CITY OF GARDNER
MASSACHUSETTS 01440-2630

OFFICE OF THE
CITY COUNCIL

September 8, 2016

CITY COUNCIL INFORMAL MEETING

Date: Monday, September 19, 2016
Time: 6:00 P.M.
Location: City Council Chamber, Room 219, City Hall

ANNOUNCEMENT - Any person may make a video or audio recording of an open session of a meeting, or may transmit the meeting through any medium, subject to reasonable requirements of the chair as to the number, placement and operation of equipment used so as not to interfere with the conduct of the meeting. Any person intending to make such recording shall notify the Chair forthwith. All documents referenced or used during the meeting must be submitted in duplicate to the City Clerk, pursuant to the Open Meeting and Public Records Law. All documents shall become part of the official record of the meeting.

AGENDA

Presentation Relative to the DPW Plan to Upgrade the Dewatering Equipment and Pursuit of a New/Expanded Sludge Landfill (Calendar #9686).

NOTICE: The listing of Agenda items are those reasonably anticipated by the Chair which may be discussed at the meeting. Not all items listed may in fact be discussed and other items not listed may also be brought up for discussion to the extent permitted by law.

CITY COUNCIL OF GARDNER

James M. Walsh

JAMES M. WALSH
Council President

9686

RESOLUTION
ENDORSING THE DEPARTMENT OF PUBLIC WORKS PLAN TO UPGRADE THE DEWATERING EQUIPMENT AND PURSUIT OF A NEW/EXPANDED SLUDGE LANDFILL

The City Council of Gardner wishes to endorse the Department of Public Works Plan to upgrade the dewatering equipment and pursue a new/expanded sludge landfill.

The plan will include improving the technology, replacing the pumps, repairing the 30 year old facility, and pursing a new/expanded sludge landfill. The City has performed a comprehensive study looking at several alternatives for the disposal of the City's sludge. These options included composting, anaerobic digestion, off-site disposal by a private hauler, and upgrading and continuing our current operations.

Based on the evaluations, the most cost effective long term solution was deemed to be upgrading the present dewatering equipment and disposing of the sludge at a City owned sludge landfill.

If 7686 (9661)

City of Gardner, *Executive Department*

Mark Hawke, Mayor

August 9, 2016

James M. Walsh, President
And City Councilors
95 Pleasant Street
Gardner, MA 01440

RE: Leave to Withdraw Council Item #9661

Dear President Walsh and Councilors,

I request Leave to Withdraw Council Item 9661; An Order Appropriating $15,000 from Sewer Surplus to Sewer, Dewatering Design.

I seek this request as Item 9661 needed to be acted upon before the end of the fiscal year. Since the fiscal year has ended, the funds are no longer available to be appropriated. However, the intent of the Order was to inform the Council, and allow action upon an item, of the City's intent to develop a new Sludge Landfill.

In order to better fulfill this objective, I have submitted a resolution stating the City's intent to pursue a new Sludge Landfill for your endorsement.

Respectfully,

Mark Hawke
Mayor, City of Gardner

City Hall, 95 Pleasant Street, Room 125, Gardner, Massachusetts 01440
Telephone: (978) 630-1490 • Facsimile (978) 630-3778 • Email: mayor@gardner-ma.gov

9661

CITY OF GARDNER
Department of Public Works

Highway
Water
Sewer
Forestry
Parks/Playgrounds
Cemeteries

Dane E. Arnold, Director
416 West Broadway
Gardner, MA 01440-2687
Telephone (978) 632-7661
Fax (978) 630-4029
darnold@gardner-ma.gov

Mayor and City Council
City Hall
95 Pleasant Street
Gardner, MA 01440

RE: Dewatering and Sludge Landfill

June 1, 2016

Dear Mayor and City Council:

I am writing you in regards to the on-going upgrade at the Wastewater Treatment Facility (WWTF). The upgrade not only includes improving the technology, replacing pumps, and repairing the 30 year old facility, but also includes determining the most cost effective method to dispose of our sludge for the next 25-30 years.

Over the past year we have completed a comprehensive study and looked into several alternatives for the disposal of the City's sludge. This evaluation was very in-depth and took into consideration future costs, fuel prices, electrical costs, trucking costs, odors, design costs, construction costs, and even contract negotiations with disposal sites, other municipalities, and trucking companies.

Options we considered for disposing of the City's Sludge:

1. Continue to dewater sludge at plant and haul to City Owned Sludge Landfill.
2. Composting Sludge at our Sludge Landfill
3. Anaerobic Digestion
    a. Another Municipality
    b. At our WWTF
4. Offsite Disposal by a Private Hauler
    a. Haul liquid sludge to off-site Landfill
    b. Haul sludge cake to off-site Landfill
    c. Haul liquid sludge to an off-site Incinerator

Attached are detailed descriptions and cost analysis of each method.

DEWATERING

This study also included looking at many technologies to reduce the amount of moisture contained in the sludge. Again, many items were evaluated, such as design costs, construction costs, electrical costs, repair and replacement costs, and ease of operation.

After evaluating different technologies and visiting other facilities, it was determined that a centrifuge would be the best alternative for the dewatering the City's wastewater sludge. A pilot test of a centrifuge was conducted in August of 2015; which is basically a large cylinder that spins and uses centripetal force to dry the sludge and great results were achieved.

The importance for the correct dewatering technology is very important for several reasons. The dryer the sludge that can be achieved, the less amendment (sand) has to be added to aid in "working" the material at the landfill. Also, the dryer the sludge, the less odors are generated during the hauling and covering process at the landfill. For every cubic yard of sand we save, its money not spent. Over 25 years, this could add up to be millions of dollars. Also, for every cubic yard of amendment we don't use, is a cubic yard we can extend the capacity of the sludge landfill in the future. In other words if we can generate a sludge that uses 30% less additive, we will extend the life of our landfill by 30%.

We have determined that replacing the old Belt Filter Presses that exist at the WWTF with Centrifuges for the dewatering process and hauling the dewatered sludge cake to the City's Sludge Landfill is the most cost effective and best alternative for the disposal of the City's sludge.

