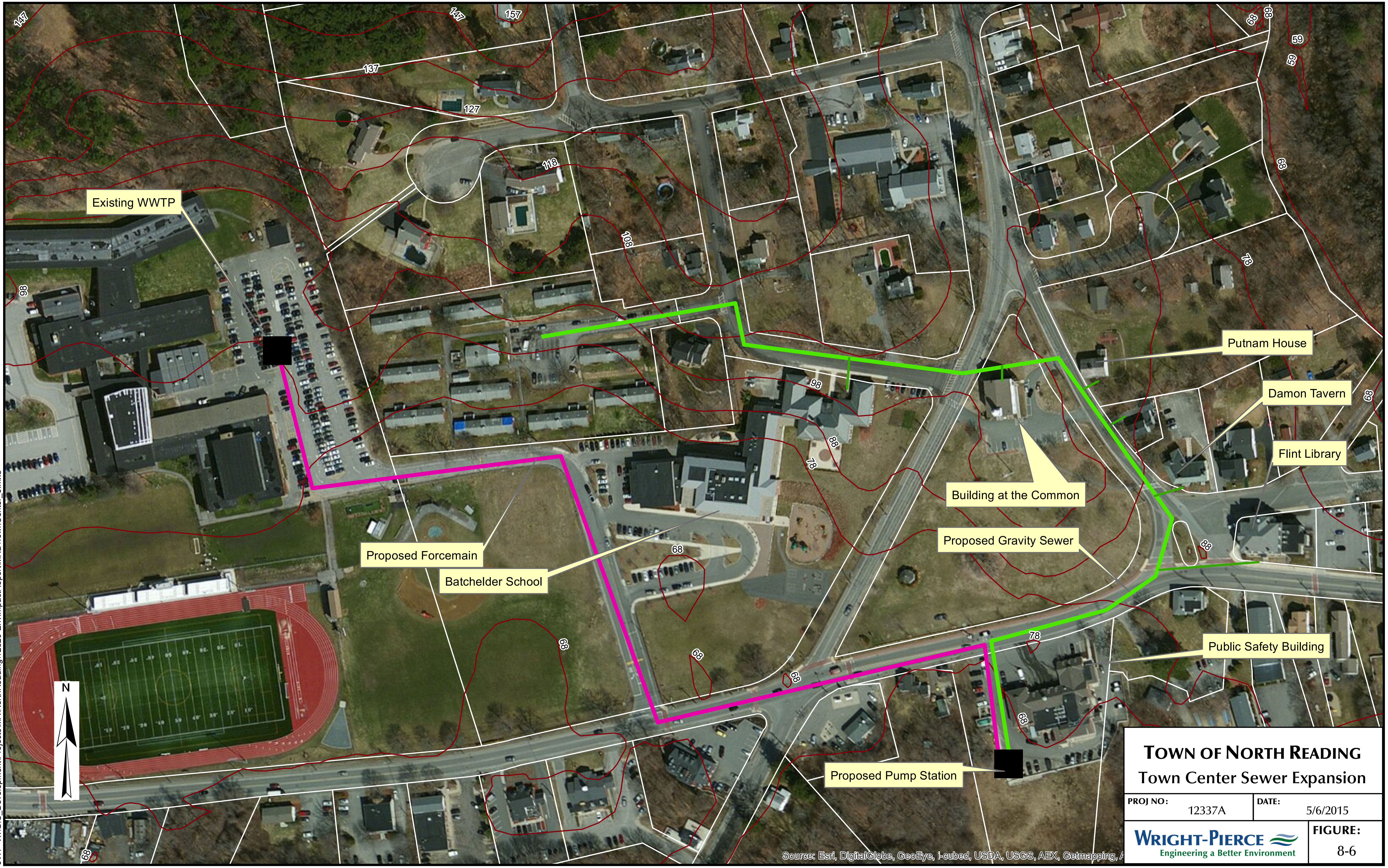
Item	Capital Cost	Annual cost	20-Year Cost
North Reading Collection System	56,000,000	$550,000	$67,000,000
Andover Connection	$9,200,000	$70,000	$10,600,000
GLSD Connection	$1,500,000	$270,000	$6,900,000
Total	**$66,700,000**	**$890,000**	**$84,500,000**

8.6 HIGH/MIDDLE SCHOOL TREATMENT FACILITY OPTIMIZATION

As discussed in Section 7, currently the wastewater treatment facility located at the High and Middle School is underutilized and underperforming. The facility is designed for an average daily flow of 17,500 gpd. However, the max daily flow for October 2014 through September 2015 is less than 9,000 gpd. The facility's discharge permit requires planning for an upgrade when the facility's annual average flow exceeds 80 percent the of the facility's design flow (14,000 gpd). Therefore, the facility could accommodate up to an additional 5,000 gpd. The facility receives flow that is affected directly by the operation of the schools. During weekends and school breaks, the facility receives little or no flow, which complicates the operation.

