Exhibit E

Summary of Shaw Identified Engineering Issues Retrofitting Cooling Towers at Canal Station

In Alden's 2003 evaluation of the feasibility of several options for addressing impingement and entrainment at the Canal Station, the practicality and impact of backfitting Units 1 and 2 with cooling towers was evaluated only at a very conceptual level. Alden used vague assumptions about site equipment to factor typical costs developed in an EPRI 2002 report "Investigating Site Specific Factors for Retrofitting Recirculating Cooling Towers" to estimate the costs for cooling towers at the Canal station. Now that US EPA Region I has issued a Final NPDES permit with a requirement to reduce entrainment to the same level as that for the closed-cycle cooling option, Mirant Canal has asked Shaw to consider in greater detail the approach used in the original conceptual level evaluation in order to determine whether installation of cooling towers would be feasible from an engineering standpoint, and, if so, to describe the extent of changes (and their consequences) necessary to install them.

The description below describes how a cooling tower would generally be backfit to an existing once through cooled steam electric generating station. The section then explains a specific constraint at Canal Station related to the design of the original condensers. Then a workaround method that allows the reuse of the existing condenser is described which also explains some specific reliability issues associated with this workaround. Finally, there is discussion of other environmental impacts of the cooling tower backfits as well as the need for a comprehensive review of environmental impacts, the economic impact of the backfit of a cooling tower, and the potential consequences to the ISO New England transmission system and generation bidding system.

Conceptual Feasibility and Typical Arrangements at New Plants

From a very conceptual level, as with most power plants, it would be possible as an engineering matter to run the Canal Station by recirculating the discharge flows into a cooling tower fill and then routing the return condenser feed line back to the condenser. In a typical cooling tower arrangement for a new power plant, one set of pumps located just upstream of the condenser and downstream of the cooling tower provides the necessary flow and head for the cooling water to pass through the condenser and up to the cooling tower fill. The hot condenser discharge flow then passes through the cooling tower fill countercurrent with the upflowing air flow so that the waste heat exits the top of the cooling tower and the condenser water falls to the cooling tower basin where the recirculation of the flow begins again.

Infeasibility of Typical Arrangements to Backfit at Canal Station

However, this typical arrangement of backfit of a cooling tower is not a feasible arrangement at Canal Station as the condensers are not designed to sustain the hydraulic

Shaw®
The Shaw Group Inc.®

head that the cooling water would place on the condenser tubes and condenser water boxes. These condensers and the associated large diameter piping are designed for hydraulic pressures of approximately 20 psig. To pump the water through the condenser and up to the cooling tower fill the pumps would require 70 to 90 psig pressure on the water side of the condenser, large diameter connecting pipes, water boxes and heat exchange tubing. At these pressures the condenser and piping and water boxes would distort and burst and the steam condenser would fail.

Alternative Arrangements at Canal Station without Rebuilding Condensers; Issues and Drawbacks

There are a few alternatives to make the conventional cooling tower arrangement work at Canal with the design of the existing condensers. In one potential arrangement, the elevation of the cooling tower fill would need to be at or near the existing level of the sea. That means the cooling tower basin would need to be depressed some 30 feet below the level of the sea to get the fill at that appropriate level. That in turn would require large volume dewatering pumps (and a new discharge structure) to depress the ground water levels around the basin to avoid uplift pressures on the cooling tower basin and prevent groundwater flooding of the cooling tower cavity in the land. This arrangement would also require the countercurrent air flow to pass into and around this cavity in the ground to enter the cooling tower shell. This depressed arrangement of the cooling tower would provide interference with the air flow unless a much larger area around the basin of the tower were excavated and additional groundwater dewatering pumps were employed to dewater this larger area. These large groundwater pumps would likely have an adverse effect on local groundwater levels and intrusion of saltwater into the local aquifer so this alternative is not considered a reasonable approach.

As an alternative, Mirant has evaluated a non-conventional arrangement of the cooling system which would allow reuse of the existing condenser but the arrangement is not without some serious drawbacks. A variation of this approach is in use now at Vermont Yankee Generating Station. This alternative arrangement requires two pump sets in separate locations (upstream and downstream of the condenser) working in series. The first pump is located between the cooling tower basin and the condenser and provides only sufficient head to pass the full condenser flows to the existing discharge canal. Shaw proposes to use the existing circulating water pumps for this function. The second, and new set of pumps, will pump, with much greater head than the first pump set, the heated condenser discharge flows from the discharge canal up to the cooling tower fill. The cooling tower discharge would flow by gravity to the existing cooling water intake structures.