LANDFILL

The decision to move forward with the design and construction of Centrifuges would ultimately mean the expansion of the Sludge Landfill located off West Street. The cost of expanding the Sludge Landfill was factored into the cost analysis of our recommended alternative. Even with the nearly million dollar construction costs of the sludge landfill factored into the annual costs, we still found it almost half the cost compared to hauling the sludge out of town. Supporting documentation is enclosed.

Currently the Sludge Landfill has capacity and Suez (formally Earth Tech) is on the hook for sludge disposal until 2018 when their contract expires. The City needs to prepare and submit design plans for a Horizontal Expansion (outward). It is very important to note that DEP has acknowledged the site is already permitted for such expansion. Once we have all design documents approved by DEP, we would be looking to have the expansion of the Landfill completed when Suez's contract expires in 2018.

If you have any questions or would like to discuss this matter as a whole, I would be glad to have a meeting.

Sincerely,

Dane E. Arnold, Director
Department of Public Works

PC: Bob Hankinson, City Engineering Department
Matt LaPointe, Suez
Jen Susan-Roy, Board of Health
Rob Sims, Maguire
Kevin Olsen, Wright Pierce

February 2, 2016

Mr. Dane E. Arnold
Director
Gardner DPW
416 West Broadway
Gardner, MA 01440

Re: Gardner Wastewater Treatment Plant Upgrades
Sludge Disposal Evaluation

Dear Dane:

This letter provides a brief overview and summary of recent studies and evaluations that have been conducted to assess long term methods for disposing of the sludge from the City's Wastewater Treatment Plant (WWTP) on Plant Road in Templeton.

EVALUATION BACKGROUND

The City has conducted a Wastewater Facility Plan for upgrades to the WWTP. One facet of the facility plan evaluations was an assessment of the sludge processing and disposal alternatives for the WWTP.

The Facility Plan evaluated several technologies for dewatering sludge including Inclined Screw Press, Horizontal Screw Press, Rotary Press, Centrifuge and the current technology Belt Filter Press. Major factors considered in the alternative evaluation included capital cost, energy consumption, disposal costs, transportation, additives (sand), sampling and general operation and maintenance.

Dewater and City Owned Landfill – This alternative included upgrades to the dewatering process at the WWTP and disposal at the City owned landfill on West Street. Capital costs including dewatering equipment upgrades and expansion costs for the landfill are included.

Dewater and Haul – This alternative included modifications to the dewatering methods at the WWTP with private hauling of dewatered sludge for disposal. Although the use of the landfill is eliminated there are increased transportation and volatile disposal costs. Unknown variables exist for the alternative as the private hauler with likely have contract provisions for changes in regulations, fuel costs and the availability of their disposal site.

Haul Liquid – This alternative involved no modifications at the WWTP, but did include disposal costs. This alternative is the most volatile due to unknown contractual impacts for changes in regulation, fuel and available space at private disposal locations. Although not a responsibility of the City, because the volume of the sludge has not been reduced through dewatering, there will be an increase in truck traffic at the WWTP.

Based on the information gathered, the present worth cost for the 20-year planning period of the three alternatives is presented in the following table. To obtain the present worth value the annual operating & maintenance costs are amortized and added to the capital costs. For this evaluation we used a 20-year term and the City's current borrowing rate of 3.75%.

Alternative	Dewater & City Owned Landfill Disposal	Dewater & Private Hauler	Haul Liquid
Capital Costs	$4,183,200 (1)	$3,416,500 (2)	$0 (3)
Annual Operation & Maintenance Costs	$221,200	$536,550 (4)	$897,300 (4)
Present Worth	$7,435,000	$12,789,000	$12,470,000

(1) Includes $3.4 million for dewatering upgrades and $0.77 million for expansion costs at the current sludge landfill.
(2) Includes $3.4 million for dewatering upgrades
(3) Does not include an amount for new sludge pumping equipment
(4) Includes costs for additional sludge sampling

Based on the evaluations, it was determined that the most cost-effective long-term solution for the City's wastewater sludge processing is to upgrade the present dewatering equipment and continue to dispose of dewatered sludge at the City's sludge landfill by expanding the capacity of the landfill.

We are prepared to meet with you to discuss our recommendation. We look forward to continuing the progress on the upgrades.

Very truly yours,

CDR MAGUIRE INC.

Robert P. Sims, PE
Project Manager

cc: Steve Landry (CDR Maguire)
Bob Hankinson (Gardner)
Matt LaPointe (United Water)
Kevin Olson (Wright-Pierce)

References:

1. Wastewater Treatment Facility Plan for the City of Gardner by Wright-Pierce, November 2015
2. CDR Maguire Landfill Expansion Capacity memorandum, February 2016

CDR|MAGUIRE

Memorandum

Date: May 20, 2015

To: Dane Arnold

From: Robert Sims

Subject: Gardner Sludge Disposal - Alternatives Analysis

BACKGROUND

The City of Gardner currently treats wastewater at a treatment facility located off of Parker Street in the Town of Templeton. The facility discharges into the Otter River. The facility is governed by the USEPA through a NPDES permit (Permit # MA0100994). This permit allows for a design flow of 5.0 million gallons per day of treated effluent to enter the Otter River. The discharge must meet limits of concentration and total loading mandated in the Permit.

As part of this process, sludge is removed during the primary and secondary phases of the treatment process. Once the sludge is removed it is stored in tanks and thickened by gravity. The thickened sludge (approximately 3% solids) is mixed with a polymer which hastens the removal of additional water and the mixture passes through a pair of belt filter presses. This process squeezes the water between two parallel permeable sheets and water is extruded. The extruded water is drained off and returned to the headwater of the plant. The solids content of the sludge is increased to about 22% and it is now referred to as sludge cake.

The cake falls off of the press and is deposited into a dump truck and hauled to the sludge landfill where it is mixed with approximately 3:1 ratio of amendment (sand, dirt and gravel) to further increase the solids content and make the material workable for spreading at the landfill. Once spread, it is covered with a daily cover to reduce odors.

