## STAFF REPORT

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| **Agenda Item:** | 5 | **Name:** | Terra Rose |
| **Proposed No**.: | 2019-0429 | **Date:** | November 4, 2019 |

**SUBJECT**

Proposed Motion 2019-0429 would acknowledge receipt of a feasibility study related to long-term disposal of the region’s waste, comparing a waste to energy facility to waste export by rail, in response to a budget proviso.

**SUMMARY**

King County’s Solid Waste Division (“SWD”) operates a regional solid waste system for the unincorporated area and 37 partner cities. This system includes one remaining local landfill, the Cedar Hills Regional Landfill, a 920-acre site located in Maple Valley owned and operated by the County. This past spring, the Council approved the 2019 Comprehensive Solid Waste Management Plan,[[1]](#footnote-1) which directed further development of the Cedar Hills landfill to maximize disposal capacity instead of the other considered options of a Waste-to-Energy facility and waste export by rail. However, the Plan did not specify the next disposal method after ultimate Cedar Hills closure. SWD is currently conducting a State Environmental Policy Act process to evaluate three engineering options to develop Cedar Hills for additional capacity that Executive staff estimate will extend the landfill’s life to between 2035 and 2041. Because the current interlocal agreements with the partner cities obligate the County to dispose of the region’s waste through 2040 and it is not known the exact year when Cedar Hills will reach capacity, an alternative waste disposal strategy will need to be identified given the lead time associated with implementing the next disposal method.

In the 2019-2020 biennial budget,[[2]](#footnote-2) the Council directed the Office of Performance, Strategy and Budget to issue a Request for Proposal and manage a contractor to conduct a study evaluating the feasibility of either a Waste-to-Energy (“WTE”) facility or waste export by rail as the County’s next disposal method. Included in the budget is a proviso that requires the feasibility study to review the County’s projected waste forecast, as well as provide estimates for the costs and environmental impacts of both options, among other items.

Proposed Motion 2019-0429 would acknowledge receipt of the *King County Waste-to-Energy and Waste Export by Rail Feasibility Study* developed by the consultant Arcadis. The consultant concludes based on its financial modeling that the total costs (offset by revenues)[[3]](#footnote-3) for both long-term disposal options are similar in the ten-year near-term at over one billion dollars, but that a WTE facility could cost less in the fifty-year long-term ($6.96 to $8.90 billion for WTE and $11.25 to $16.14 billion for waste export).

Additionally, the consultant estimates that a WTE facility would have comparatively less greenhouse gas emissions than waste export by rail given the opportunity for emissions offsets through recycling the resulting ash byproduct and recovered metals. The study notes, however, that the estimates are dependent on the different variables and assumptions made in the financial and greenhouse gas models. Further detail concerning how these figures were derived and the consultant’s assumptions can be found both in the remainder of this staff report, as well as the in the study and associated appendices.

Approval of Proposed Motion 2019-0429 release the funds encumbered by the proviso, however would not provide Council approval for the next disposal method. The main legislative vehicle for solid waste system planning decisions, including long-term disposal, is through updates to the Comprehensive Solid Waste Management Plan.

**BACKGROUND**

The King County Solid Waste Division (“SWD”) operates eight transfer stations, two drop boxes, the Cedar Hills Regional Landfill, as well as waste prevention and recycling programs for the unincorporated area and 37 partner cities. The County’s solid waste system is supported by a variety of disposal fees that are approved by the Council. The per ton disposal fee for garbage at most recycling and transfer stations is currently $140.82.[[4]](#footnote-4) For the 2019-2020 budget, SWD has been appropriated $323.2 million[[5]](#footnote-5) and $178.8 million in capital[[6]](#footnote-6) funds.

**Cedar Hills Regional Landfill and Long-Term Disposal Planning.** The Cedar Hills Regional Landfill, owned and operated by the County, has served as the final disposal location for the region’s mixed municipal solid waste since its opening in 1965. In 2017, approximately 931,000 tons of waste were disposed at the landfill.[[7]](#footnote-7)

This past spring, the Council approved the 2019 Comprehensive Solid Waste Management Plan,[[8]](#footnote-8) which directed further development of the Cedar Hills landfill to maximize disposal capacity instead of the other considered options of a Waste-to-Energy facility and waste export by rail. Funding for landfill development capital projects was included in the 2019-2020 biennial budget.[[9]](#footnote-9) SWD is currently conducting a State Environmental Policy Act process to evaluate three engineering options to develop Cedar Hills for additional landfill capacity, which is based on acreage within the permitted boundaries of the facility, as well as associated airspace. Executive staff indicate that, based on the three development alternatives being considered and the current tonnage forecast, Cedar Hills is expected to reach capacity sometime between 2035 and 2041.

Because the current interlocal agreements (“ILAs”) with the partner cities obligate the County to dispose of the region’s waste through 2040 and it is not known the exact year when Cedar Hills will reach capacity, an alternative waste disposal strategy will need to be identified given the lead time associated with implementing the next disposal method. The 2019 Comprehensive Solid Waste Management Plan did not specify the next disposal method after ultimate Cedar Hills closure, but the Council added a requirement that the Office of Performance, Strategy and Budget engage with SWD and regional partners to develop a plan for long-term disposal. Under this requirement, a progress report is due to the Council by December 31, 2021 that outlines how the plan will be developed and that includes the timing for the transmittal of the plan, as well as the implementing legislation.

**Waste-to-Energy and Waste Export by Rail Feasibility Study Proviso.** In the 2019-2020 biennial budget, the Council directed the Executive to lead a study that evaluates the feasibility of a Waste-to-Energy facility and waste export by rail as the County’s next disposal method. Specifically, an expenditure restriction restricts $500,000 to be expended only for the Office of Performance, Strategy and Budget to issue a Request for Proposal and to manage a contractor to conduct the feasibility study. A linked proviso describes the requirements of the study and specifies that $100,000 shall not be expended until the feasibility study is transmitted to the Council, which should occur by October 4, 2019. The expenditure restriction and proviso state:[[10]](#footnote-10)

ER3 EXPENDITURE RESTRICTION ER:

 Of this appropriation, $500,000 shall be expended or encumbered solely for the office of performance, strategy and budget to issue a request for proposals, and to manage and pay a contractor to conduct the feasibility study for a waste to energy facility to manage the region's solid waste that provides a comparison to waste export by rail as described in Proviso P3 of this section.

