July 21, 2023

Mr. Scott Watson – Director of Maintenance
Mr. Eric Hann – Operations Manager
Mount Desert Island Regional School System
AOS #91
P.O. Box 60
Mount Desert, Maine 04660

Re: Wastewater Treatment System Evaluation and Alternatives Analysis

Dear Mr. Watson and Mr. Hann:

Enclosed you will find our Wastewater Treatment System Evaluation and Alternatives Analysis which has been prepared for the Mount Desert Island Regional School System (MDIRSS) in accordance with our Contract for Engineering Services, dated May 26, 2023.

At your request, the report evaluates the feasibility, benefits, and drawbacks of three separate and distinct alternatives for wastewater treatment and disposal. The alternatives considered include maintaining the existing system of lagoon treatment and spray irrigation for disposal, a new subsurface wastewater treatment and disposal system, and a new collection and conveyance system to the Somesville Publicly Operated Treatment Works (POTW).

Based on our analysis, we believe the most feasible and cost-effective solution is to continue to operate the current system of lagoon treatment and spray irrigation disposal. With this in mind, we have identified deficiencies and areas that we would recommend be improved to further enhance the lifespan of the system.

If you have any questions or comments concerning this report, please contact either of the undersigned at (207) 989-4824.

Sincerely,
Haley Ward, Inc.

Travis Noyes, P.E.
COO

Justine Drake, P.E.
Project Manager

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INTRODUCTION

The Mount Desert Island (MDI) High School is located on Eagle Lake Road in Bar Harbor, Maine. The property, identified in the Town of Bar Harbor's tax database as Parcel ID 244-011-000, generally consists of the high school and associated facilities, a well and drinking water treatment system, a wastewater conveyance and treatment system, and a spray irrigation field, all on approximately 103 acres of land.

The MDI High School is part of the MDI Regional School System (MDIRSS), and the MDIRSS treats on-site sanitary wastewater from the high school through a conventional septic tank and facultative lagoon treatment system. The wastewater treatment system has been in operation for approximately 54 years. Due to aging infrastructure and alleged unpermitted discharge incidents, the school is considering abandoning the existing lagoon system and is looking at alternative options for the treatment and disposal of their sanitary wastewater.

This report takes a comprehensive approach to evaluating alternatives for sanitary wastewater treatment that will allow the MDIRSS to maintain compliance with regulatory requirements into the future. Haley Ward has analyzed three alternatives:

1) Rehabilitating the existing wastewater treatment and disposal system,
2) Constructing a new subsurface wastewater treatment and disposal system, and
3) Constructing a new wastewater collection and conveyance system to discharge sanitary wastewater to the nearby Somesville Publicly Operated Treatment Works (POTW).

The three alternatives have been evaluated for useful life, ability to meet future demands, and estimated costs for design, construction, operation, and maintenance.

EXISTING CONDITIONS

Sanitary wastewater at MDI High School is currently treated using one 37,000-gallon septic tank followed by two facultative lagoons operated in series. Treated sanitary wastewater from the lagoons is then applied seasonally to the adjacent 3.85-acre spray irrigation field. Wastewater treatment and disposal is conducted in accordance with Maine Waste Discharge License (WDL) #W-003319-6B-F-R. Between April 15th and November 15th of each year, MDIRSS is permitted to spray irrigate at varying rates that range from 27,150 gallons/acre/week to 95,025 gallons/acre/week.

Wastewater Demands

Wastewater at MDI High School is typically generated through restrooms, kitchen facilities, water fountains, and janitorial services. The existing treatment system demand is approximately 9,300 gallons per day (gpd) of sanitary wastewater. This demand is generated by a population of approximately 611 teachers, students, and staff. The school year is approximately 200 days long, so this amounts to a cumulative sanitary wastewater demand of approximately 1.9 million gallons per year (MGY). The 9,300 gpd of sanitary wastewater is first treated in the existing septic tank before it enters the facultative lagoons.

In addition to the sanitary wastewater generated by the school, other sources of wastewater demand on the lagoons, per the WDL, include precipitation, surface water runoff, and groundwater inflow. The permitted demand from these sources on the lagoons is 10,400 gpd or 3.8 MGY.