The pressing and hauling currently occurs 4 days a week and 8 trucks of sludge are deposited and worked at the landfill. The average monthly total (as reported in annual reports) is approximately 400 cubic yards per month.

This evaluation is to perform a comparison of three additional alternatives for processing of the sludge. The driving factor in the analysis will be cost, but other factors such as land use and needed infrastructure improvements will be part of the discussion. Although much harder to define, but equally important are the impact of environmental changes and reliance on stable and predictable costs from private waste haulers.

ALTERNATIVES

As part of the alternatives analysis we investigated the cost and non-cost impacts for utilizing each alternative. The costs included the cost of land, infrastructure improvements, equipment purchase and operation and maintenance. The non-cost impacts included traffic and odors.

- Continue dewatering and landfilling
- Composting
- Anaerobic Digestion
- Offsite disposal

For the new options we considered the pros and cons of performing the activity at the treatment plant and at the landfill site.

OPTIONS

Option 1 - Continue dewatering and landfilling. This option is a continuation of the current method of sludge disposal and would require little change. Sludge is thickened and dewatered at the plant and transported to the sludge landfill. Due to size restraints of the existing landfill, the current landfill would have to be expanded. The City currently owns the property for the expansion. In addition, the site has been assessed and approved by the regulatory agencies. This was completed prior to the original construction in the late 1980's.

The costs for this option will include development of the plans for the expansion, replacement of the existing dewatering equipment, site work, installation of a liner, an extension of the existing leachate collection system and mixing material. It is anticipated that a portion (if not all) of the in-situ material can be used for daily cover and final cover material for the closing of the existing landfill.

As stated above, the land has already been set aside for development as a sludge landfill. This was completed as part of the original approval.

Option 2 – Composting. This option would involve gravity thickening and dewatering of the sludge prior to conversion to compost. To convert to compost, the dewatered sludge will be mixed with an amendment (typically wood chips) and stored for decomposition. To facilitate a consistent process and finished product, the mixed piles of sludge and amendment are placed over a pumped air distribution system. The mixture can also be simply turned with mechanical equipment, but utilizing the supplemental air controls the process and ensures complete conversion of the material.

For composting it is best to have the process be performed under cover. This does not have to be an enclosed setting, but protection from rain is key. Simple structures are available to perform this process, but the process needs a place for construction. Besides needing space for the cover, air blowers, piping and wood chips would have to be purchased and stored. It's anticipated that approximately 3 acres of space would be needed for this process. It's expected that this would either occur at the existing treatment plant or at the sludge landfill.

Each site has its limitation and would require some site work. The existing sand filter beds at the treatment plant were constructed to allow treated water to soak into the ground. This condition is not preferred for composting and would have to be modified with some sort of impenetrable covering, most likely concrete. The landfill site is suitable yet is currently wooded. Some clearing and site development would have to occur. Each option would require that a site specific design be performed.

A key component of the composting option is being able to dispose of the finished product. Testing of the sludge is being performed to determine the quality. Massachusetts environmental regulations (310 CMR 32.00) dictate the limits of the end use of compost based on the concentration of certain components of the sludge.

1. Type I Sludge – Distributed without further DEP approval
2. Type II Sludge – Distributed only with prior DEP approval
3. Type III Sludge – Not for food chain crops and applications are recorded for the property at the Registry of Deeds

The Type of material created greatly dictates the ability to dispose of the finished product. Whereas a Type I sludge can be sold or given to homeowners for lawn and garden supplement without any further input from the regulatory agencies, a Type III compost would have a very limited distribution and it is feasible that a cost would be incurred for final disposal. The Town of Pepperell has a small composting facility that has is a Type I product and the Town is able to dispose of their product through uses by the DPW, homeowners and landscapers. Their sludge meets the DEP requirements.

Additionally, since composting occurs in an open air environment, the generation of odors and other vectors (birds and rats) are a distinct possibility.

Option 3 – Anaerobic Digestion. This process involves utilizing the gravity thickened (but not dewatered) sludge and introducing it into an anaerobic (no oxygen) environment that allows certain bacteria to grow that destroy the pathogens in the sludge. Food waste can also be added to enhance the process. Changes in food waste disposal regulations support the development of these kinds of operations. Depending on the characteristics of the sludge certain amounts of methane are produced that can be used for energy production (and cost recovery). One of the inherent downsides to this operation is that sludge is still produced requiring disposal. Disposal through the open market is possible, but quality limitations determine the approved end use.

The City of Fitchburg has recently begun an investigation to create an energy generation project by utilizing sludge from their in-City treatment plant, in-City paper mill waste, in-City food waste and wastewater sludge from surrounding communities. At a public hearing on March 31, 2015, the consulting engineer for the City held a public forum to present the idea and facilitate a discussion.

The Proposed Fitchburg proposal would generate 1.5 mega-watts of energy and require in addition to the six in-City truckloads of material, the delivery of 24 40-cubic yard dump trucks of wastewater sludge from surrounding communities. When asked why the proposal was for such a large complex and included the necessity for material from outside the community, the engineer stated that it needed to be that big to make the project viable by achieving the appropriate economy of scale. That being, that a smaller project would not be cost effective.

Fitchburg is in a unique situation because many of the facilities necessary for the process are already built. Their West Treatment plant was recently decommissioned yet some of the existing structures could house some of the needed equipment. This significantly reduces the capital costs. The intent of the Fitchburg facility is to fund the construction and operation through tipping fees and energy credits. If Gardner was to proceed with participating in the Fitchburg process, the existing process of dewatering the thickened sludge could be discontinued. However, a new tanker vehicle would be needed to transport the liquid sludge to Fitchburg. Additional capital would be required for new vehicle and new personnel expenses would be encumbered for the transportation to Fitchburg. Based on current sludge production, it is anticipated that approximately 10 tanker trucks a week would be delivered to Fitchburg.