This push-pull arrangement protects the condenser from hydraulic pressures that exceed the design capacity but can also create some difficult balancing issues with the pump flows and the elevations of the two water storage reservoirs in the system – the cooling tower basin and the enclosed discharge canal. This could be resolved by under sizing the volume of the new cooling tower pumps. This arrangement would require that the existing circulating water pumps draw the entire volume of cooled water from the cooling towers plus the excess volume from the Cape Cod Canal. This excess flow would be discharged to the canal via the existing diffuser. A system of valves or gates in the intake canal dams and a weir in the discharge canal would be required to accomplish this. Although this is not an efficient way to pump the large volumes of flow required for cooling, some levels of operating efficiency would need to be sacrificed to retain the service of the existing condenser.

Even with this workaround, which should be effective, despite the inefficiency, the Canal cooling system will be less reliable and will reduce the dispatch reliability of the operating units. This is because the cooling system is dependent on two sets of pumps to operating the cooling system instead of just the original pumps. If the new set of pumps fail, then the steam electric generation unit will trip out as soon as the cooling water in the closed off intake well runs below the minimum operating level of the pumps. The system can also fail if the original set of cooling water pumps fail and this would happen with the same probability as with the previous operation. Upset conditions associated with the additional pumps will lead to additional unscheduled unit trip outs of the steam generating unit. These trip outs could also trip the high pressure steam release to the atmosphere (a very loud and intrusive condition) which is used to cool the boiler and steam when the cooling system fails.

Although Shaw believes that the push-pull pump arrangement with the use of new cooling towers should be mostly reliable, the reliability of the cooling system would be considerably less (about half) than the current once through cooling arrangement. If this unusual pumping arrangement proves in actual use to be less reliable than anticipated, then the ISO New England might be forced to limit the dispatch of Canal station even during times when Canal may be essential to the local electric transmission stability and reliability.

Arrangements that include Rebuilding Condensers; Issues and Drawbacks

Replacing steam condenser shells and water boxes is very expensive in terms of capital and outage time and if done only to accommodate the operation of new cooling towers, the change will generate no additional plant revenue or operating margin unless other design changes are also made on the steam side equipment at the plant.

In addition to condenser replacement, most if not all existing circulating water pipe and pipeline equipment including valves, expansion joints and other equipment would either have to be reinforced in place or replaced to accommodate the higher pressures.

The condensers of a conventional steam electric generating plant are sized and located with respect to the elevation of the cooling water and with close proximity to the steam turbine as a first step in both the design and with the construction of the power plant. The condensers are typically placed immediately below the steam turbine and proximate to the foundations of the steam turbine. The condensers are the heart of the design of the power plant, as everything else is built around the design capacity and elevation and location of the condensers.

As such, condensers are extremely difficult to replace in total. The condenser tubes are relatively easily replaced but the shells and water boxes would require a very time consuming and delicate extraction and reinstallation process that could prevent operation of the generating unit for many months. To replace the existing condenser with another capable of withstanding the higher hydraulic pressures, different types of heat exchanger metals or thicker metal piping and plate are generally required. In order for this new condenser with thicker walled pipe and plate to provide the same rated heat exchange as the existing condenser, the new condensers would likely be larger in dimension – just to achieve the same thermal heat exchange function.

A larger sized condenser may be difficult or impossible to place in the same location below the existing steam turbine. A larger dimension condenser would also require that the large diameter steam ducts from the steam turbine be expanded to spread the steam over a longer or wider condenser. The space between the turbine and condenser is very restricted and this may not be possible. Mirant would require a detailed evaluation of the feasibility of replacement of the condenser, as a design or dimension change can adversely affect the function of the steam turbine and ducting.

If one were to replace the condenser to accommodate a cooling tower, that redesign would also likely greatly influence the water flow path and basic design. Once through cooling plants typically have three (or more) parallel condenser flow paths whereas a steam condenser for the cooling tower project typically has a series arrangement of the shells and the water flow path. This series arrangement will generally reduce the size and capital cost of the cooling tower since the series condenser will generally deliver a higher temperature and smaller flow than a once through condenser for the same steam condensing capacity. As a part of the evaluation of the cooling tower cost alternatives, Shaw has considered two arrangements of the flow through the existing condensers that can be used to reduce the size and cost of the cooling towers. The two arrangements only considered changes in the rate of flow through the condensers – not a conversion of the flow path. However, neither arrangement considered a complete redesign of the condensers to do this because the costs are extremely high and may not be possible with the continued use and location of the existing steam turbine and large diameter steam ducts.