Existing Treatment System

The first step in the existing treatment system is solids settling and scum separation using a 37,000-gallon septic tank. At 37,000 gallons of capacity and a flow rate of 9,300 gpd, the detention time in the tank is approximately four days. Typical detention times utilized when sizing septic tanks range from 24 to 48 hours and for two to three times the average daily flow. Based on the size and the average daily flow, the existing septic tank provides sufficient time for solids and scum separation. The septic tank is approximately 54 years old, and the condition is unknown.

Following the septic tank, wastewater flows by gravity to facultative lagoons. When the wastewater treatment system was originally constructed in 1968, it consisted of two lagoons that operated in series. These two lagoons have a combined area of approximately 2.6 acres. In 1988, a third lagoon was added following the second, increasing the combined area to approximately 3.2 acres. See **Appendix A** for the existing site plan with the lagoons labeled as Lagoon 1, Lagoon 2, and Lagoon 3. With a maximum operating capacity, assuming two feet of freeboard, the three lagoons have a total storage volume of approximately 5.1 million gallons (MG). Based on the combined demand from sanitary wastewater and precipitation/groundwater inflow of 5.7 MGY, the average detention time in the three lagoons is approximately 327 days. Although the lagoons have clay bottoms, they do not contain a manufactured liner, such as HDPE.

In 2023, Lagoon 3 was removed from operation. Although the exact volume of the remaining two lagoons is unknown, it was estimated that removing Lagoon 3 from service reduced the maximum operating capacity to approximately 4.2 MG based on a projection of volume determined in the WDL. With this reduction, it is estimated that the average detention time is approximately 268 days.

Following the lagoons, the final step in wastewater treatment is slow-rate land irrigation (spray irrigation). Spray irrigation is limited to occur between the months of April and November. All water is pumped from Lagoon 2 to the spray irrigation field via a force main during these months. The spray irrigation system consists of nine lateral distribution lines that each contain between three and nine distribution nozzles. The laterals and distribution nozzles create a circular pattern for water application to the land with a diameter of approximately 90 feet. During the months of December to March, the spray irrigation system is not used, and wastewater remains in the lagoons.

Regulatory Compliance

The MDIRSS has received two known notices of violation related to their wastewater treatment system by the Maine Department of Environmental Protection (MDEP) within the last 10 years. In June 2003 and in July 2023, the MDIRSS received Notices of Violations from the MDEP for unpermitted discharges of wastewater from the lagoons. MDEP alleges that the MDIRSS's wastewater treatment system is causing the unpermitted discharge of wastewater to adjacent wetlands either by seeping through the lagoon berms or via infiltration into the ground beneath the lagoons. This conjecture was made after facilities staff responsible for monitoring the lagoons' surface water elevations noted unusual decreases in wastewater levels.

In the past, MDI High School has also had compliance issues with drinking water regulations for per- and polyfluoroalkyl substances (PFAS), also known as "forever chemicals." In 2021, the school installed a PFAS treatment system to remove the chemicals from drinking water. Representatives from MDIRSS have inquired about integrating PFAS treatment technology into the wastewater treatment process. This inquiry was raised out of concern that PFAS found in the wastewater will contaminate groundwater of abutting property owners after leaving the site through runoff and infiltration following the spray irrigation process. PFAS levels found in effluent samples from the lagoons on site reached 40 parts per trillion (ppt).

PFAS is currently known to be removed from water by means of three major treatment technologies: granular activated carbon, ion exchange resins, and high-pressure membrane systems. These treatment technologies are most commonly used to treat drinking water and do not generally respond well to high levels of certain organics and inorganics found in wastewater effluent. If such PFAS treatment technologies were to be integrated into the wastewater process, it would likely need to be accompanied by some mechanism to remove solids prior to the PFAS removal process. Furthermore, there are currently no requirements or standards for PFAS treatment in wastewater effluent.

For these reasons, and because the alternatives considered in this evaluation vary greatly in process, we did not consider the integration of PFAS removal technology. Because the drinking water at MDI High School is already treated for PFAS, we recommend reducing PFAS by limiting the quantity of product sources of PFAS used on site. PFAS is commonly found in the following products that we expect are used in schools:

- Food Packaging
- Artificial Turf
- Protective Floor Coatings
- Pesticides
- Cleaning Products
- Non-stick Cookware
- Hand Soap
- Stain Resistant Fabrics/Furniture

These are just a few examples of products that contain PFAS. Many of these product types have alternatives with, in the very least, lower concentrations of PFAS.