For new anaerobic digestion facilities in Gardner, new structures would be required including tanks for processing, mixing and storage. Siting the anaerobic digestion process is complicated. It would be most cost-effective to locate it at the treatment plant to reduce the hauling of the liquid to an off-site location (most likely the sludge landfill).

The anticipated mixing ratio of food waste to sludge is estimated to be 1:5. That is you need 1/5 of the amount of food waste for the process. The exact ratio would need to be verified before a detailed analysis could be completed. Based on a study by the Commonwealth, the City of Gardner has 17 viable sources of dfood waste. These are shown in Table X. As seen in Table X, the 17 establishments in the City generate an estimate 3.31 tons of food waste per day. Based on the estimated ratio and the average production of 13.3 tons per day of sludge, the new anaerobic digestion facility would require 2.9 tons of food waste per day. That amounts to 88% of the food waste generated in the City. This data was taken from the Massachusetts Department of Environmental Protection Website – Food Waste Generation.

Because of the multiple sources of food waste, the collection by the City will require additional staff. Another option is to require the delivery of the food waste. Either way, the City will need a person to either collect the material of oversee the disposal by the generator.

TABLE 1
SUMMARY OF FOOD WASTE GENERATORS IN GARDNER

Source	Location	Amount (Tons/year)
Burger King	Crawford Street	39.0
Legend Rehabilitation	Eastwood	39.4
Dunkin Donuts	Main Street	30.0
D'Angelo's	Union Square	24.0
Friendly's	Pearson Blvd	90.0
Heywood Hospital	Green Street	83.6
Heywood Transitional Care	Green Street	6.2
McDonald's	Timpany Blvd	45.0
Mt. Wachusett Community College	Green Street	92.5
Papa Gino's	Timpany Blvd	21.0
Peter Ray's Pan	Ross Road	105.0
Stop-n-Shop	Timpany Blvd	165.0
Stop-n-Shop	Timpany Blvd	300.0
Taco Bell	Peearson Blvd	27.0
Wachusett Manor	Hospital Hill	31.5
Wendy's	Pearson Blvd	40.5
Williams Restaurant	Pearson Blvd	67.5
	TOTAL	1207.2 or 3.31 tons/day

There appears to be available space at the treatment plant for construction. The downside is that the plant is located in the Town of Templeton and the power grid is owned and operated by the Templeton Power Utility that does not have incentive programs for these kinds of arrangements. Not receiving an incentive would reduce the viability of this option.

Siting the anaerobic digestion at the landfill site is possible but would involve developing a portion of the available space, the construction of the infrastructure, and hauling of the liquid to the site. It would however allow for the return of the investment in energy recovery. It's expected that the anaerobic digestion process would return power to the grid as the sanitary landfill currently does.

A major impact to the anaerobic digestion process is the ability to receive consistent quality of material (food waste and sludge). A consistent material will assist in generating a consistent product (energy and waste sludge). To allow for the delivery of consistent amounts of material, it is anticipated that storage facilities will be required for both sludge and food waste.

As with the production of compost, the quality of the sludge will affect the ability to dispose of the treated sludge from the anaerobic digestion process. Testing of the sludge is being performed to determine the quality. Massachusetts environmental regulations (310 CMR 32.00) dictate the limits of the end use of compost based on the concentration of certain components of the sludge.

1. Type I Sludge – Distributed without further DEP approval
2. Type II Sludge – Distributed only with prior DEP approval

3. Type III Sludge – Not for food chain crops and applications are recorded for the property at the Registry of Deeds

The Type of material created greatly dictates the ability to dispose of the finished product. Whereas a Type I sludge can be sold or given to homeowners for lawn and garden supplement, a Type III compost would have a very limited distribution and it's feasible that a cost would be incurred for final disposal.

To date the sludge generated in Gardner has not been sufficiently tested and an expectation of the quality of the end product of the anaerobic digestion process is uncertain.

At this time, based on the contributing issues in Gardner and the downsides from the presentation by Fitchburg, we would not recommend the creation of an anaerobic digestion facility for sludge disposal. However, in light of the recommendation, we have included a cost estimate for this option.

In addition to our evaluation of anaerobic digestion, we have had conversation with solid waste regulator's at the MADEP in Worcester and their opinion is that the logistic of a consistent product, food waste and byproduct render, this not a viable option.

Option 4 – Offsite Disposal. This option involves no action by the City other than contracting with a sludge hauler. There are subcategories for this type of disposal including:

- Hauling of liquid sludge by a hauler to a offsite landfill
- Hauling of sludge cake by a hauler to offsite landfill
- Hauling and incineration of liquid sludge to an offsite incinerator

Each subcategory has inherent costs. Aside from the cost of hauling and disposal, the sludge cake option would require the replacement of the belt filter press while the hauling of liquid sludge would require a retrofit at the treatment plant to accommodate the disposal of liquid sludge which is not currently an option.

These options are all viable, and in some cases moderately cost competitive, there is the unknown impact of changes regulatory environment and unknown contract language impacts from a private hauler. Specific modifications to the planned cost are very difficult to include in the analysis, but pose a significant risk.

COST

For the cost evaluation we converted the capital and operating costs to an annualized cost. The City of Gardner Sludge Alternative Cost Summary is included at the end of this memorandum as well as a simplified summary for each option. For this evaluation we made the assumptions listed below.

- The term of the borrowing for the evaluation would be 20 years.
- The interest rate would be 4% (based on current borrowing).
- We assumed that the plant will not expand and will produce sludge at a consistent rate for the life of the term.
- We assumed that the gravity thickener produces sludge at a consistency of 3% solids.
- The belt filter press generates sludge at a rate of 22% solids.

