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To: Madison Metropolitan Sewerage District

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Subject: 50-Year Master Plan  
**TM-8: Planning Alternative Evaluation Criteria (Final)**

Project No.: MMSD No. 8425001  
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## 1. Purpose

This technical memorandum has been developed as part of the Madison MSD 50-Year Master Plan. The objectives of this memorandum are:

- To identify the applicable evaluation criteria to be used for master planning alternative evaluation.
- To determine appropriate level of importance for all evaluation criteria to be used in the planning alternative evaluation process.

## 2. Background

A list of alternative projects was developed in Technical Memorandum No. 7 – Development of Alternatives (TM-7) to meet the District’s needs for wastewater conveyance, wastewater treatment, and biosolids management during the 50 year planning period. As part of TM-7, a rational screening process was conducted to generate a list of four master planning alternatives. The evaluation criteria developed in this technical memorandum will be used to evaluate and rank these identified alternatives on a common basis, and to determine the most cost-effective alternative(s) to be implemented to achieve the District’s planning goals during the planning period.

Several meetings and workshops have been conducted with the MMSD and Technical Advisory Committee (TAC) to identify applicable evaluation criteria and determine their levels of importance. A survey has also been conducted to solicit opinions on evaluation criteria from TAC members and MMSD staff. The documents used in the

survey and a MMSD prepared memo summarizing the survey results are attached to this technical memorandum in Appendix A.

The identified planning criteria are categorized into the following 4 groups:

- Economic criteria  
The impacts the planning alternatives have on the economic conditions of the District's stakeholders and on the District's own financial performance.
- Technical criteria  
The impacts the planning alternatives have on the technical aspects of the District operation, such as the ease of maintenance, system reliability, system flexibility, etc.
- Social criteria  
The impacts the planning alternatives have on the social systems within which the District operates, including public acceptance, staffing requirements, etc.
- Environmental criteria  
The impacts the planning alternatives have on natural systems, including ecosystems, land, air and water.

These evaluation criteria incorporate the major elements of typical sustainability evaluations of water and wastewater utilities. Adoption of these criteria in the evaluation process will allow evaluating and ranking planning alternatives from a multiple dimension perspectives.

### **3. Evaluation Criteria Description and Level of Importance**

In this section, all the identified evaluation criteria are described and discussed. Levels of importance (Low, Medium and High) are then assigned to each of 10 criteria based on the combined efforts of the TAC, MMSD and the consultant.

#### **3.1 Economic Criteria**

##### 3.1.1 Life Cycle Cost

A District mandate is to provide cost-effective wastewater conveyance, treatment and biosolids management services. Life cycle cost is used as a basis for making economic comparisons between alternatives. The life cycle costs is the total discounted dollar cost of owning, operating, maintaining, and disposing of the planning alternatives over the 50 year planning period. The life cycle cost includes the components listed below:

- **Initial Capital Costs**

Initial capital costs include the purchase of land, buildings, equipment, and construction activities to bring all the component projects associated with a planning alternative to a fully operable status. Initial costs do not include labor costs except for the labor used for construction.

- **50-Year Replacement Cost**

All of the costs associated with the replacement of the structures, equipment, and other major components of the facilities included in a planning alternative to maintain the proper operation efficiency and physical conditions of the facilities during the 50 year planning period.

- **Annual Operation/Maintenance Costs**

The annual operation/maintenance costs are composed of all the expenses including labor, materials, and other expenses for maintaining day-to-day facility functions and preserving the operating efficiency and physical condition of the facilities included in a planning alternative.

## **3.2 Technical Criteria**

### 3.2.1 Regulatory Constraints

Alternatives must meet all regulatory requirements. However, the regulatory requirements associated with any given planning alternative may be easier or more difficult to meet, depending on a number of factors. For example, the regulatory requirements associated with an effluent discharge to an Exceptional Resource Water (ERW) or to a lake would be more stringent than those associated with discharge to a warm water stream.

### 3.2.2 Proven Effectiveness

The selected alternative(s) must be able to provide reliable service during the planning period. This criterion is used to evaluate planning alternatives for their reliability in providing required service. For example, fifteen years ago, biological phosphorous removal was not as proven a technology for removing phosphorous as chemical addition. As such, it would not have been considered to be as well “proven” as chemical addition. The proven ability of an alternative to meet the regulatory goals will need to be considered.