The following alternatives analysis was performed to evaluate solutions proposed to address the concerns cited in the most recent MDEP Notice of Violation.

ALTERNATIVES ANALYSIS

Three alternatives were evaluated for MDI High School to determine the most feasible approach to wastewater treatment in relation to continued regulatory compliance, future growth, and operation and maintenance. These alternatives include: 1) Update the existing wastewater treatment and disposal system, 2) Construct a new subsurface wastewater treatment and disposal system, and 3) Construct a new wastewater collection and conveyance system to send sanitary wastewater to the nearby Somesville Publicly Operated Treatment Works (POTW).

Alternative 1 | Rehabilitate Existing Wastewater Treatment and Disposal System

For improved reliability and maintenance of the existing wastewater treatment and disposal system, it is not feasible to follow a "do nothing" approach. As such, this alternative is intended to analyze what improvements and updates need to be made to the existing treatment and disposal system for continued compliance with the waste discharge license and for potential growth with future demands.

The High School currently has approximately 611 combined students, faculty, and staff that use the facilities during the school year. The maximum capacity, which was used to design the existing treatment system, is 650 students and 100 faculty and staff (750 total individuals). Between April 2013 and April 2023, enrollment at the MDI High School has decreased from 522 students to 495 students with the maximum number of students during the 10-year period being 557 students. The census population data for many of the communities that send students to the MDI High School also shows a slightly decreasing trend in the general population. Although school enrollment and general populations have shown a declining trend within the last 10 years, the general and student populations have remained relatively constant. If MDI High School does not create any large expansions within the next 10-year period, it appears that populations will likely stay similar to what they have been for the previous 10-year period. Given this information, the existing sanitary wastewater treatment and disposal system is adequately sized for the population that it serves.

The third lagoon, Lagoon 3, was drained and decommissioned as MDI High School began the process of pursuing a replacement subsurface wastewater treatment and disposal system to the existing treatment system. With two lagoons still in operation, this leaves the storage capacity at approximately 4.2 MG. Per MDI High School's waste discharge license, the estimated demand is approximately 5.7 MGY, so the detention time in the two remaining lagoons is approximately 269 days. This provides sufficient time to treat the wastewater before it is pumped to the spray irrigation field.

In April 2023, it was identified by MDI High School that there was a loss of approximately ½-inch per day of water in Lagoon 2 based on liquid measurement levels when no spray irrigation was occurring. At the time of writing of this report, the cause of this water loss has not been identified. As such, the first recommendation for updating the existing wastewater treatment system is to inspect the treatment system and identify locations where water may be unpermitted discharged from the lagoons.

Sanitary Wastewater System Inspection
Because the condition of the existing septic tank is unknown, it is recommended that MDIRSS inspect the tank. Photos documenting the condition of the septic tank will be especially important to identify any cracks or clogs caused by age. No known leaks have been identified to date.

Lining the Lagoons
Many older lagoons, like the lagoons at MDI High School, were originally constructed with only clay to line the basins and to prevent direct infiltration into the groundwater. Although the existing lagoons are operable, as part of the upgrades to the existing wastewater treatment system, it is recommended that the existing lagoons be lined with a 60-mil smooth geomembrane to improve future operation and to reduce the risk of unpermitted discharges. This will also help to provide additional protection against infiltration from groundwater.

It is anticipated that lining the lagoons will consist of draining the existing lagoons, removing existing sludge (either by dewatering or by other methods), patching any abrasions that cause protrusions greater than ½-inch, placing liner in pieces with fusion welds between sheets, performing shear and peel tests on test welds, air testing the liner welds for any defects, and filling the lagoons back in with water. During the process of lining the lagoons, the underdrain and connection pipes between lagoons should also be inspected. Following lagoon lining, normal operations and maintenance can commence. The lagoons should continue to be monitored for leaks. A lagoon liner has a typical expected useful life of over 30 years.