- The current landfill accepts approximately 400 cubic yards of material every month (@22% solids). This calculates to approximately 1,500 dry tons per year.
- We assumed that the engineering, permitting and construction oversight for each alternative is 25%.
- To be slightly conservative in our approach and to allow for certain variability, we have also included a 25% contingency.
- For an option involving sludge cake, we assumed that the belt filter press would be replaced
- Operation & Maintenance of equipment is equal to 4% of the capital cost.
- Costs for Hauling liquid sludge, sludge cake and incineration were prorated to increase over the term of the evaluation at 4%.
- Power from anaerobic digestion valued at $0.15 per Kilo-watt

TRAFFIC

Another intangible that was not included as part of the cost evaluation is traffic. Currently the landfill option generates about 8 trips per week.

Composting would also include 8 trips per week of sludge cake to the landfill. The increase in traffic for hauling amendment would offset the hauling of amendment for the landfill option. Composting will not increase traffic.

The anaerobic digestion process involves the hauling of a liquid sludge. Since the dewatering reduces the overall volume, the number of truck trip would increase to approximately 10 trips per week of a 9,000 gallon truck.

A private hauler of sludge cake would likely reduce traffic as they would likely use a larger truck to maintain efficiency. A truck twice the size of the one currently used by the city would reduce the truck trips by 50% to approximately 4 a week. However, for hauling liquid sludge (disposal or incineration) would result is the same increase as hauling liquid to Fitchburg (8 to 10).

ODORS

Odors are a part of sludge handling. Of the options investigated, the landfilling and compost have the highest incident of odor complaints. For anaerobic digestion and private hauling, it is expected that the odors would be limited to the treatment plant. Anaerobic digestion at the landfill site might have some odors, but they would be expected to be less that landfilling or composting.

As part of the vertical expansion of the existing landfill, the operator (United Water) is investigating the odors and is developing a plan for reducing the odors associated with the landfill operations.

OTHER COSTS

A private hauler will also require that the material meet certain contaminant levels and require additional testing. From our discussion with a private waste hauler, some parameters are annually and

some are quarterly. The hauler's estimate of additional sampling would be an annual amount of $15,000 to $20,000.

SUMMARY

Given the cost comparison and the intrinsic risk of utilizing a private waste hauler, we recommend continuing with the process of dewatering and landfilling of the current sludge generated at the wastewater plant. Given the reasonably close cost analysis it may be beneficial to consider the hauling of sludge cake as a backup alternative.

Both options do require the replacement of the sludge dewatering equipment at the treatment plant and we feel confident that the City can continue with those plans.

CITY OF GARDNER
SLUDGE DISPOSAL ANALYSIS
COSTING OF ALTERNATIVES

OPTION	DESCRIPTION	ANNUAL COST	Delta	% inc.	VOLUME (dt/yr)	COST ($/dt)
1	**Landfill**	**$ 360,960**	**$ -**	**0%**	**1,500**	**$ 240.64**
2	Compost	$ 626,400	$ 265,440	74%	1,500	$ 417.60
3A	Anaerobic Digestion - Fitchburg	$ 623,780	$ 262,820	73%	1,500	$ 415.85
3B	Anaerobic Digestion - Gardner	$ 676,160	$ 315,200	50%	1,500	$ 450.77
4A	Haul Liquid	$ 937,700	$ 576,740	160%	1,500	$ 625.13
4B	**Haul Sludge**	**$ 435,600**	**$ 74,640**	**21%**	**1,500**	**$ 290.40**
5	Haul & Burn	$ 1,237,700	$ 876,740	243%	1,500	$ 825.13

CITY OF GARDNER SLUDGE ALTERNATIVES

OPTION 1 - LANDFILL		Item	term	interest	A/P, 20,4% Cost Factor	Annual Cost
Capital	BFP	$ 1,500,000	20	0.04	0.0736	$ 110,400
	Land @ 150k/acre	$ 900,000	20	0.04	0.0736	$ 66,240
	Subtotal	$ 2,400,000	20	0.04	0.0736	$ 176,640
	Engineering (25%)	$ 600,000	20	0.04	0.0736	$ 44,160
	Contingency (25%)	$ 600,000	20	0.04	0.0736	$ 44,160
		$ 3,600,000	20	0.04	0.0736	$ 264,960
O&M	O&M (4% of capital)	$ 96,000				$ 96,000
					Annualized cost	$ 360,960

OPTION 2-COMPOST		Item	term	interest	A/P, 20,4% Cost Factor	Annual Cost
Capital	BFP	$ 1,500,000	20	0.04	0.0736	$ 110,400
	Composting Equip	$ 500,000	20	0.04	0.0736	$ 36,800
	Land Development	$ 1,500,000	20	0.04	0.0736	$ 110,400
	Subtotal	$ 3,500,000	20	0.04	0.0736	$ 257,600
	Engineering (25%)	$ 875,000	20	0.04	0.0736	$ 64,400
	Contingency (25%)	$ 875,000	20	0.04	0.0736	$ 64,400
		$ 5,250,000	20	0.04	0.0736	$ 386,400
O&M	O&M (4% of capital)	$ 140,000				$ 140,000
	Manpower	$ 100,000				$ 100,000
					Annualized cost	$ 626,400

OPTION 3A ANAEROBIC DIGESTION - FITCHBURG		Item	term	interest	A/P, 20,4% Cost Factor	Annual Cost
Capital	Tanker	$ 200,000	20	0.04	0.0736	$ 14,720
	Minor Improvements	$ 500,000	20	0.04	0.0736	$ 36,800
	Subtotal	$ 700,000	20	0.04	0.0736	$ 51,520
	Engineering (25%)	$ 175,000	20	0.04	0.0736	$ 12,880
	Contingency (25%)	$ 175,000	20	0.04	0.0736	$ 12,880
		$ 1,050,000	20	0.04	0.0736	$ 77,280
O&M	O&M (4% of capital)	$ 28,000				$ 28,000
	Personnel	$ 100,000				$ 100,000
	Tipping Fee	$ 279	1500			$ 418,500
					Annualized cost	$ 623,780