### 3.2.3 Flexibility, Expandability, and Compatibility

The selected alternative(s) must have the ability to be phased into connection with the existing system. This allows for ease of construction and financial burden to the District. The selected alternative(s) must be compatible with the existing collection system and treatment facilities, and maximize continued use of the existing facilities. The selected alternative(s) must also be compatible with other planning goals of Dane County and the City of Madison. This criterion is used to rank alternatives for their potentials to meet the following requirements:

- Can the alternative be readily modified to meet potential future needs such as re-routing wastewater, meeting more stringent future permit limits and regulations, etc?
- Can it be readily expanded to meet future flows and loadings?
- Is the alternative compatible with the existing collection system and treatment facilities?
- Does it maximize continued use of existing facilities?
- Can it be phased into connection with the existing system?
- Is it compatible with other planning goals of Dane County and the City of Madison?

### 3.2.4 Ease of Operation

Some alternatives may be more difficult or challenging to operate. For example, operation of a facility utilizing membrane filtration facility may be more difficult than operating the District's current facility. The selected alternative(s) must consider the level of complexity involved in operating the facilities included in the planning alternatives. This criterion will be used to rank all planning alternatives for efforts involved in the facility operation.

## **3.3 Social Criteria**

### 3.3.1 Public Acceptance

Public acceptance has significant impacts on the implementation of planning alternatives. The selected planning alternative(s) must have the support of the public or a plan must be developed to gain this support. This criterion ranks all the planning alternatives for the likelihood of being accepted or resisted by the public.

### 3.3.2 Staffing Implications

Alternatives may have different staffing implications, both in terms of staffing level and required skills. For example, operation of multiple plants may be more labor intensive than operation of a centralized system. In addition, operating an advanced treatment (tertiary) system may require a more skilled workforce than operating a secondary treatment system. This criterion will be used to rank all planning alternatives for these staffing requirements.

## **3.4 Environmental Criteria**

### 3.4.1 Maintains Watershed Balance

Stream flow augmentation and water balancing within the watershed are issues to address in the Master Plan. The volumes and locations at which the District discharges its effluent based on recommendations by the Master Plan will have significant impacts on sustaining water level in streams and aquifers, and maintaining watershed balancing throughout the watersheds. This criterion will be used to rank all the planning alternatives for their potential in augmenting low flow streams and alleviating imbalanced inter-watershed water transfer.

### 3.4.2 Opportunities for Effluent Reuse

One of the potential outcomes of the Master Plan is to maximize the use of treated effluent as a resource. Effective effluent reuse could reduce the need for groundwater withdrawals from the Madison area aquifer and improve the sustainability in water resource utilization in the Madison and the Dane County areas. The available effluent reuse options include:

- Turf irrigation
- Groundwater recharge
- Industrial water use
- Other uses

Some alternatives may present greater opportunity to beneficially reuse effluent because of location of facilities, level of treatment, etc. This criterion will be used to rank all the planning alternatives for their potential in treated effluent utilizations.

### 3.4.3 Carbon Footprint

Carbon footprint is a measure of the impact that the planning alternatives have on the environment in terms of the amount of the greenhouse gases produced. It will be evaluated for the utilization of electricity, natural gas, gasoline, etc. Some alternatives may have larger carbon footprint than the others. This criterion will be used to rank all the planning alternatives for their magnitude of carbon footprints.

## 4. Planning Alternative Level of Importance

The levels of importance for all planning alternatives were determined based on independent rankings by the TAC, MMSD and the consultant. The ranking scores from three sources were then averaged to calculate the final scores for all planning criteria. Evaluation criteria receiving scores higher than 10 are classified as “High” level of importance; those with scores between 6 and 10 are classified as “Medium” level of importance; while those with scores lower than 6 are classified as “Low” level of importance. The ranking results of all evaluation criteria are shown in Table 1.

**Table 1. Planning Alternative Evaluation Criteria**

No.	Evaluation Criteria	TAC Ranking Score	MMSD Ranking Score	Consultant Ranking Score	Average	Level of Importance
1	Life Cycle Cost	15	33	30	26	High
2	Public Acceptance	10	14	15	13	High
3	Watershed Balance	12	10	10	11	High
4	Flexibility/Expandability/Compatibility	12	9	7	9	Medium
5	Effluent Reuse	13	7	8	9	Medium
6	Regulatory Constraints	8	9	10	9	Medium
7	Proven Effectiveness	10	7	8	8	Medium
8	Carbon Footprint	9	3	3	5	Low
9	Ease of Operation	6	5	4	5	Low
10	Staffing Implications	5	4	5	5	Low

**Appendix A**  
**Planning Alternative Ranking Criteria Survey**

## **Madison Metropolitan Sewerage District 50-Year Master Plan**

### **TAC Planning Alternative Ranking Criteria Survey**

#### **INTRODUCTION**

As discussed at the March 17, 2009 Master Plan meeting, there are a number of criteria that have been discussed to assist in ranking alternatives for the Master Plan. Many of these alternatives have been discussed with the TAC either at a Planning Variables Workshop or a Scenario Planning Workshop. The District would now like feedback from the TAC on the relative importance of the criteria.