P3 PROVIDED FURTHER THAT:

 Of this appropriation, $100,000 shall not be expended or encumbered until the executive transmits the feasibility study for a waste to energy facility to manage the region's solid waste that provides a comparison to waste export by rail and a motion that should acknowledge receipt of the feasibility study and reference the subject matter, the proviso's ordinance, ordinance section and proviso number in both the title and body of the motion and a motion acknowledging receipt of the feasibility study is passed by the council. The study should be performed by a contractor with significant experience in the field of waste management and recycling, demonstrated expertise with waste to energy technology and familiarity with the capital and operating needs of waste to energy facilities located around the world, and shall primarily consider a waste to energy facility that uses mass burn technology. The contractor may also identify other technologies that may be feasible to accommodate the current and future projections for the amount and composition of the county's waste stream. The solid waste division must provide the county's waste tonnage forecast model to the contractor upon request and explain any assumptions.

 The feasibility study shall include, but not be limited to:

 A. A review of factors that may affect the county's future waste tonnage forecast completed in 2018, and an analysis, with a range of estimates, of how different assumptions could affect the forecast;

 B. A discussion of the potential for exporting the county's waste by rail that includes an analysis of the future rail capacity forecast, the estimated capital and operating costs and the environmental impacts;

 C. An evaluation of the size of a waste to energy facility that would be needed to accommodate the county's solid waste over a twenty to fifty year time horizon, beginning in 2025, with any assumptions clearly articulated, and a description of any siting needs including the necessary parcel size;

 D. A discussion of the costs of a waste to energy facility and potential financing options that includes estimates for the capital costs, the annual operating and maintenance costs and the estimated impact on the county's tipping fee, with any assumptions clearly articulated;

 E. A discussion of any environmental impacts of a waste to energy facility;

 F. An assessment of regional electricity markets and the regulatory structure to produce an estimate of potential revenues from the sale of electricity by a waste to energy facility;

 G. An analysis of other potential revenue sources from the potential byproducts of a waste to energy facility that includes, but is not limited to, the sale of recovered metals and possible uses of bottom ash;

 H. A discussion of the state and federal regulatory environment related to waste to energy facilities; and

 I. A reasonable timeline for implementation of a waste to energy facility, and an analysis of the potential impact on the lifespan and capacity of the Cedar Hills regional landfill if a waste to energy facility was developed according to the timeline.

 The executive should file the feasibility study and a motion required by this proviso by October 4, 2019, in the form of a paper original and an electronic copy with the clerk of the council, who shall retain the original and provide an electronic copy to all councilmembers, the council chief of staff and the lead staff for the committee of the whole, or its successor.

**ANALYSIS**

The Office of Performance, Strategy and Budget issued a Request for Proposal earlier this year for the feasibility study required by the proviso and expenditure restriction described above, selecting Arcadis (“Consultant”) as the consultant to perform the work. The *King County Waste-to-Energy and Waste Export by Rail Feasibility Study* (“Feasibility Study”, “Study”), with Proposed Motion 2019-0429 that would acknowledge its receipt, was transmitted to the Council on October 4, 2019.

A summary of the Consultant’s findings in each of the areas requested by the proviso is provided in the following subsections of the staff report.

**County’s Future Waste Tonnage Forecast.** The proviso required the consultant to review the factors that may affect the County’s future waste tonnage forecast and analyze how different assumptions could affect the forecast, as well as include a range of estimates. The Consultant reviewed the waste forecast developed in February 2019 by the Solid Waste Division (“SWD”), along with population growth projections, per capita waste generation, and recycling rate data to determine whether the same methodology should be used through the 2075 planning horizon specified by the proviso. The Feasibility Study notes that waste per capita depends on several factors including:

* Economic activity (e.g., the amount of waste generated per capita tends to decrease during recessions);
* Technological factors (e.g., packaging, recycling infrastructure);
* Social factors (e.g., a person’s attitude toward recycling); and
* Administrative/Governmental factors (e.g., government policies on recycling and how easy or difficult it is to recycle).

Executive staff note that the SWD forecast model is based on multiple variables (e.g., retail sales data, per capita waste disposed) which are challenging to predict and become more uncertain the farther out you look in time. Because the SWD forecast model was not designed to develop 50-year estimates, the Consultant felt it was not appropriate to use that projection methodology and instead recommends a simpler approach with population as the major variable, as it reduces the potential number of assumptions to project out fifty years. Arcadis developed two waste tonnage forecasts representing a high[[11]](#footnote-11) and low[[12]](#footnote-12) bound. Both forecasts assume a 52 percent recycling rate throughout the entire study period and the Feasibility Study explains that this is based on the leveling off in the County’s recycling rate in recent years and the limited role of the County in enforcing recycling rate improvements in the partner cities. Table 1 below provides the estimated waste generated in a few key years under each developed forecast. For context, approximately 931,000 tons of waste were disposed at the Cedar Hills landfill in 2017.[[13]](#footnote-13)

**Table 1. Projected Total Tons Disposed Annually Under Low and High Bound Forecasts**

| **Model**  | **2025** | **2040** | **2045** | **2075** |
| --- | --- | --- | --- | --- |
| **Consultant High Bound Forecast (tons)** | 1,079,268 | 1,454,250 | 1,496,171 | 1,774,331 |
| **Consultant Low Bound Forecast (tons)** | 928,046 | 1,006,379 | 1,035,239 | 1,226,639 |

**Comparison of Waste-to-Energy Facility and Waste Export by Rail Findings.** The Consultant concludes based on its financial modeling that the total costs (offset by revenues)[[14]](#footnote-14) for both long-term disposal options are similar in the ten-year near-term at over one billion dollars, but that a WTE facility could cost less in the fifty-year long-term ($6.96 to $8.90 billion for WTE and $11.25 to $16.14 billion for waste export). Additionally, the consultant estimates that a WTE facility would have comparatively less greenhouse gas emissions than waste export by rail given the opportunity for emissions offsets from recycling the resulting ash byproduct and recovered metals. The Study notes, however, that the estimates are dependent on the different variables and assumptions made in the financial and greenhouse gas models. Additional detail concerning how these figures were derived and the Consultant’s assumptions can be found both in the remainder of this staff report, as well as the in the Feasibility Study and associated appendices.