CITY OF GARDNER SLUDGE ALTERNATIVES

OPTION 3B ANAEROBIC DIGESTION - GARDNER						A/P, 20,4% Cost Factor		Annual Cost
		Item		term	interest			
Capital	Tanker	$	200,000	20	0.04	0.0736	$	14,720
	Site Improvement	$	1,875,000	20	0.04	0.0736	$	138,000
	Land Development	$	450,000	20	0.04	0.0736	$	33,120
	Subtotal	$	2,525,000	20	0.04	0.0736	$	185,840
	Engineering (25%)	$	631,250	20	0.04	0.0736	$	46,460
	Contingency (25%)	$	631,250	20	0.04	0.0736	$	46,460
		$	3,787,500	20	0.04	0.0736	$	278,760
O&M	O&M (4% of capital)	$	101,000				$	101,000
	Personnel	$	100,000	3			$	300,000
	Annual Energy Return (23.5 MW)	$	(3,600)				$	(3,600)
						Annualized cost	$	676,160

OPTION 4A-HAUL LIQUID						A/P, 20,4% Cost Factor		Annual Cost
		Item		term	interest			
Capital	Retrofit at Plant	$	500,000	20	0.04	0.0736	$	36,800
	Subtotal	$	500,000	20	0.04	0.0736	$	36,800
	Engineering (25%)	$	125,000	20	0.04	0.0736	$	9,200
	Contingency (25%)	$	125,000	20	0.04	0.0736	$	9,200
		$	750,000	20	0.04	0.0736	$	55,200
O&M	Hauling	$	575	1500			$	862,500
	O&M (4% of capital)	$	20,000				$	20,000
						Annualized cost	$	937,700

OPTION 4B-HAUL CAKE						A/P, 20,4% Cost Factor		Annual Cost
		Item		term	interest			
Capital	BFP	$	1,500,000	20	0.04	0.0736	$	110,400
	Subtotal	$	1,500,000	20	0.04	0.0736	$	110,400
	Engineering (25%)	$	375,000	20	0.04	0.0736	$	27,600
	Contingency (25%)	$	375,000	20	0.04	0.0736	$	27,600
		$	2,250,000	20	0.04	0.0736	$	165,600
O&M	Hauling	$	140	1500			$	210,000
	O&M (4% of capital)	$	60,000				$	60,000
						Annualized cost	$	435,600

CITY OF GARDNER SLUDGE ALTERNATIVES

OPTION 5-INCINERATE		Item		term	interest	A/P, 20,4% Cost Factor	Annual Cost	
Capital	Retrofit at Plant	$	500,000	20	0.04	0.0736	$	36,800
	Tank Hauler	$	-	20	0.04	0.0736	$	-
	Land Development	$	-	20	0.04	0.0736	$	-
	Subtotal	$	500,000	20	0.04	0.0736	$	36,800
	Engineering (25%)	$	125,000	20	0.04	0.0736	$	9,200
	Contingency (25%)	$	125,000	20	0.04	0.0736	$	9,200
		$	750,000	20	0.04	0.0736	$	55,200
O&M	O&M (4% Capital)	$	20,000	1			$	20,000
	Haul & Burn	$	775	1500			$	1,162,500
						Annualized cost	$	1,237,700

CDR MAGUIRE

Memorandum

Date: February 2, 2016

To: Dane Arnold, Director (Gardner Water/Sewer Department)

From: RS Robert Sims (CDR Maguire), Robin Dyer (CDR Maguire)

Subject: Landfill Expansion Capacity
CDR/Maguire, Inc. Project No. 19474.01

SLUDGE DISPOSAL BACKGROUND

Since the mid 1980's the City of Gardner has been utilizing the sludge only landfill on West Street for disposal of sludge generated from the wastewater treatment plant (WWTP). The site was permitted to encompass the entire 37 acre parcel taken from multiple parties in 1919. The current landfill footprint only incorporates 11 acres. In addition to the landfill itself, this area includes the existing variable width (14' to 20' wide) perimeter access road and an existing building that houses equipment. Outside of the existing perimeter fence are drainage control including two retention ponds.

The site abuts the former municipal landfill. The former municipal landfill has a gas extraction and energy recovery component. It also has two small buildings, one for equipment and one that houses the sludge landfill leachate pumping station. The former municipal landfill does not have a leachate collection system while the sludge landfill does.

Approximately 400 cy of sludge are generated each month at the WWTP. The sludge is trucked to the site from the WWTP, mixed with amendment, spread and covered daily. The existing sludge landfill is approaching the capacity allowed by its current permit. A new application (WP 44) for vertical expansion of the landfill has been submitted to the Massachusetts Department of Environmental Protection (DEP) and is under review. For more information on the vertical expansion see "Vertical Expansion" below.

The current sludge is historically dewatered to an average solids content of 22%. This information was used to determine an approximate unit weight of the amended sludge to allow for the conversion to tonnage from volume. The sludge is dewatered at the WWTP with the use of two belt filter presses. The current amendment ratio is three (3) parts amendment to one (1) part sludge and yields the design unit weight is 75 pounds per cubic foot.

In addition to the expansion to the landfill, the City of Gardner has enlisted the services of an engineering firm to perform upgrades at the existing WWTP. The first design component is a new headworks facility. In addition to the upgrade of the headworks, the City is also evaluating an upgrade of the sludge processing equipment. The upgrades to the sludge processing equipment will allow for the reduction in the amendment ratio due to attaining a higher solids content in the sludge. The amendment is added to increase the workability; the drier the sludge, the less amendment that is

required. Currently an amendment (sand) is mixed with the sludge at a 3:1 ratio. Through pilot testing, the new processing equipment is expected to produce a drier sludge (30% solids) and lower the ratio to 2:1. This change will result in significant savings and extend the life of the landfill.

PREVIOUS WORK

As part of the ongoing management of the landfill, we have reviewed the last few years of the Operations Reports generated by the contract operator (Suez North America) as well as performed a Sludge Recommendation study (2012) to analyze a horizontal expansion. An existing conditions survey was completed by DiPrete Engineering Associates, Inc. in 2012 to assist in the evaluation of the possible vertical expansion of the sludge landfill. CDR/Maguire, Inc. prepared a slope stability analysis in 2012 for the City of Gardner to confirm that the vertical expansion of the landfill was possible. Areas of concern included the area where washouts previously occurred. It was determined that a 3 ft horizontal to 1 ft vertical side slope was acceptable.