A Ranking Criteria Survey has been developed and is attached to this document. Ten alternative ranking criteria have been categorized into 4 groups: economic criteria, technical criteria, social criteria and environmental criteria. A detailed description for all these ranking criteria is provided below. The survey respondents should assign a weighting score ranging from 1 to 50 to each of the 10 ranking criteria in the spreadsheet provided according to their relative importance. The more important a ranking criterion is, the higher score is should be assigned to. However, to “force” a differentiation among the criteria, we ask that the total sum of the weighting scores for all 10 ranking criteria be equal to 100. For example, if someone thinks that all ten criteria are equally important, then they would each receive a score of 10. Or, if someone thinks that Life Cycle Costs is by far the most important criteria, it could receive a maximum score of 50 and the remaining 50 points could be spread among the remaining criteria as the evaluator sees fit. Evaluators may also add comments, in the appropriate section, if they wish.

Please send your comments to Dave Taylor at [davet@madsewer.org](mailto:davet@madsewer.org). If you have any questions, you may call Dave at 608-222-1201 x-276. We would appreciate a response by April 3, 2009.

#### **RANKING CRITERIA DESCRIPTION**

##### **Economic Criteria**

###### **Life Cycle Cost**

A District mandate is to provide cost-effective wastewater conveyance, treatment and biosolids management services. Life cycle cost is used as a basis for making economic comparisons between alternatives. The life cycle costs is the total discounted dollar cost of owning, operating, maintaining, and disposing of the planning alternatives over the 50 year planning period. The life cycle cost includes the components listed below:

- Initial Capital Costs

Initial capital costs include the purchase of land, buildings, equipment, and construction activities to bring all the component projects associated with a planning

alternative to a fully operable status. Initial costs do not include labor costs except for the labor used for construction.

- **50-Year Replacement Cost**

All of the costs associated with the replacement of the structures, equipment, and other major components of the facilities included in a planning alternative to maintain the proper operation efficiency and physical conditions of the facilities during the 50 year planning period.

- **Annual Operation/Maintenance Costs**

The annual operation/maintenance costs are composed of all the expenses including labor, materials, and other expenses for maintaining day-to-day facility functions and preserving the operating efficiency and physical condition of the facilities included in a planning alternative.

## **Technical Criteria**

### **Regulatory Constraints**

Alternatives must meet all regulatory requirements. However, the regulatory requirements associated with any given option may be easier or more difficult to meet, depending on a number of factors. For example, the regulatory requirements associated with an effluent discharge to an Exceptional Resource Water (ERW) or to a lake would be more stringent than those associated with discharge to a warm water stream.

### **Proven Effectiveness**

The selected alternative(s) must be able to provide reliable service during the planning period. This criterion is used to evaluate planning alternatives for their reliability in providing required service. For example, fifteen years ago, biological phosphorous removal was not as proven a technology for removing phosphorous as chemical addition. As such, it would not have been considered to be as well “proven” as chemical addition. The proven ability of an alternative to meet the regulatory goals will need to be considered.

### **Flexibility/Expandability/Compatibility**

This criterion is used to rank alternatives for their potentials to meet the following requirements:

- Can the alternative be readily modified to meet potential future needs such as re-routing wastewater, meeting more stringent future permit limits and regulations, etc?
- Can it be readily expanded to meet future flows and loadings?

- Is the alternative compatible with the existing collection system and treatment facilities?
- Does it maximize continued use of existing facilities?
- Can it be phased into connection with the existing system?
- Is it compatible with other planning goals of Dane County and the City of Madison?

### **Ease of Operation**

Some alternatives may be more difficult or challenging to operate. For example, operation of a facility utilizing membrane filtration facility may be more difficult than operating the District's current facility.

## **Social Criteria**

### **Public Acceptance**

Public acceptance will significantly impact the ability to implement an alternative. This criterion assesses the likelihood that an alternative will be accepted or resisted by the public.

### **Staffing Implications**

Alternatives may have different staffing implications, both in terms of staffing level and required skills. For example, operation of multiple plants may be more labor intensive than operation of a centralized system. In addition, operating an advanced treatment (tertiary) system may require a more skilled workforce than operating a secondary treatment system.