In addition to the septic system inspection and lagoons rehabilitation, it is recommended that MDIRSS install a fence around the existing lagoons and spray field.

Alternative 2 | Subsurface Wastewater Treatment and Disposal System
In place of the existing lagoons wastewater treatment system, MDI High School is interested in constructing a new subsurface wastewater treatment and disposal system. This type of treatment and disposal system, which is conventionally used in many residential applications, would eliminate the need for the spray irrigation system. However, there are other operation and maintenance considerations for this type of system.

The existing septic tank is adequately sized for the typical wastewater demand by the high school. It is recommended that MDI High School conduct an investigation, similar to that as described in Alternative 1, to document the condition of the septic tank and provide any repairs, as necessary.

Following the septic tank, instead of the lagoons, the settled wastewater would flow by gravity or be pumped to a leach field. Typical leach fields are designed with either a concrete or an HDPE chamber that collects the wastewater from the septic tank and allows it to slowly drip infiltrate into the subsurface. In addition to leach field chambers, there are proprietary technologies for piping that allow for additional treatment with the slow infiltration into the ground. These technologies tend to be more expensive than chamber systems, but they have the potential for smaller construction footprints.

Some important considerations for subsurface disposal systems include; soil types and depths to the seasonal groundwater table, distance from water sources, distance to bedrock, and setbacks from property lines. From a surficial geologic perspective, Mount Desert Island is known particularly for being underlain by rock and ledge formations. In a 2004 soils investigation for test pits throughout the property, the depth to bedrock ranged from 6.5 feet to 27 feet. Because the site has such variable depth to bedrock, it would be imperative to determine the exact location of a proposed subsurface disposal system to ensure adequate depth to bedrock per the Maine Subsurface Wastewater Disposal Rules. In shoreland areas, the minimum depth allowed is 15 inches to both bedrock and the seasonal groundwater table. Outside of shoreland areas, the minimum depth to both is nine inches.

Based on the Maine Subsurface Wastewater Disposal Rules, it is estimated that, per the existing demand of the system, a new subsurface disposal system may require approximately 30,000 square feet of disposal field. The size could be smaller or larger, depending on the soils encountered or the use of pretreatment or proprietary technologies for treatment and disposal. One potential location for a new subsurface disposal system that can meet this size requirement is the area of the existing spray field. Based on previous soils studies, it appears that the soil is mostly well drained in that area, which is good for infiltration. Additional soil studies will be necessary to identify the exact location of a new subsurface disposal system. Updates to the existing Waste Discharge License will also be necessary.

Decommissioning the Existing Lagoons System

If the MDIRSS would like to move forward with abandoning the existing wastewater treatment system and replacing it with a subsurface disposal system, it will be necessary to decommission the existing lagoons. Decommissioning the lagoons will consist of pumping down the supernatant water, removal, and proper disposal of sludge, and abandoning the lagoons.

The proper removal and disposal of sludge will require sampling of the sludge encountered once water is pumped out of the lagoons. Sampling will determine chemical constituent levels that may influence the method of proper disposal. Once the makeup of the sludge is determined, it can be removed. Sludge removal processes typically involve dewatering, which consumes both time and money. In some instances, the sludge may be able to be bulked with materials and hauled with a resulting higher moisture content. It is difficult to estimate the proper disposal technique and cost for sludge removal without a preliminary assessment of the sludge constituents.

Alternative 3 | Convey Wastewater to Somesville Wastewater Treatment Plant

As an alternative to continued on-site sanitary wastewater treatment, the Somesville Publicly Operated Treatment Works has expressed to MDIRSS that they would be interested in, and willing to accept, sanitary wastewater to be treated at their facility. The POTW has a maximum daily treatment limit of 80,000 gallons, and they are currently operating in the average daily range of 25,000 to 30,000 gallons. The High School's sanitary wastewater demand of 9,300 gpd is not anticipated to overwhelm the Somesville POTW's treatment system. Representatives from the POTW agreed that the additional wastewater flow will aid in improving operations of the treatment plant, especially during periods of low influent flows. This is especially important for this community as it has a widely varying seasonal population and tourist seasons.