Costs of Cooling Tower Backfit Cannot be Recovered Unless Other Plant Changes are Incorporated

A redesign of the condenser would require a detailed engineering and economic evaluation of the cooling and steam systems. With a planned condenser replacement, one would generally reconsider the optimization of the steam and cooling systems to extract additional energy from the existing equipment. However, in the case of adding a cooling tower and potentially replacing a condenser, the new system will only achieve less generation and will do so with less thermal efficiency than the existing operation. There is no opportunity to recover the additional capital costs ($182.3 to 224.5 million) of the cooling tower with additional new generation.

But if one is going to the expense of adding a cooling tower and also modifying the condenser to accommodate the higher water pressures for a conventional cooling tower single pump set flow arrangement, then one would also want to look at the blading and efficiency of the steam turbine connected to the replaced condenser. The redesigned condenser may allow for an economically advantageous replacement of the turbine or reblading of the steam turbine to recover some of the costs of the redesigned cooling system. Although this adds additional capital costs it may allow recovery of some of the costs associated with the condenser replacement.

But if the steam turbine is resized, replaced or rebladed to accommodate the condenser, then it would be foolish to ignore the steam supply from the boiler. If that older boiler is generating steam by the simple cycle conversion of fossil fuel to electric energy, then it would be wise to consider replacement of the fuel and steam supply side with the cooling tower condenser and steam turbine. Replacing an older fossil fuel fired boiler with gas or distillate fired combustion turbines and a HRSG or with a supercritical unit may greatly increase the energy conversion efficiency of the overall power plant. And the conversion may also help to recover the capital costs of the cooling tower, new condenser, and new or rebladed steam turbine.

Why go to all this length to explain why not to replace the condenser? Because if a cooling tower could easily be incorporated into the design of an existing steam electric generator without the need to replace or work around a deficiency in the condenser design, then that site is reasonably suited to accommodate the change with existing plant equipment. But when the replacement of once through cooling with a cooling tower requires work-arounds for operation of existing equipment, as is the case here at Canal, or when the backfit affects the reliability of operation, it generally requires complete rethinking of the optimal operation and strategic competitive placement of the plant in the competitive ISO New England dispatch process of recovery of capital expenses.

Conclusions of Practicability of Backfit of the Cooling Tower

Unless the Canal plant is completely redesigned with major changes to the boiler and steam side of the plant, then the capital costs of the cooling tower backfit will only add to the overall dispatch cost of operation of the station. If cooling towers are constructed, then Mirant would need to either contract long term power sales at higher rates or bid into the ISO New England auction at higher rates to recover the capital costs of the new cooling towers. This higher dispatch cost will then likely further limit the capacity utilization of the station with respect to other generating facilities with which Canal competes. Given the low current level of plant utilization, it is likely the capital costs of a cooling tower backfit will eliminate the Canal station from the competitive electric generation market.

Additional Issues

In addition to the challenge to the competitiveness of a Canal Station with a backfit cooling tower, there are many other potential changes that will adversely affect the natural and human environment that should be the cause for concern and for additional study before such a change is made. Some of the environmental impacts associated with the backfit of cooling towers that should be considered more carefully include:

- Visual impacts of the cooling tower structure
- Noise during construction and operation
- Heat rate penalties – which are in addition to the capital cost competitiveness issues described above
- Loss of plant generating capacity – associated with additional electrical use of plant operation
- Cooling tower plume effects
- Potential fogging and icing effects on local area, roads, and bridges
- Salt drift from the cooling tower on native vegetation and local infrastructure
- Suitability of soils to support the cooling tower structures
- Traffic impacts during construction

Each of these human and natural environment potential impacts also requires more detailed study to identify the level of impact, cumulative effects of these impacts, need for mitigation for these impacts, and costs of impact mitigation.

The impacts on capital and operating costs, the competitiveness of the Canal Station with the reconfigured operation with cooling towers, and the many potential natural and human environment impacts must be considered collectively and with respect to the existing entrainment and impingement mortality impacts of the current operation. Without such a set of comprehensive reviews and consideration of all the potential plant economic effects and environmental effects, decision making on the suitability of addition of a cooling tower is not reasonable.