Table 2 below provides a summary comparison of some of the key Study findings for a WTE facility compared to waste export by rail (“WEBR”) in terms of the potential implementation timeline, estimated greenhouse gas (“GHG”) emissions, and estimated costs. In the table, total cost includes capital and operating costs offset by revenues, but does not include some departmental costs, which are assumed to be the same for both options. The average cost per ton refers to the average over the described period (e.g., 10-Year Term). Executive staff indicate that the cost per ton figure does not include the following departmental costs: capital improvements at the recycling and transfer stations, transfer operations, recycling transportation, recycling programs, post-closure maintenance at closed landfills, and support services.

**Table 2. Comparison of Potential Implementation Timeline, Estimated GHG Emissions, and Estimated Costs for WTE and WEBR**

|  |  |  |
| --- | --- | --- |
| **Category** | **Preliminary WTE Estimates**  | **Preliminary Rail Export Estimates** |
| **Potential Implementation Schedule** | 8-11 years | 3-6 years |
| **Net GHG Emissions** | -0.05 MTCO2E/ton | 0.08-0.33 MTCO2E/ton |
| **10-Year Term** | **Total Cost****(Low – High Bound)** | $1.07 - $1.30 billion | $1.03 - $1.36 billion |
| **Average Cost Per Ton**  | Low Bound: $106.65 High Bound: $97.35 | Low Bound: $109.94High Bound: $110.25 |
| **20-Year Term** | **Total Cost****(Low – High Bound)** | $2.37 - $2.92 billion | $2.42 - $3.38 billion |
| **Average Cost Per Ton**  | Low Bound: $118.42High Bound: $99.62 | Low Bound: $126.35High Bound: $127.19 |
| **50-Year Term** | **Total Cost****(Low – High Bound)** | $6.96 - $8.90 billion | $11.25 – 16.14 billion |
| **Average cost Per Ton** | Low Bound: $116.06High Bound: $112.18 | Low Bound: $215.15High Bound: $216.90 |

For comparison, the analysis contained in the 2019 Comprehensive Solid Waste Management Plan comparing the two long-term disposal options resulted in the opposite conclusion and determined that waste export was the more inexpensive option per ton. Executive staff provided a memo to Councilmembers by email on October 24th that described the different assumptions that led to this conclusion. The memo is included as Attachment 3 to this staff report for reference.

**Waste-to-Energy Facility.** The proviso requires that the consultant primarily consider a WTE facility that uses mass burn technology. Per the Feasibility Study, a mass burn WTE facility involves the combustion of waste in a controlled furnace system where heat is recovered via boilers to generate electricity, which can be used internally to operate the facility and/or can be sold to local utilities. Gas exiting the boiler is processed through an air pollution control system, metals remaining after combustion can be recovered and sold to recycling companies, and the ash resulting from the combustion process is landfilled or may be directed toward reuse opportunities discussed later in the staff report. The Feasibility Study notes that the WTE process will typically reduce the incoming volume of waste by 85 to 90 percent and 75 percent or more by weight.

*Facility Size and Site Evaluation.* The budget proviso directs for an evaluation of the size of a WTE facility that would be needed to accommodate the County’s waste over a twenty to fifty-year time horizon, beginning in 2025, with any assumptions clearly articulated, as well as a description of any siting needs (e.g., parcel size).

Based on the high and low bound forecasts described in the previous subsection, the Consultant developed two facility sizing options: (1) a facility with initial processing capacity of 3,000 tons per day that would be expanded to 4,000 tons per day in 2048 (reflecting the Low Bound forecast); and (2) a facility with initial processing capacity of 4,000 tons per day that would be expanded to 5,000 tons per day in 2040 (reflecting the High Bound forecast). Executive staff indicate that the initial facility size in each scenario is designed to meet the disposal needs through approximately the first 20-year period and assumes the facility can be expanded thereafter to meet the disposal needs of the remaining required study period. Note that the Study assumes that a WTE facility can operate up to ten percent above the design capacity based on historic experience and industry standard.

These initial facility size estimates are lower than the 5,000 tons per day facility that the 2019 Comprehensive Solid Waste Management Plan assumed would be needed to handle the County’s projected waste tonnage, and which was based on SWD and external consultant analysis.[[15]](#footnote-15) For context, Executive staff indicate that in 2018, the County’s solid waste system averaged 2,520 tons per day.[[16]](#footnote-16)

The Feasibility Study indicates that approximately 43 to 55 acres would be needed for a WTE facility with the processing capacities described above, but also notes that it is often possible to condense buildings and equipment into a smaller footprint with additional cost and that this acreage range represents a slightly larger site requirement than ultimately may be needed.

According to the Feasibility Study, the WTE facility is assumed to conform to the following requirements (which is thought by staff to refer to siting needs and features in a suitable site):

* Located in proximity to an intermodal facility for out-of-county disposal of process residuals (bypass waste and resulting ash);
* Land zoning is consistent with medium or heavy industry;
* Located away from “sensitive receptors” to minimize noise impact and to protect against other nuisances;
* Located near existing or planned major thoroughfares in place prior to construction for site access;
* Located near the center of waste generation;
* Availability and sufficient capacity of utilities to operate and meet performance needs of facility and within close proximity to avoid high construction and operating costs;
* Proximity to a connection point for a surplus energy distribution;
* Site access and perimeter road sufficient for appropriate truck loading standards and queueing without detriment to surrounding traffic flow;
* Sited within the borders of King County;
* Parcel shape roughly rectangular and suitable for required facility structures and equipment;
* Reasonable topography, with ground slopes are compatible with vehicle traffic, buildings, and structures; and
* Sufficient space for equipment laydown and storage during construction.