VERTICAL EXPANSION

In November of 2014, United Water submitted a plan for the vertical expansion of the landfill. This was to be a temporary solution until a horizontal expansion could be planned and executed. The vertical expansion would raise the top of the sludge landfill from its current cap elevation of 1020.0 to elevation 1046.0. This additional capacity would add 107,563 cubic yards (CY) which is equivalent to adding approximately six (6) years to the life of the existing landfill with the current 3:1 amendment ratio. The initial survey was completed in August 2012 for the site. The revised buildout elevation would be reached in the year 2018.

WORK PERFORMED TO DATE

Additional survey of the horizontal expansion area was completed by DiPrete Engineering Associates, Inc. in October and November, 2013. The boring program was completed in November, 2013. Seven 2-inch diameter groundwater monitoring wells were installed at the location of the seven borings. The monitoring wells include a 4-inch diameter steel sleeve and locking cap. The boring locations were staked in the field by DiPrete Engineering Associates, Inc. As drilled location were determined by tape and hand compass from the staked locations. In February, 2014 CDR/Maguire issued a report entitled, "Geotechnical Report Proposed Sludge Landfill Expansion Area Subsurface Characterization." This report covered the findings from the field and laboratory testing for the soils. Also, included were water table adjustments using the method described in "Probable High Ground-Water Levels in Massachusetts", issued by the U.S. Geological Survey in cooperation with the Commonwealth of Massachusetts Department of Environmental Quality Engineering, known as the "Frimpter Method".

HORIZONTAL EXPANSION

The current 3:1 amendment to sludge cake ratio and a potential 2:1 amendment to sludge ratio have been evaluated in the determination of the life expectancy for the expanded landfill. The decreased ratio is based on the new sludge dewatering process being more efficient than the current one. The current product averages 22% solids. The expectation of the new method is a final product of 30% solids (less water). The higher solids content allows for less amendment to make the product "workable" at the landfill.

The volume of a proposed horizontal landfill expansion was estimated using the program AutoCAD Civil-3D. This was done utilizing the existing survey information collected by DiPrete Engineering Associates, Inc. and water table information gathered by our geotechnical engineer. This information was input into AutoCAD Civil 3D and representative surfaces were developed. A surface was created which represented the existing groundwater table with the input of water table data from the seven borings, supplemented with engineering assumptions about extrapolating beyond existing data points. Along the edge of the wetlands, a water table with a two foot depth was assumed. The existing site was then graded down to the elevation four feet above the ground water table, utilizing 3:1 side slopes. In areas which were already steeper than 3:1, the existing grading remained and the proposed grades were tied into those areas. No grading was to be done within one hundred feet of the wetlands or fifty (50) from the northeasterly property line. This resulted in the removal of 155,412 CY of existing material. A new surface was then developed with a merger of the existing grades, proposed vertical expansion and the new lowered grading. This was designated as the new existing condition to determine the volume of sludge which the site could accept. The site was then graded up to elevation 1060 and a new surface was developed to represent this condition. The proposed grading was also used to develop surfaces with cap elevations of 1020, 1030, 1040 and 1050. These surfaces were then compared to the new existing surface to determine storage capacities at the various elevations. The table below shows the additional volume as they relate to the elevations.

Landfill Cap Elevation	Landfill Volume (CY)
1030	367,831
1030	470,732
1040	554,633
1046	594,249
1050	620,659
1060	666,142

Horizontal expansion would increase the portion of the site utilized for the sludge land fill from 11 acres to approximately 19.5 acres of the 37 acres previously permitted. The proposed layout will maximize the available property. The remaining land is a buffer, wetland or functionally unusable.

LANDFILL LIFE

Using the geospatial data, an estimate of the volume of space available within the landfill property was calculated. This volume was divided by the annual volume of material generated annually. Based on this information, we determined the number of years the life of the landfill would be extended for each proposed elevation. This calculation was performed both the 2:1 and 3:1 amendment ratios. We have also included a conservative settlement factor of 30% for the sludge. The following table shows the results of these calculations, assuming the deposit of 400 CY of sludge within the landfill each month.

For the sake of the evaluation, we ran the calculations for a variety of cap elevations. Additional years of capacity can be attained by increasing the cap elevations. However, because of the pyramid shape, the extra elevation does not translate to significantly more volume. For example, the volume increases 15% when raising from 1030 to 1040, but only 7% when raising it from 1050 to 1060.

For the recommended analysis, we assumed that the cap of the horizontal expansion would match the current planned cap of the vertical expansion (1046.0 feet). Therefore, the new landfill will have a cap elevation of 1046.0 and the life would be 45.8 years at a 2:1 sludge to amendment ratio and 33.4 years for a 3:1 ratio.

Final Landfill Cap Elevation	Available Volume (cy)	Years at 3:1 (current conditions)	Years at 2:1 (dewater upgrades)
1020	367,831	20.7 yrs	28.4 yrs
1030	470,732	26.5 yrs	36.3 yrs
1040	554,633	31.2 yrs	42.8 yrs
1046	594,249	33.4 yrs	45.8 yrs
1050	620,659	34.9 yrs	47.8 yrs
1060	666,142	37.5 yrs	51.3 yrs

