

TABLE 7-1

SUMMARY OF TREATED WATER RECHARGE TECHNOLOGIES

| ALTERNATIVE | REGULATORY REQUIREMENTS | EFFLUENT QUALITY | MAINTENANCE REQUIREMENTS AND COMPLEXITY OF OPERATION | FLEXIBILITY | ENERGY USE | LAND REQUIREMENTS | POTENTIAL FOR AIR EMISSIONS | PUBLIC ACCEPTANCE | RELATIVE CAPITAL COSTS | RELATIVE O&M COSTS | SELECTED FOR DETAILED EVALUATION |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|---------------------------------------------------------------------------------|
| Sand infiltration beds | Permitting and monitoring of treated water recharges and design requirements. Disinfection may be required by MassDEP. | Effluent is already treated and sand beds provide some additional treatment. | Treated water recharge is reliable throughout the year and easy to maintain. | Flexibility is possible with multiple beds. | Lowest energy requirements due to no need to repump the treated water at the sand beds. | Moderate at large wastewater flows when compared to subsurface leaching. | Effluent is treated to a high level and odors would be minimal. | Potential for low acceptance from residents who are impacted by bed siting and construction. | Relatively low due to low land area and easier construction. | Low due to low energy requirements and minimal maintenance. | Yes; the technology is simple and reliable. O&M requirements are minimal. |
| Subsurface infiltration | Disinfection is not required prior to recharge, unless required to meet the Interim Guidelines for Reclaimed Water Use. | Effluent is already treated and infiltration facilities provide additional treatment. Effluent should be filtered before recharge. | Repair of the beds would be difficult because they are subsurface. | Moderate depending on construction of dosing equipment and distribution piping. | Moderate due to effluent dosing pumps. | Relatively high. Land surface above the infiltration system can be used for other purposes | Minimal | Acceptance should be high due to minimal visual impacts and potential reuse of land area. | Relatively high due to highest land area and extensive piping. | High due to pumping requirements and potential high repair/cleaning costs. | Yes; technology is reliable and provides secondary use of recharge area. |
| Spray irrigation | Permitting and monitoring of treated water recharges and design requirements. Disinfection may be required by MassDEP. | Spray irrigation provides further uptake of nitrogen in the effluent. | Moderate maintenance to maintain piping. Spray irrigation cannot be used in freezing weather. | Must have redundant back-up facilities for winter recharge. | Moderate due to repumping requirements. | Relatively high. Land above system can be used for other purposes when spray irrigation is turned off. | Minimal | The public will want to see recycling of the treated water though they may be concerned about possible health threats. | Site work is relatively low due to minimal excavation, and minimal need to reshape the land. Additional treatment and transmission costs are very high. | High due to treatment maintenance and pumping requirements. | Yes; it provides additional nitrogen uptake and reuse of the effluent. |
| Ocean Outfall | The Massachusetts Ocean Sanctuaries Act prohibits recharge of municipal wastewater into an ocean sanctuary. Special legislation and NPDES permit required. | Disinfection may be required for the outfall. | Maintenance similar to a large force main. | Minimal, unless land disposal remains for some backup recharge. | Moderate due to pumping requirements. | Minimal | Minimal | Low. Based on the opposition to the Deer Island outfall and the Ocean Sanctuaries Act. | Relatively high due to land area, extensive permitting pumping requirements. | Moderate due to pumping requirements. | No. This is not allowed by State Law without a variance. |
| Wick Wells | Permitting and monitoring of treated water recharges and design requirements. MassDEP may require a second technology for redundancy. | Disinfection and filtration may be required. No credit for any additional treatment received. | Uncertain reliability due to few operating installations and increased maintenance due to the potential of plugging of injection point with solids. | Installation of multiple wells would allow individual wells to rest or be repaired. | Moderate due to pumping requirements. | Relatively low compared to sand infiltration beds and subsurface leaching. | Minimal. | Land area requirements and visual impacts are minimal. | Relatively low due to minimal excavation, and minimal need to reshape the land. | Moderate due to pumping requirements. | No, because of the possible requirement for a second technology for redundancy. |

TABLE 7-1 (continued)

SUMMARY OF TREATED WATER RECHARGE TECHNOLOGIES

| ALTERNATIVE | REGULATORY REQUIREMENTS | EFFLUENT QUALITY | MAINTENANCE REQUIREMENTS AND COMPLEXITY OF OPERATION | FLEXIBILITY | ENERGY USE | LAND REQUIREMENTS | POTENTIAL FOR AIR EMISSIONS | PUBLIC ACCEPTANCE | RELATIVE CAPITAL COSTS | RELATIVE O&M COSTS | SELECTED FOR DETAILED EVALUATION |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-----------------------------------------|----------------------------------------------------------------------------|----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| Drip Irrigation | Permitting and monitoring of treated water recharges and design requirements. | Disinfection and filtration may be required. No credit for any additional treatment received. | Uncertain reliability due to few operating installations and increased maintenance due to the potential of plugging of system. | Moderate depending on construction of dosing equipment and distribution piping. | Moderate due to pumping requirements. | High, due to the low discharge rates. | Minimal | The public will want to see recycling of the treated water though they may be concerned about possible health threats as this application would most likely be in a park or playing field. | High because of the large land areas and the site restoration required for parks and athletic fields. | High, annual maintenance of system, drainage and flushing and pumping requirements. | Possible as alternative to traditional subsurface leaching. However limited long term data available on technology in N.E. for large facilities |
| Wetland Restoration | May require extensive permitting as a wetland in addition to the normal requirements of monitoring and design. | Additional nitrogen removal credits potentially could be negotiated with MassDEP. | Uncertain reliability due to few operating installations and increased maintenance may be required to deal with excessive vegetative growth. | Highly dependant on the wetland system. | Low, can be gravity fed. | High | Low to moderate, highly dependant on the wetland system. | Acceptance should be high due to minimal visual impacts and potential restoration of the wetland system and additional nitrogen removal possible. | Relatively high due to permitting and design considerations, construction costs (if restoring an existing wetland) should be low. | Low, if pumping is not required. | Yes, for its potential nitrogen uptake. |
| Deep well injection | Permitting and monitoring of treated water recharges and design requirements. MassDEP has been less supportive of this technology. | Effluent must be well treated (filtered and chlorinated) before recharge. | Uncertain reliability due to few operating installations and increased maintenance due to the potential of plugging of injection point with solids. | Installation of multiple wells would allow individual wells to rest or be repaired. | Moderate due to repumping requirements. | Relatively low compared to sand infiltration beds and subsurface leaching. | Minimal | Land area requirements and visual impacts are minimal. | Relatively low due to minimal excavation, and minimal need to reshape the land. | Moderate due to pumping requirements. And maintenance needs. | No; MassDEP is resistant to support the technology due to the need to chlorinate the effluent. |