*Costs and Financing Options.* In response to the proviso requirement for a discussion of estimated costs, as well as potential financing options, the Consultant developed a financial model that includes the costs for development, construction, operation, and expansion of a WTE facility based on the high and low bound forecast estimates over the 50-year planning period. The Feasibility Study model assumes a design-build-operate contract is used, meaning that the contracted entity is responsible for design, construction, and operation of the County-owned facility. Additionally, capital costs and operation and maintenance costs are escalated at three percent per year according to the Consultant based on historic contractual escalation seen at other facilities and the Consumer Price Index (“CPI”).

Table 3 provides the estimated total cost and average cost per ton for both facility sizing options. In the table, total cost includes capital and operating costs offset by revenues, but does not include some departmental costs, which are assumed to be the same for both options. The average cost per ton refers to the average over the described period (e.g., 10-Year Term). Executive staff indicate that the following departmental costs are not included: capital improvements at the recycling and transfer stations, transfer operations, recycling transportation, recycling programs, post-closure maintenance at closed landfills, and support services.

**Table 3. Estimated Total Cost and Average Cost per Ton for WTE Facility by Sizing Option**

| **Facility Sizing Option** | **Cost Type** | **10-Year Term** | **20-Year Term** | **50-Year Term** |
| --- | --- | --- | --- | --- |
| **Initial Facility Size of 3,000 Tons per Day** | Total Cost (offset by revenues) | $1.07 billion | $2.37 billion | $6.96 billion |
| Average Cost Per Ton | $106.65 | $118.42 | $116.06 |
| **Initial Facility Size of 4,000 Tons per Day** | Total Cost (offset by revenues) | $1.30 billion | $2.92 billion | $8.90 billion |
| Average Cost Per Ton | $97.35 | $99.62 | $112.18 |

As noted previously, the Feasibility Study assumes that a WTE facility under either sizing option would need to be expanded at a future point to accommodate the region’s waste. Initial construction and expansion construction costs are summarized in the table below.

**Table 4. Estimated Initial and Expansion Construction Costs for a WTE Facility by Sizing Option**

| **Facility Sizing Option** | **Cost Type** | **Amount** |
| --- | --- | --- |
| **Initial Facility Size of 3,000 Tons per Day** | Initial Construction Costs | $1.19 billion |
| Expansion Construction Costs | $289.5 million |
| **Initial Facility Size of 4,000 Tons per Day** | Initial Construction Costs | $1.49 billion |
| Expansion Construction Costs | $231.0 million |

The Consultant based the estimated capital costs on the most recent facility constructed in the United States located in West Palm Beach, Florida, which is of a comparable size to the developed sizing scenarios and assumes long-term bond financing. The Feasibility Study notes that costs were adjusted for higher labor costs in this region, a higher sales tax rate for equipment purchase, and to account for differences in land acquisition costs. Additionally, according to the Feasibility Study, the financial model assumes costs related to carbon sequestration technology and advanced metal recovery equipment,[[17]](#footnote-17) the former of which is anticipated to be required under a new state law concerning electricity sales. The implications of the state law are described in further detail later in this staff report. The Study notes that the construction figures cited above also include: project contingency funds, consultant fees, and bond issuance costs that assume a 4.0 percent interest rate.

Table 5 summarizes the estimates for the total operation and maintenance (O&M) costs offset by revenues under the two facility sizing options over a 50-year time horizon.

**Table 5. Estimated O&M Cost for a WTE Facility by Sizing Option**

| **Facility Sizing Option** | **Cost Type** | **Total Revenue Over 20-Year Term** | **Total Revenue Over Remaining 30-Year Term** |
| --- | --- | --- | --- |
| **Initial Facility Size of 3,000 Tons per Day** | Total O&M Cost (offset by revenues) | $954.6 million | $3.44 billion |
| **Initial Facility Size of 4,000 Tons per Day** | Total O&M Cost (offset by revenues) | $1.06 billion | $4.85 billion |

The Consultant describes the following O&M costs, revenues, and assumptions included in the model:

* Operator Contract: The estimate for the operator contract was based on the actual operating contract for the West Palm Beach facility, adjusted for 2019 dollars and for the additional costs for operation and maintenance of the equipment related to carbon sequestration and advanced metal recovery.
* Consumables: This category includes air pollution control reagents, which were estimated based on usage of the West Palm Beach facility, and the utilities needed to operate the facility, which were adjusted to account for local prices.
* Ash Disposal: The financial model includes the costs of exporting the resulting ash that has no reuse value by rail to an out-of-county landfill permitted specifically for ash disposal. The Consultant notes that an additional scenario of ash disposal at Cedar Hills could also be considered and would provide reduced disposal costs.
* Hauling Costs: Included in the model are the estimated costs to haul waste from existing transfer stations to a WTE facility and the Feasibility Study notes that it assumes a similar distance from the transfer stations to the current landfill.
* Revenues: The O&M figures cited above are offset by revenues from electricity sales, sale of recovered metals, as well as assume revenue from acceptance of out-of-county waste. Executive staff indicate that the available facility capacity for out-of-county waste was determined by subtracting the projected King County waste from the design capacity of the facility in a given year, but that the interest on the part of non-County jurisdictions was not specifically evaluated as part of this Study.
* “Throughput Guarantee”: The Consultant assumes an “annual throughput guarantee” to the facility operator, which provides that a certain amount of waste will be provided to the facility.

As noted previously, the Consultant indicates that the model-generated estimates are influenced by a variety of variables and assumptions. The top five risks or assumptions impacting the financial model identified by the Consultant are summarized in Table 6.