The Somesville POTW facility is located approximately four miles away from the high school. There is an existing pump station located approximately two miles away from the high school that could be used to collect and convey the school's wastewater prior to treatment. Because there is no existing sanitary sewer collection infrastructure within the two miles to the existing Somesville pump station, MDI High School would be required to construct new sanitary sewer mains and necessary appurtenances to convey the wastewater to the combined collection point.

A new sanitary sewer collection branch to the Somesville collection system would generally consist of piping, valves, manholes, and likely a new pump station. The topography of Route 233 and Route 3, where the new collection system would be located, is fairly steep in both uphill and downhill directions. From the High School to slightly beyond the intersection between Route 233 and Route 3, the sanitary piping could likely be a gravity sewer main, as the topography is generally sloping downhill. Beyond that point, the road starts sloping uphill again, and would likely require a pump station with a force main to send the sanitary wastewater beyond the crest and to the existing Somesville pump station. The new pump station would be sized to accommodate the necessary flow and lift required to pump the wastewater up approximately 60 feet of elevation change.

Construction of wastewater piping generally consists of excavation, trenching, laying pipe and valves, setting and testing manholes, backfilling trenches, and repaving, as necessary. As previously discussed, Mount Desert Island is known for being underlain with plenty of rock and ledge. This means that during construction of sewer piping, the installation will require hammering and/or blasting of ledge to obtain the appropriate bury depth to avoid pipe freezing. Blasting is an expensive process, so the extent of ledge removal should be further explored should MDI High School consider this alternative.

This alternative will likely have a high upfront cost for MDI High School. In addition to the cost for constructing the new sanitary sewer collection system, MDIRSS will also be required to decommission the existing wastewater treatment system, as discussed under Alternative 2. For long-term costs, MDI High School will need to enter into a contract with the Somesville POTW that will identify costs to dispose of their wastewater in the POTW. A new collection and conveyance system to the Somesville POTW has the potential to benefit the surrounding community as this new system could create access to more users.

Summary of Alternatives

The following table summarizes the pros and cons of each alternative:

ALTERNATIVE	PROS	CONS
Rehabilitate Existing Treatment System	• Most Expedient and Least Expensive Alternative • Limited Maintenance Required	• Continued Spray Irrigation • Continued WDL compliance requirements
Subsurface Wastewater Disposal System	• Limited Maintenance Required • No Spray Irrigation	• New/Amended WDL Required • High Upfront Cost, Decommissioning Costs, and Future Maintenance/Repair Costs • Large Footprint
Convey Wastewater to Somesville Wastewater Treatment Plant	• WDL No Longer Required • Could Support Future Development (Construction Cost Share Opportunity) • Could Easily Support Future Growth of School	• Engineering Design and Construction Duration • High Upfront Cost and Decommissioning Costs • Pumping Costs and Maintenance • Likely Presence of Ledge (Cost and Constructability/Time)

Based on the table above, the most expedient and cost-effective alternative appears to be rehabilitating the existing wastewater treatment system. This alternative is beneficial to MDIRSS because it allows the existing system, which is already permitted and operational with minimal issues, to continue and the upfront cost will be lower compared with the other alternatives. Long-term maintenance costs will include, but are not limited to, re-lining the lagoons every 30-40 years and installing new equipment such as pumps, piping, and spray irrigation heads within the useful life span. Another benefit to maintaining the existing wastewater treatment system is that it is robust enough to handle potential future growth.

Contrary to the existing lagoons wastewater treatment system, a subsurface wastewater treatment and disposal system does not easily allow for future growth. Once the system is designed and operational, it is difficult to upsize if the future demand on the system were to increase. Additionally, subsurface wastewater treatment and disposal systems tend to be tricky for operation and maintenance, so although they require limited daily maintenance, they may take some effort by operations staff to ensure that they are working effectively. One benefit to a subsurface wastewater treatment and disposal system is that it would not require the operation of a spray irrigation field. Spray irrigation is only allowed during certain months of the year and at varying rates, so a subsurface system would allow MDIRSS to operate their system year-round.