## **Environmental Criteria**

### **Carbon footprint**

Carbon footprint is a measure of the impact that the alternative will have on the environment in terms of the amount of the greenhouse gases produced. This carbon footprint of each alternative will be considered.

### **Opportunities for Effluent Reuse**

Effective effluent reuse could reduce the need for groundwater withdrawals from the Madison area aquifer and improve the sustainability in water resource utilization in the Madison and the Dane County areas. Some alternatives may present greater opportunity to beneficially reuse effluent because of location of facilities, level of treatment, etc. The available effluent reuse options include:

- Turf irrigation
- Groundwater recharge
- Industrial water use
- Other uses

**Maintains Watershed Balance**

The volumes and locations at which the District discharges its effluent will have significant impacts on sustaining water level in streams and aquifers, and maintaining watershed balancing throughout the watersheds.

**Madison-MSD 50 Year Master Plan  
Planning Criteria Survey**

Survey Respondent:

Date:

1	2	3	4	5
Ranking Criteria Category	Ranking Criteria	Total Category Weighting Score	Ranking Criteria Weighting Score (1-50)	Comments
<b>Economic Criteria</b>	Life Cycle Cost	0		
<b>Technical Criteria</b>	Regulatory Constraints	0		
	Proven Effectiveness			
	Flexibility/Expandability/Compatibility			
	Ease of Operation			
<b>Social Criteria</b>	Public Acceptance	0		
	Staffing Implications			
<b>Environmental Criteria</b>	Carbon Footprint	0		
	Effluent Reuse			
	Watershed Balance			

**Total Score: 0**

**Note:**

1. Survey respondent should only input in column Nos. 4 and 5 (the areas in yellow color). All other columns were locked for protecting the spreadsheet format and formulas.
2. The respondent should assign a weighting score ranging from 1 to 50 for each criterion in column 4 based on their relative importance. The more important a criterion is, the higher score it should receive.
3. The sum of the weighting scores in column 4 should be equal to 100.

**A Brief Summary of Ranking Criteria Weighting Results  
(04/09/09-prepared by Dave Taylor)**

Ten criteria were identified for possible use in assisting with the ranking of Master Planning alternatives. TAC members and District Directors were each given 100 points and were asked to assign a score to each criterion according to their opinion of its relative importance. A maximum of 50 points could be assigned to any one criterion, with criterion deemed more important being assigned a higher score. Respondents were also given the opportunity to provide comments. Comments were recorded on the individual scoring worksheets which are being sent to you via email.

Responses were received from all but one TAC member and all District Directors. Raw data is given in the spreadsheet that accompanies this memo. Figure 1 compares the TAC and Director scores (average, min and max) for each criterion. The following table lists the criterion from highest to lowest average score for both the TAC and Directors. Use of median scores would not have changed the order for the TAC and would have resulted in minor differences for the Directors.

<b><u>TAC</u></b>	<b><u>Average score</u></b>	<b><u>Directors</u></b>	<b><u>Average score</u></b>
Life cycle cost	15	Life cycle cost	33
Effluent reuse	13	Public acceptance	14
Watershed balance	12	Watershed balance	10
Flexibility	12	Regulatory constraints	9
Public acceptance	10	Flexibility	9
Proven effectiveness	10	Effluent reuse	7
Carbon footprint	9	Proven effectiveness	7
Regulatory constraints	8	Ease of operation	5
Ease of operation	6	Staffing	4
Staffing	5	Carbon footprint	3

Drawing conclusions from the data is challenging because it is difficult to know the thought process that respondents used when assigning scores. For example, some respondents may have thought that while carbon footprint is important, it basically comes down to energy consumption, which was accounted for in the life cycle cost. Therefore, they may have assigned more points to life cycle costs and fewer points to carbon footprint. That said, some initial observations are given below:

- In general, the TAC scores were grouped tighter than the Director's scores.

- Both groups assigned the highest score to life cycle cost. There was a small gap between life cycle cost and the next highest ranked criterion for the TAC and a substantial gap for the Directors.
- Public acceptance and regulatory constraints were ranked relatively high by Directors-the TAC ranked these categories lower.
- Watershed balance received a relatively high score from both groups, but the TAC assigned a higher score to effluent reuse than the Directors.
- Ease of operation and staffing received relatively low scores from both groups.

We will need to get together with Malcolm Pirnie to discuss the scoring information and determine how to best use this information moving forward.

### Ranking Criteria Weighting Factors TAC vs. MMSD Staff