**Table 6. Top Five Risks or Assumptions Impacting the WTE Facility Financial Model as Identified in the Feasibility Study**

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| **Risks or Assumptions Impacting Financial Model**  |
| * **Facility capacity and tonnage projections.** If the larger facility capacity option is selected and the actual waste processed is significantly lower (e.g., County not able to secure out-of-county waste to process), the cost per ton of waste may increase. The Feasibility Study notes that the cost per ton would be nine percent higher if excess waste capacity is not successfully sold, however, indicates that this is still less than the waste export by rail costs over the 50-year term.
* **Electricity sales revenues.** Given that electricity sales make up two-thirds of estimated revenues, deviations higher or lower may impact the cost per ton.
* **Carbon sequestration.** The 2019 Clean Energy Transformation Act passed by the legislature (and described later in the staff report) imposes new requirements for electricity generation. According to the Study, to meet the carbon neutral requirements, a new WTE facility may be able to offset emissions through carbon sequestration, however uncertainties remain related to technologies at the scale that would be needed by the County and in how the state law will be implemented over time.
* **Escalation Rate.** The current CPI estimate of three percent was used for all costs except electricity revenue, but actual CPI may vary over time.
* **Materials Recovery.** Quantity of metals recovered and associated revenues, as well as the reduction of ash for disposal through reuse opportunities may impact costs and revenues, relative to the model assumptions.
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While the financial model assumes long-term bond financing, the Consultant notes that third-party financing as part of a contract to design, build, and operate a facility may be possible. The Feasibility Study concludes that this option typically costs more than long-term bond financing since the contracting entity is taking on more risk for the project and the County would not have the advantages of facility ownership.

*Assessment of Regional Electricity Markets.* Included in the budget proviso is a requirement that the study provide an assessment of the regional electricity markets and regulatory structure. The Feasibility Study points out two significant features of the regional electricity markets and associated regulatory environment that could affect the potential revenue resulting from electricity generated by a WTE facility – the comparatively low electricity prices in the area and the Clean Energy Transformation Act[[18]](#footnote-18) passed by the Legislature earlier this year.

The Consultant notes that hydroelectric power is the predominant source of electricity generation in this state and provides lower-cost electricity to the region relative to power prices in other states. Furthermore, due to the state’s hydroelectric power generating capacity, Washington produces excess electricity relative to demand and exports electricity to 14 other states and Canada. For these reasons, the Feasibility Study concludes that electricity pricing will likely remain lower and more stable over time relative to other parts of the country.

Additionally, the Consultant indicates that the passage of the Clean Energy Transformation Act (“CETA”) by the State Legislature and resulting implementation may also influence electricity revenues from a future WTE facility. Under CETA, the Feasibility Study explains that all retail electricity sales must be carbon neutral by 2030. By 2045, all utilities in the state must obtain electricity from sources classified as renewable or non-emitting. Failure to comply with the requirements under the law will result in monetary penalties (e.g., $/non-compliant megawatt-hour). According to the Consultant, new WTE facilities would likely require carbon sequestration or carbon capture technology and/or require the purchase of renewable energy credits to offset emissions in order to meet the carbon neutral goal. However, the Consultant suggests that it will be difficult for a WTE facility to meet the 2045 requirement for renewable or “non-emitting” electricity generation even with carbon sequestration or capture, absent a modification of the rule.

*Potential Revenue Sources.* The budget proviso requires an analysis of potential revenues from the sale of electricity and any WTE facility byproducts including, but not limited to, sale of recovered metals, and possible uses of the ash resulting from combustion. The Feasibility Study describes the revenue potential from four sources: (1) electricity sales; (2) sale of recovered metals, (3) acceptance of out-of-county waste for a fee per ton, and (4) the reuse of ash. Table 7 summarizes the revenue included in the financial model from these sources. The Consultant notes that the revenue estimates use current estimates (e.g., electricity prices from 2018) as “Facility Operation Year 1” prices in the model and therefore are conservative estimates.

**Table 7. Estimated Revenues for a WTE Facility by Sizing Option**

| **Facility Sizing Option** | **Revenue Source** | **Total Revenue Over 20-Year Term** | **Total Revenue Over Remaining 30-Year Term** |
| --- | --- | --- | --- |
| **Initial Facility Size of 3,000 Tons per Day** | Electricity Sales | $485.6 million | $1.42 billion |
| Sale of Recovered Metals | $212.4 million | $905.6 million |
| Out-of-county Waste | $34.3 million | $650.8 million |
| Use of Ash | $0 | $0 |
| **TOTAL** | **$732.3 million** | **$2.97 billion** |
| **Initial Facility Size of 4,000 Tons per Day** | Electricity Sales | $718.0 million | $1.77 billion |
| Sale of Recovered Metals | $316.6 million | $1.13 billion |
| Out-of-county Waste | $140.9 million | $186.0 million |
| Use of Ash | $0 | $0 |
| **TOTAL** | **$1.18 billion** | **$3.09 billion** |

As noted previously, the financial model developed by the Consultant assumed an advanced materials processing component to the facility which would yield cleaner metals that command a higher price than comparable facilities that do not have such equipment. An additional assumption in the financial model relates to the acceptance of out-of-county waste for remaining facility capacity above the anticipated tonnage forecast for a per ton fee.[[19]](#footnote-19) Out-of-county waste in this context is waste not provided by the 37 partner cities in the County’s solid waste system. The Consultant notes that accepting out-of-county waste may also result in improved facility operation, as WTE facilities operate more efficiently when they process waste at the designed capacity.

The Feasibility Study provides that a portion of the ash resulting from combustion may be directed towards reuse opportunities such as in cement or asphalt, but that revenues depend on the market for ash and area demand. The financial model assumes no revenue for ash directed towards reuse, but that the recipient would pay hauling costs. Note that the portion of ash not reused would have to be landfilled.

*Environmental Impacts.* The budget proviso requires a discussion of any environmental impacts of a WTE facility. The Study focuses primarily on greenhouse gas (“GHG”) emissions and non-greenhouse gas emissions.

The Consultant estimated GHG emissions using two methods (1) the default U.S. Environmental Protection Agency (“EPA”) WARM[[20]](#footnote-20) tool; and (2) the WARM tool with line item adjustments based on the Consultant’s professional judgment (“adjusted WARM tool”). Both models consider gross GHG emissions (e.g., emissions of carbon dioxide and nitrogen dioxide from the combustion of waste) offset by avoided emissions (e.g., avoided carbon dioxide emissions from electricity generation). According to the Study, the WARM tool and adjusted WARM tool do not quantify annual emissions from a WTE facility because they do not explicitly model the timing of GHG emissions, thus the GHG emissions estimated in the Study should only be used to compare alternative waste management strategies.