The most expensive alternative would be for MDIRSS to construct a new wastewater collection and conveyance system to discharge sanitary wastewater to the Somesville POTW. Although this alternative has a high upfront cost, it would eliminate the need for MDIRSS to hold a waste discharge license. It would also benefit the local community by providing more efficient treatment at the Somesville POTW, and like the first alternative, it could allow for future growth. Operation and maintenance costs would come from maintaining the new infrastructure as well as paying wastewater rates to the Somesville POTW. Upfront costs have been estimated, but there are many unknowns at this time including the presence of ledge. If ledge is encountered and blasting is required for a significant portion of the project, this can drastically increase the overall cost of the work.

COST ANALYSIS

The cost of each alternative was evaluated at a preliminary level. Please consider that cost estimates were developed using today's market prices. Unit prices were gathered through communication with local contractors and by referencing bid prices from recent, similar projects. In each of the three alternatives, we did not estimate costs associated with emptying the lagoons. We assume that the lagoons may be emptied by a combination of spray irrigation and pumping wastewater into the decommissioned third lagoon. Details of the factors considered for each alternative, as well as unknowns for each alternative are as follows:

Alternative 1 | Rehabilitate Existing Treatment System

The cost of rehabilitating the existing sanitary wastewater treatment and disposal system is estimated to be approximately **$______**. This estimate includes the cost for lining the two existing and operational lagoons with miscellaneous trenching and backfilling around the lagoons. The estimate does not include the cost for sludge dewatering, removal, and disposal or the cost for a leak detection system. The costs for sludge removal are not able to be determined until a preliminary analysis is completed on the existing sludge content in the lagoons.

It should be noted that the cost of HDPE liners fluctuates with the cost of oil. Estimates have been prepared based on today's market value. It is also noted that the existing spray irrigation pumps and mechanical components, septic tank, and sanitary sewer piping to the lagoons are all assumed to be in good working condition and will not add cost to this alternative.

Alternative 2 | Subsurface Wastewater Disposal System

The cost of a new subsurface wastewater disposal system is estimated to be approximately **$______**. This estimate includes the cost to construct a new, 30,000 square foot subsurface disposal field including excavation and backfilling. As with Alternative 1, this estimate does not include the cost for sludge dewatering, removal, and disposal. Costs for emptying and filling the existing wastewater ponds and ledge removal were not considered in these estimates. Some of the existing wastewater treatment system components, such as the septic tank, pump, and sanitary sewer piping, are assumed to be in good working condition and will be reused. As such, costs associated with new materials for these items have not been included.

Alternative 3 | Convey Wastewater to Somesville Publicly Operated Treatment Works