COSTS

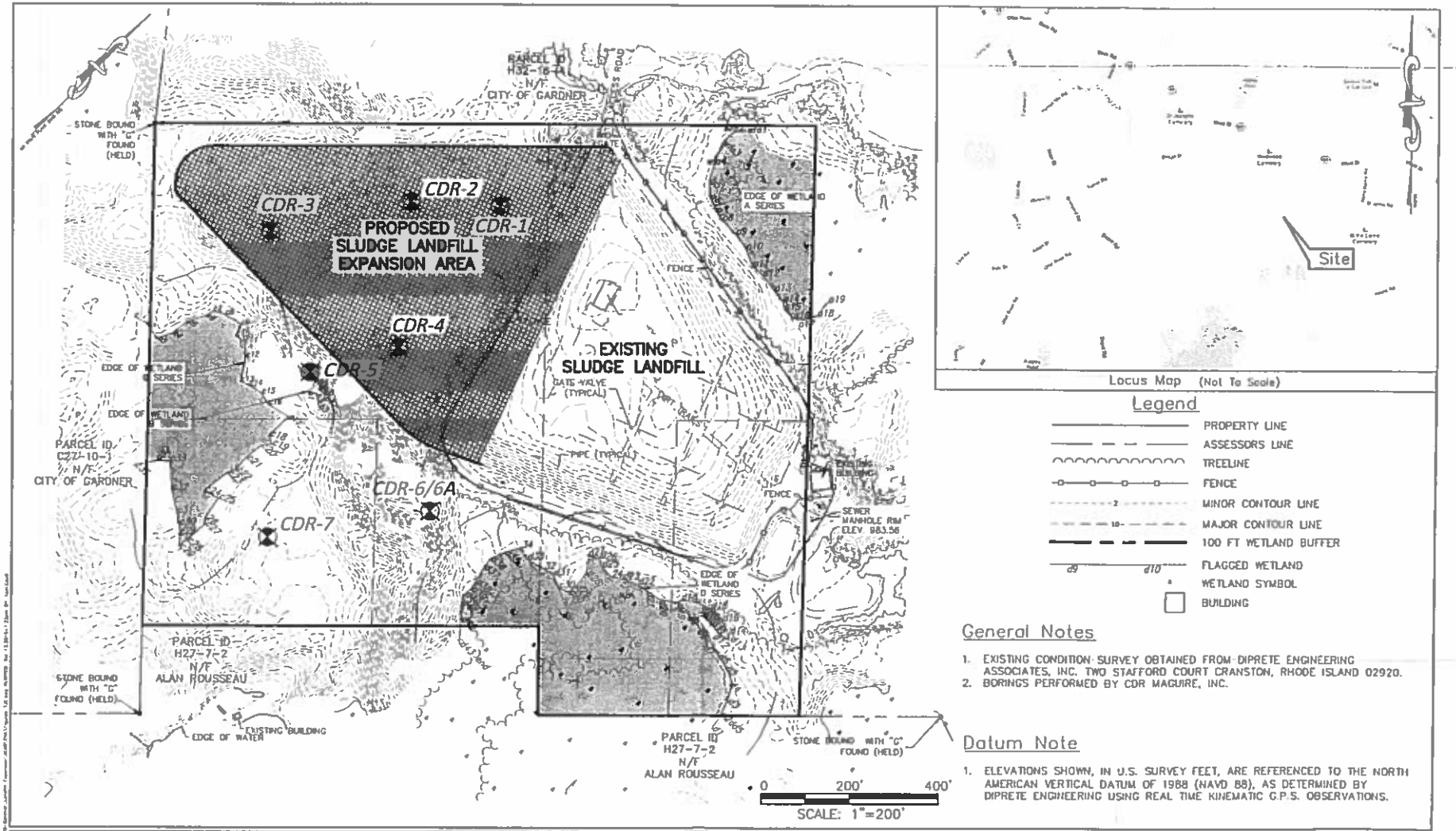
Based on the cost estimate of developing the landfill site at $150,000 per acre, we estimate that preparing the site to receive sludge will cost $1,275,000 ($150,000 for 8.5 acres).

Because the landfill will last longer than the 20-year planning period, we developed an annual cost for the life of the landfill and then amortized the cost of a 20-year period. For example – the $1.275 million dollars to develop the landfill for the cap elevation of 1046 feet for the proposed conditions would spread over 45.8 years. The amortized cost of the landfill would calculate to be $55,200 per year.

Calculating the present worth for the 20-year design period would result in a capital cost of the 20-year landfill of $770,000. For the current amendment conditions (3:1), the same procedure is utilized except the original $1,275,000 is spread out over 33 years. The resulting 20-year present worth cost would be $903,000.

CONCLUSION

The conclusion is based on the horizontal expansion being capped at the same elevation as the current landfill after vertical expansion approval. At a sludge to amendment mix of 2:1, the expanded landfill will have an estimated life of 45.8 years and project an annual cost of $55,200. If the sludge to amendment ratio remains at 3:1, the life shortens to 33.4 years and the annualized cost increases to $65,000. The 20-year present worth of the two options is $770,000 and $903,000 respectively.



Locus Map (Not To Scale)

Legend

- PROPERTY LINE
- ASSESSORS LINE
- TREELINE
- FENCE
- MINOR CONTOUR LINE
- MAJOR CONTOUR LINE
- 100 FT WETLAND BUFFER
- FLAGGED WETLAND (d9, d10)
- WETLAND SYMBOL
- BUILDING

General Notes

1. EXISTING CONDITION SURVEY OBTAINED FROM DIPRETE ENGINEERING ASSOCIATES, INC. TWO STAFFORD COURT CRANSTON, RHODE ISLAND 02920.
2. BORINGS PERFORMED BY CDR MAGUIRE, INC.

Datum Note

1. ELEVATIONS SHOWN, IN U.S. SURVEY FEET, ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88), AS DETERMINED BY DIPRETE ENGINEERING USING REAL TIME KINEMATIC G.P.S. OBSERVATIONS.

THIS LINE IS ONE INCH LONG WHEN PLOTTED AT FULL SCALE ON A 11" X 17" DRAWING

CDR|Maguire Inc.
275 Chapman Street 4th Floor
Providence, Rhode Island 02903
401-272-8100

PROJECT NO.	19474.00
DESIGNED BY	
DRAWN BY	MED
CHK'D BY	DN
DATE	03/03/2014
SCALE	

GARDNER SLUDGE LANDFILL
EXPANSION AREA

FIGURE 2
AS-DRILLED BORING LOCATION PLAN

DRAWING NO.
FIGURE-2
SHEET 2 OF 2