For a WTE facility, the Study notes that both modeling tools yielded the same net estimate of -0.05 metric tons of carbon dioxide equivalent per ton of waste (MTCO2e/ton). The negative result indicates that, in the Consultant’s modeling, the estimated offsets, or emissions avoided, for things like ash and metals recycling at a WTE facility are greater than the generated emissions. For comparison, the GHG emissions estimate in the 2019 Comprehensive Solid Waste Management Plan, which also used the WARM tool but included different assumptions, yielded the opposite conclusion and estimated that GHG emissions for a WTE facility would be a net positive, meaning emissions are higher than offsets.[[21]](#footnote-21)

The Feasibility Study also notes that a WTE facility would have environmental impacts associated with non-GHG air emissions (e.g., carbon monoxide, lead) that would be subject to emission standards and, in some instances, Best Available Control Technology requirements. The Study includes a table of air permit limits and emissions compliance test results for the West Palm Beach WTE facility for illustrative purposes on page 3-57 of the Study and concludes that, “Due to the small size of the facility, the air modeling required to meet Title V and PSD [air quality permit] requirements, and the sophisticated air pollution control systems included, the emissions will not have a measurable effect on local air quality” (page 3-58).

*State and Federal Regulatory Environment.* The budget proviso includes the requirement for a discussion of the state and federal regulatory environment. The Feasibility Study includes a preliminary assessment of the applicable regulatory requirements for construction and operation and identifies licenses, permits, or other approvals that may be needed, however notes that it does not represent an exhaustive list. Some examples include the following, with the permitting agency noted in parentheses:

* Environmental Impact Statement (SWD);
* Traffic Control Plan (Roads Services Division);
* Building and Construction Permit (Permitting Division or City);
* Solid Waste Permit (Washington State Department of Ecology via Public Health Seattle & King County);
* Industrial Wastewater Discharge Permit (Wastewater Treatment Division); and
* Endangered Species Act Compliance (U.S. Fish and Wildlife Services and National Oceanic and Atmospheric Administration - Fisheries)

According to the Consultant, one significant task would be securing a Prevention of Significant Deterioration construction permit from the Puget Sound Clear Air Agency (PSCAA), which has jurisdiction for regulating sources of air pollution in the County. The PSD permitting process includes public participation and review by a few different entities (e.g., EPA). Permit application preparation would be expected to take 18 to 24 months, with an estimated 12 to 24 months for PSCAA review and final permit issuance.

The Feasibility Study also outlines the major applicable regulations for a WTE facility, including the following examples:

* Federal: Clean Air Act, Resource Conservation and Recovery Act, Clean Water Act;
* State: State Environmental Policy Act, Washington Clean Air Act, Special Incinerator Ash Management Standards, Solid Waste Management Act, etc.

*Potential Implementation Timeline.* In response to the budget proviso requirement for a reasonable implementation timeline for a WTE facility, the Consultant developed two potential schedules, an accelerated and extended version. Both schedules include extending the interlocal agreements with the partner cities and updating the Comprehensive Solid Waste Management Plan, siting and permitting, procurement, and design and construction. The fast-track schedule assumes no significant regulatory hurdles or public opposition to the project and availability of long-lead time materials. The extended schedule allows for up to two years of delay for permitting or siting issues. Both schedules assume design-build-operate procurement, which the Feasibility Study notes is typical in the industry, but that there are a variety of alternative delivery methods that could be considered. Additionally, both schedules assume that procurement would occur concurrently with siting, planning, and permitting. Table 8 summarizes the two potential implementation schedules.

**Table 8. Potential WTE Facility Implementation Schedules – Accelerated and Extended**

| **Phase** | **Accelerated Schedule** | **Extended Schedule** |
| --- | --- | --- |
| **Extend and negotiate ILAs and update Comprehensive Solid Waste Management Plan** | 1-2 years | 2 years |
| **Siting, Planning, Permitting** | 3 years | 5 years |
| **Procurement**  | 1-2 years\**Concurrent with Siting, Planning, Permitting* | 2 years *\*Concurrent with Siting, Planning, Permitting* |
| **Design and Construction** | 4 years | 4 years |
| **TOTAL** | 8-9 years | 11 years |
| *Commercial Operations Date if Start 1/1/2020* | *Jan 2028 – Jan 2029* | *Jan 2031* |

The budget proviso also required the Consultant to provide an analysis of the potential impact on the lifespan and capacity of the Cedar Hills landfill if a WTE facility was developed according to the potential timeline. The Feasibility Study provides that because SWD is in the process of evaluating options to develop the Cedar Hills landfill and the ultimate capacity is at this point unknown since an option has not been selected, the Consultant could not determine the effect of WTE implementation on the remaining life of the Cedar Hills landfill.

Additionally, the Feasibility Study considered the possibility of mining the existing landfill and using the materials as fuel should the County develop a WTE facility. The Consultant notes that this has been done in few facilities in the U.S. and Europe and only for waste that had been landfilled within the past year, as older waste tends to have a low heating potential and this “low-quality” waste can result in operation and maintenance issues. Landfill mining is not included in the financial model developed in the study and described previously in this staff report.

**Waste Export by Rail.** The budget proviso requires a discussion of the potential for exporting the County’s waste by rail that includes an analysis of the future rail capacity forecast, the estimated capital and operating costs, as well as the environmental impacts. The consultant findings in these areas were informed by interviews with railroad companies and out-of-county landfill operators and they are summarized in the subsections below.

*Costs and Financing Options.* Table 9 provides the estimated total cost and average cost per ton for both the high and low bound waste forecasts. In the table, total cost includes capital and operating costs, but does not include some departmental costs, which are assumed to be the same for both options. The average cost per ton refers to the average over the described period (e.g., 10-Year Term). Executive staff indicate that the following departmental costs are not included: capital improvements at the recycling and transfer stations, transfer operations, recycling transportation, recycling programs, post-closure maintenance at closed landfills, and support services.