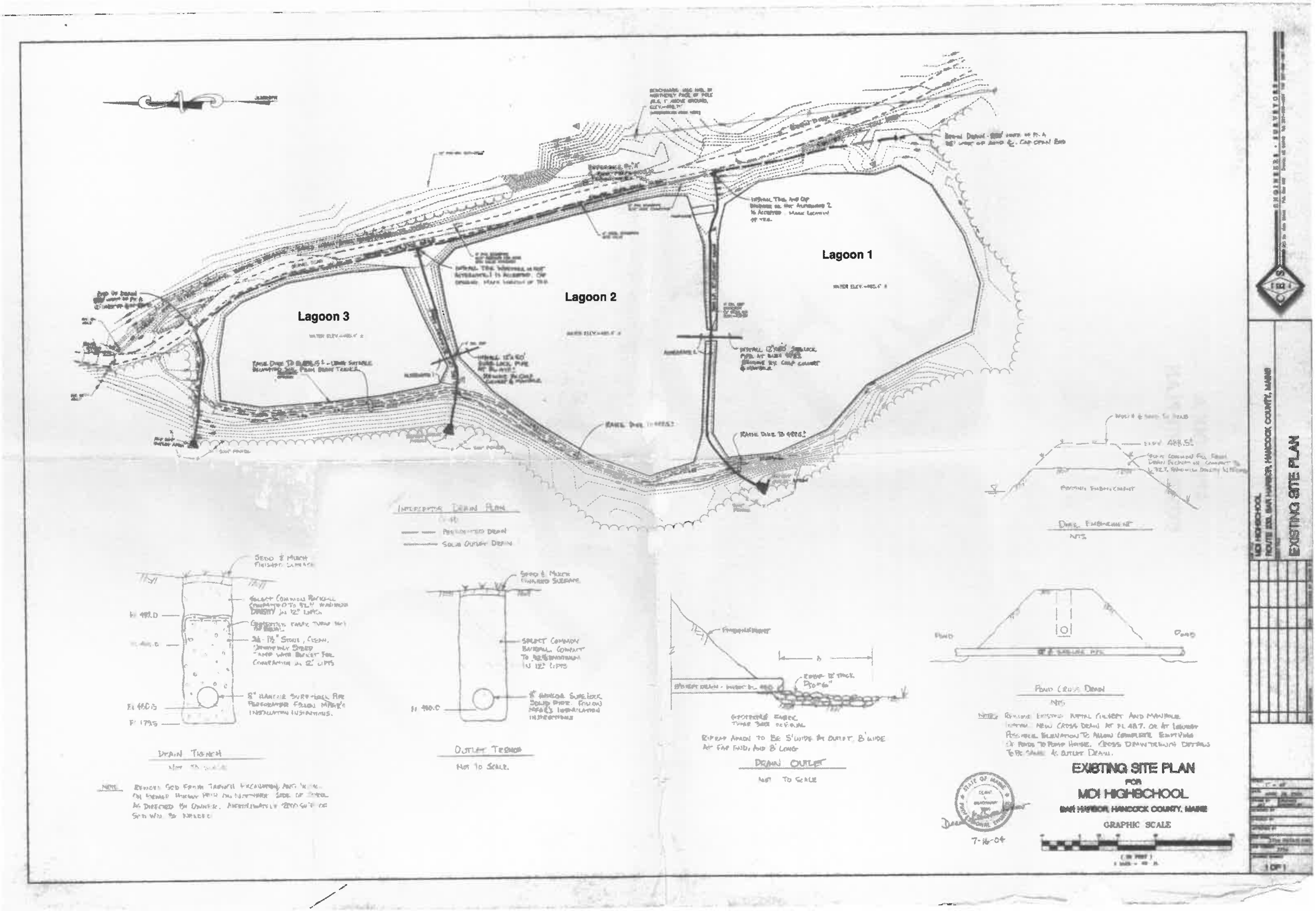
The cost of a new wastewater conveyance system to the Somesville POTW is estimated to be approximately **$______**. This estimate includes the cost for PVC gravity sanitary sewer main, manholes and force main and one pump station. We also included an estimate for ledge, assuming that 11,000 linear feet of ledge may be encountered, and the estimate has been prepared based on today's market value. We did not consider the costs associated with emptying and filling the existing wastewater ponds, or sludge dewatering, removal, and disposal.

CONCLUSIONS

The findings of this report indicate that MDIRSS has three viable alternatives to manage sanitary wastewater generation. Each alternative will require a significant capital investment, as well as coordination with MDEP, engineering consultants, and contractors. Haley Ward recommends rehabilitating the existing wastewater treatment system as it is expected to be the most expedient and least costly alternative. Despite this recommendation, MDIRSS must compare the costs and benefits of each alternative and determine the best long-term approach for the facility, users, and its future operations.

ALTERNATIVE	CONSTRUCTION COST SUBTOTAL	ENGINEERING & PERMITTING (APPROXIMATELY 20%)	CONTINGENCY (APPROXIMATELY 20%)	TOTAL ESTIMATED PROJECT COST
Rehabilitate Existing Treatment System				
Subsurface Wastewater Disposal System				
Convey Wastewater to Somesville Wastewater Treatment Plant				

APPENDIX A
EXISTING SITE PLAN


Lagoon 1
Lagoon 2
Lagoon 3
Interceptor Drain Plan
Perforated Drain
Solid Outlet Drain
Dike Embankment
NTS
Drain Trench
Outlet Trench
Not to Scale.
Drain Outlet
Not To Scale
Pond Cross Drain
NTS
Pond
EXISTING SITE PLAN
FOR
MDI HIGHSCHOOL
BAR HARBOR, HANCOCK COUNTY, MAINE
GRAPHIC SCALE
7-16-04
MDI HIGHSCHOOL
ROUTE 233, BAR HARBOR, HANCOCK COUNTY, MAINE
EXISTING SITE PLAN