The High School treatment plant represents an opportunity to improve water quality in the downtown area which is adjacent to the Ipswich River by using existing capacity at the plant to capture flow generated nearby. This area contains several Town-owned facilities.

As presented if Figure 8-6, the optimization would include approximately 2,600 feet of gravity sewer, 2,600 feet of force main and a submersible pump station. The optimization would capture eight new customers and result in a total flow of 13,000 gpd to the facility.



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8.6.1 Ability to Meet Needs

The existing facility has experienced inconsistent treatment results. Optimizing the plant and utilizing the excess capacity will improve the water quality in the surrounding area while keeping the wastewater discharge within the Ipswich River Basin. The surrounding area is adjacent to the Ipswich River which is impaired and would benefit greatly from improved effluent quality. The project would improve reliability without adding any complexity to the town's wastewater management.

8.6.2 Environmental Impacts

Since the treatment facility is an existing structure, only temporary construction impacts are anticipated. These impacts will be coordinated with the regulatory agencies during design and mitigated through use of BMPs during construction. Although the design includes a new pump station it will be located on a property within the existing impervious area; therefore, there will be no net change in impervious area.

8.6.3 Economics

A cost estimate prepared by Wright-Pierce recently for this project estimated a capital cost of approximately $2,000,000.

Based on the Wastewater Management Systems cost study, the treatment facility with a design flow of 17,500 gpd, would have an annual cost of approximately $230,000 and a 20 year cost of $4,600,000.

8.7 WATER REUSE

Reuse of wastewater can be a cost effective way to dispose of wastewater and reduce water consumption. Reuse can only be considered in certain situations. Reuse is restricted to specific uses and requires treatment to ensure effluent that is virtually free of pathogens and contaminants. The most common uses for reclaimed water currently approved by MassDEP are: industrial water use, toilet and urinal flushing, boiler feed, industrial process water and irrigation to golf courses, parks, agricultural fields, landscaped areas and cemeteries. All use of reclaimed water must be permitted under BRP WP 84. The level of treatment is covered under 314 CMR 20.17 and varies based on the intended use. For example, Class A reuse standards apply to any approved use where individuals may come in contact with the effluent such as irrigation or parks, cemeteries and golf courses. Class A reclaimed water must meet the following discharge limits:

- pH = 6.5-8.5
- BOD < 10 mg/l
- TSS < 5 mg/l
- Turbidity < average of 2 NTU within a 24-hour period, cannot exceed five NTU more than 5% of the time within a 24-hour period, and cannot exceed ten NTU at any time.
- Total Nitrogen < 10 mg/l

- Median of no detectable fecal coliform/100 ml over continuous seven-day sampling periods, not to exceed 14/100 ml in any one sample
- Other parameters as specified by the Department, such as phosphorus limits

Treatment to these limits would require a treatment facility. The only alternative applicable would be the DPW treatment facility. Should this alternative be selected, reuse should be a consideration in the design. Water reuse should be considered for use as plant water (Class B reuse) and toilet flushing water (Class A reuse.)

Additionally, the adjacent property contains a town owned park which could use the reclaimed water for irrigation. Since the park includes a ballfield, residents could come into contact with the reclaimed water which would require Class A reclaimed water. Additionally this would not preclude the construction of a conventional effluent disposal SAS.

8.8 SELECTED ALTERNATIVE

As a result of the analysis included above, discharge of wastewater to GLSD via Andover is the preferred alternative. This alternative addressed the needs as well or better than all other alternatives. While the DPW treatment facility was a desirable option due to its ability to keep wastewater discharge within the Ipswich River Basin, ultimately the other environmental concerns with the site resulted in an overall negative impact to the environment.

The selected alternative provided the highest quality effluent while minimizing environmental impacts. It represents the lowest overall GHG emissions of the alternatives evaluated. Although not the driving force behind the decision, the selected alternative was the most cost effective option other than the No Build alternative.

The High/Middle School facility optimization alternative is also recommended since it is consistent with needs established in this report while having a positive impact on the environment by improving water quality without any long term negative impacts.