**Table 9. Estimated Total Cost and Average Cost per Ton for Waste Export by Rail**

| **Facility Sizing Option** | **Cost Type** | **10-Year Term** | **20-Year Term** | **50-Year Term** |
| --- | --- | --- | --- | --- |
| **Waste Export by Rail – Low Bound Forecast** | Total Cost | $1.03 billion | $2.42 billion | $11.25 billion |
| Average Cost Per Ton | $109.94 | $126.35 | $215.15 |
| **Waste Export by Rail – High Bound Forecast** | Total Cost | $1.36 billion | $3.38 billion | $16.14 billion |
| Average Cost Per Ton | $110.25 | $127.19 | $216.90 |

The Feasibility Study notes that a waste export program would have four major cost components: (1) construction of an intermodal facility (IMF) where waste is trucked to the IMF and then is loaded onto rail cars; (2) transport of waste from the transfer stations to the IMF; (3) transport of waste by rail to the landfill; and (4) the disposal fee at the landfill.

Executive staff indicate that the financial model assumes that current IMFs would not offer sufficient capacity to handle the County’s volume of waste, and therefore would be financed and constructed by the rail companies. Under the model, the rail companies would charge the County for these capital expenses in the per ton fee charged for waste export by rail. The per ton fee related to IMF construction is estimated at approximately $3.35 per ton over a ten-year period, based on an estimated construction cost of $5 million, estimated land acquisition cost of $18 million for a 20-acre site, and a four percent interest rate. The ten-year time period was selected as the interviews with the railroads indicated that it would likely be the maximum contract period that would be acceptable to them.

As noted previously, the Consultant indicates that the model-generated estimates are influenced by a variety of variables and assumptions. The top five risks or assumptions impacting the financial model identified by the Consultant are summarized in Table 10.

**Table 10. Top Five Risks or Assumptions Impacting the Waste Export by Rail Financial Model as Identified in the Feasibility Study**

|  |
| --- |
| **Risks or Assumptions Impacting Financial Model**  |
| * **Short-term contracts.** The contract terms (5-10 years) identified in interviews with railroad operators may result in uncertainty related to hauling/disposal costs over the long-term.
* **Rail capacity.** Capacity on some rail stretches is limited presently and may be in the future, which could impact cost as demand increases.
* **Congestion or service interruption.** Snowstorms or earthquakes which disrupt the rail system may result in lower reliability and additional costs for expansion or improvements or the need to haul waste by road.
* **Compaction.** Variances in compaction of waste per container, relative to the assumptions in the model, may impact hauling and disposal costs.
* **Captive shipper landfills.** Captive shipper landfills, meaning landfills that typically partner with a specific rail hauler, may make it more difficult to switch landfills and rail hauler at the end of a contract period, potentially resulting in less competition.
 |

*Environmental Impacts.* The Study focuses primarily on the environmental impacts of rail export related to greenhouse gas (“GHG”) emissions and non-greenhouse gas emissions.

The Consultant modeled GHG emissions for waste export by rail using the same two methods that were described in a previous subsection – the WARM tool and the adjusted WARM tool. As noted earlier, the two modeling tools do not quantify annual emissions from a WTE facility because they do not explicitly model the timing of GHG emissions, thus the GHG emissions estimated in the Study should only be used to compare alternative waste management strategies.

For waste export by rail, the Study notes that the two modeling tools yielded a low of 0.08 metric tons of carbon dioxide equivalency per ton of waste (MTCO2e/ton) and a high of 0.33 MTCO2e/ton. The positive result indicates that, in the Consultant’s modeling, the generated emissions for waste export by rail are greater than the offsets for avoided emissions. The Feasibility Study notes that an important consideration in the GHG analysis for waste export is the issue of offset credit for carbon sequestration in a landfill. The Study goes on to point out that biogenic[[22]](#footnote-22) carbon in wastes such as wood and yard waste will not significantly degrade with the lack of oxygen in a landfill compared to the degradation that would occur if theses materials were not landfilled. The WARM model subtracts the amount of carbon dioxide that would have been generated if these wastes were allowed to naturally degrade; in this particular instance the credit is calculated at -0.21 MTCO2/ton. The Consultant notes that Intergovernmental Panel on Climate Change guidance is that the carbon sequestration credit be identified so the user may decide whether the credit shall be applied or not.

For comparison, the GHG emissions estimate for waste export by rail in the 2019 Comprehensive Solid Waste Management Plan, which also used the WARM tool but included different assumptions, yielded the opposite conclusion that estimated GHG emissions for waste export would be a net negative, meaning emissions are lower than offsets.[[23]](#footnote-23)

The Feasibility Study also notes that waste export by rail would have environmental impacts associated with non-GHG air emissions, citing nitrogen dioxide (NO2) and particulate matter released from the use of locomotives. According to the Consultant, one of the railroads interviewed indicated they were testing alternative engine technology and particulate devices but suggested that use of these could not be guaranteed to the County in the event of waste export by rail.

*Future Rail Capacity.* The Consultant reviewed state rail plans and capacity studies and concluded that there appears to be sufficient capacity now to accommodate the region’s waste and that there will continue to be some rail capacity in the future but availability of that capacity may depend on an entity’s willingness to pay. Specifically, the Feasibility Study states:

*As of summer 2019, there appears to be enough rail capacity to ship an additional 1.2 million tpy [tons per year] to either of the two private landfills that currently serve city and county governments in Washington and Oregon. We can reasonably conclude that absent a major catastrophe such as a landslide or earthquake that destroys a significant portion of the Seattle-Portland track, there will continue to be some rail capacity. If in 2035 there is not enough capacity to carry an additional 1.2 million tpy, then the question becomes who gets to use the available capacity. The answer depends on how much each entity is willing to pay to move its own products. It seems likely that each railroad will select and prioritize what commodities it will haul based on its own economic self-interest: that is, which combination of total tons and rate / ton provides the highest economic benefit for the railroad* *(page 4-23).*

The Consultant indicates that the railroads suggested in their interviews that the County consider phasing-in waste export over time, which would allow both the railroads and landfill companies to phase-in their investments (e.g., shipping containers, rail cars). This option, according to the Feasibility Study, would potentially slightly extend the capacity of the Cedar Hills landfill and initially allow use of existing IMFs. However, the Consultant notes that the primary drawback of phasing-in waste export would be that the costs to continue operating the Cedar Hills landfill and the cost of partial waste export “would likely exceed the value of nominally increasing the life of Cedar Hills” (page 4-23). Phase-in of waste export was not considered in the financial model that has been described in this staff report.

**Summary of Consultant Recommendations.** Based on its analysis, the Consultant recommends that the County consider pursuing additional preliminary evaluation, permitting, and siting considerations in order to move forward with a WTE facility over waste export by rail. Specifically, the Feasibility Study states that “Due to the long-term cost saving, improved recycling rates, and potential for net negative GHG emissions with the inclusion of carbon capture technology, WTE disposal will provide a significant financial and environmental benefit to the County over WEBR [waste export by rail]. Additionally, even with the potential hurdles during the permitting and siting process, WTE represents a much more stable long-term financial profile over WEBR to protect the County’s solid waste rate structure against future inflation and escalation” (page 6-3). The Consultant also recommends that the County explore the potential of carrying out siting and planning studies concurrently with the update to the Comprehensive Solid Waste Management Plan, and also evaluate opportunities at Cedar Hills for future ash disposal.

**Council Action and Next Steps.** With the transmittal of this feasibility study required by the proviso, the funds encumbered by the proviso can be released, if Proposed Motion 2019-0429 is approved by the Council. However, approval of the proposed motion would not provide Council approval for the next disposal method. The main legislative vehicle for solid waste system planning decisions, including long-term disposal, is through updates to the Comprehensive Solid Waste Management Plan.

The 2019 Comprehensive Solid Waste Management Plan included a requirement that the Office of Performance, Strategy and Budget engage with SWD and regional partners to develop a plan for long-term disposal. Under this requirement, a progress report is due to the Council by December 31, 2021 that outlines how the plan will be developed and that includes the timing for the transmittal of the plan, as well as the implementing legislation.

**INVITED**

1. Dwight Dively, Director, Performance, Strategy and Budget
2. Pat McLaughlin, Director, Solid Waste Division

**ATTACHMENTS**

1. Proposed Motion 2019-0429 (and its attachments)
2. Transmittal Letter
3. Waste-to-Energy Studies Cost Comparison Memo - Performance, Strategy and Budget
1. Ordinance 18893 [↑](#footnote-ref-1)
2. Ordinance 18835, Sec. 19 (Proviso P4; Expenditure Restriction ER2); Sec. 102 (Proviso P3; Expenditure Restriction ER3) [↑](#footnote-ref-2)
3. Total costs include capital and operating costs offset by revenues. The Consultant indicates that some departmental costs are not included in the cited figures as they are expected to be the same under both options. [↑](#footnote-ref-3)
4. Ordinance 18784 [↑](#footnote-ref-4)
5. Figure includes appropriations in the Solid Waste Operating Fund and Solid Waste Post-Closure Maintenance Fund and includes appropriations in supplemental budget ordinances [↑](#footnote-ref-5)
6. Figure includes appropriations in the Solid Waste Capital Equipment Replacement, Solid Waste Construction, and Landfill Reserve Funds and includes appropriations in supplemental budget ordinances [↑](#footnote-ref-6)
7. Motion 15174 [↑](#footnote-ref-7)
8. Ordinance 18893 [↑](#footnote-ref-8)
9. Ordinance 18835 [↑](#footnote-ref-9)
10. In Ordinance 18835, duplicate provisos and expenditure restrictions are found in Sections 19 (Office of Performance, Strategy and Budget) and 102 (Solid Waste). [↑](#footnote-ref-10)
11. The Feasibility Study explains that the Consultant’s High Bound forecast is based on the SWD baseline model through 2040, which considers inputs such as per capita employment and retail sales data. For years 2040 through 2075, the forecast switches to an average annual growth rate based on the Puget Sound Regional Council Land Use Vision population forecast. [↑](#footnote-ref-11)
12. For the Consultant’s Low Bound forecast, the Feasibility Study notes that an average annual growth rate is used for the entire study period that is based on the Puget Sound Regional Council Land Use Vision population forecast. [↑](#footnote-ref-12)
13. Motion 15174 [↑](#footnote-ref-13)
14. Total costs include capital and operating costs offset by revenues. The Consultant indicates that some departmental costs are not included in the cited figures as they are expected to be the same under both options. [↑](#footnote-ref-14)
15. SWD retained the services of Normandeau Associates to conduct a study on recommendations for a Waste-to-Energy facility given King County’s waste projections and profile, as well as evaluate out-of-county landfill options and rail capacity. The resulting report was internally used at SWD and was not a Council request, therefore was not transmitted to the Council. [↑](#footnote-ref-15)
16. Figure provided during deliberations on the 2019 Comprehensive Solid Waste Management Plan [↑](#footnote-ref-16)
17. The Feasibility Study notes that advances in metals recovery equipment makes it possible for the separation of more precious metals from unwanted residue which commands a more premium price when recovered metals are sold. [↑](#footnote-ref-17)
18. E2SSB 5116 [↑](#footnote-ref-18)
19. In the financial model, the Feasibility Study notes that out-of-county waste is priced at $35 per ton to be competitive with potentially interested jurisdictions and provides Snohomish County’s current disposal cost of $50 per ton as an example. [↑](#footnote-ref-19)
20. Waste Reduction Model (WARM) [↑](#footnote-ref-20)
21. Note that the metric used in the Feasibility Study (MTCO2e/ton) and the metric used in the 2019 Comprehensive Solid Waste Management Plan (MTCO2e) are not the same and so cannot be directly compared. [↑](#footnote-ref-21)
22. Biogenic is not defined in the Feasibility Study but is thought to mean “produced by living organisms” based on the dictionary definition. [↑](#footnote-ref-22)
23. Note that the metric used in the Feasibility Study (MTCO2e/ton) and the metric used in the 2019 Comprehensive Solid Waste Management Plan (MTCO2e) are not the same and so cannot be directly compared. [↑](#footnote-ref-23)