ACE Consultants, Inc.

City of Madras

Wastewater System Master Plan

REGISTERED PROFESSIONAL ENGINEER 9673 OREGON JULY 14, 1978 WEN H. JOU

Exp. 6-30-97

Amended
November 15, 1996

4755 S.W. Watson Avenue
Suite 200
Beaverton, Oregon 97005
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CIVIL / ENVIRONMENTAL ENGINEERS

ACE Consultants, Inc.

February 5, 1997

Honorable Mayor and Council
City of Madras
71 S.E. D Street
Madras, OR 97741-1685

Re: Amended Wastewater System Master Plan

Honorable Mayor and Council:

In our letter of transmittal dated November 15, 1996, we have summarized the amended items of the master plan. This letter further outlines the amendment and clarifies the assumptions and our recommendations.

Amendment

Items amended in the Master Plan dated November 15, 1996 include:

1. For the existing treatment plant upgrade, the addition of aerators in two primary ponds and the modification of existing Storage Pond to increase the storage volume are recommended instead of Lemna System originally proposed. Discussions with DEQ and the City and further evaluation of Lemna System have concluded that Lemna System would not be as viable or cost effective as conventional aerators. In addition, Lemna System has not been used in this region and its performance cannot be determined. (Pages 6-18 to 6-21)
2. A sludge drying bed at the existing north treatment plant has been added to reduce the operation and maintenance cost of sludge disposal. Also sludge lines and pumps are added to SandFloat system to alleviate the present line clogging problem. (Page 6-19 and Pages 7-16 to 7-42)
3. Modification of the discharge to Willow Creek option (Alternative 7) with a filtration process to ensure high effluent quality followed by wetlands for enhancing wildlife habitats. (Pages 6-23, 7-34 to 7-36)
4. Addition of land costs in all alternatives (Pages 7-16 to 7-42) and addressing comments from Rural Economic and Community Development, mostly typos. A flood boundary map (Figure 7-1) at the proposed south treatment plant site and evaluation of the new plant site (Page 7-6) have been added.
5. Addition of a public involvement section in Chapter 8.

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Alternative 5 - SBR South Plant with Irrigation vs.
Alternative 7 - SBR/Filtration South Plant with Discharge to Willow Creek

In the Master Plan, we have recommended the implementation of either Alternative 5 or Alternative 7. The present worth analysis may have indicated that a mechanical plant with effluent irrigation (Alternative 5) would have a lower present worth than that with effluent discharge into Willow Creek (Alternative 7) though Alternative 5 has a higher capital cost. Our analysis was based on the assumptions that Level II effluent can be used for irrigation and storage ponds can be located within one mile of the plant site. If no land for applying Level II effluent can be found and Level IV effluent is required, then the capital cost and present worth for Alternative 5 can be substantially higher than those presented in the Master Plan. Therefore we have evaluated the impact of Level IV effluent requirements and a longer irrigation line (2 miles instead of 1 mile) on the cost of Alternative 5. Our further analysis has found that Alternative 5 with Level IV effluent treatment will cost 21 million vs. 17.4 millions for Alternative 7. The present worth of Alternative 5 compares favorably with that of Alternative 7.

With the Level IV effluent constraints and a longer irrigation line (2 miles), Alternative 5 would not be as cost effective as Alternative 7. Beside, Alternatives 7 will allow the City to have a total control of the entire wastewater system; whereas the City would be at the landowner's mercy for meeting the regulations for irrigation under Alternative 5 scheme. In light of the impact stated herein, we are in favor of implementing Alternative 7. Since the main components for either Alternatives are the same, the City can always fall back to Alternative 5 for irrigation if the permit for discharge to Willow Creek cannot be obtained in time for the Phase 1 implementation.

Finally we would like to emphasize that costs presented in the Master Plan are order-of-magnitude figures for comparison of various alternatives under consideration. These are in 1995 dollars. More detailed cost estimates should be prepared during the design based on actual design details and allowances for inflation and then market conditions. We have seen substantial price increases in the construction industries recently and would have no doubt about the cost escalation when the proposed improvements are bid.

Again we appreciate your input and assistance in completing your Master Plan.

Respectfully yours,

Wen H. Jou

Wen H. Jou, P.E.
Principal

ACE Consultants, Inc.

November 15, 1996

Honorable Mayor and Council
City of Madras
71 S.E. D Street
Madras, OR 97741-1685

Honorable Mayor and Council:

We have completed and amended the Madras Wastewater System Master Plan. This Master Plan was ammended and expanded beyond the original scope to include options of wetlands for effluent polishing and direct discharge to Willow Creek and evaluation of 11 alternatives instead of three alternatives required. ACE Consultants completed these additional tasks without additional costs to the City as a way to express our thanks to the Council and City staff working closely with us and providing valuable input as well as assistance during the study period.

The original Plan and recommendations were adopted by the Council at the second public hearing on February 27, 1996. Subsequently the Plan was submitted to Rural Economic and Community Development for comments. On May 14, 1996, a third public hearing was held in one of the Council's regular meetings. In the mean time the City has been exploring the practicality of discharge to Willow Creek option and has found the concept receptive to DEQ and environmental groups. Therefore, the Master Plan was then amended to include the following.

1 Modification of the discharge to Willow Creek option (Alternative 7) with a filtration process to ensure high effluent quality followed by wetlands for enhancing wildlife habitats.
2. Addition of land costs in all alternatives and addressing comments from Rural Economic and Community Development.
3. Addition of a public involvement section in Chapter 8.

We believe this Master Plan will provide the City with a blueprint for the needed wastewater system improvements to meet the growth demand. We appreciate the opportunity to be of service in preparing this plan and look forward to assisting you with its implementation.

Very truly yours,

Wen H. Jou

Wen H. Jou, P.E.
Principal

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CHAPTER 1

SUMMARY AND RECOMMENDATIONS

Summary

1. The study area encompass approximately 7.4 square miles (4,760 acres) compared to 4.5 square miles (2,890 acres) within the present urban growth boundary. The total number of residential dwelling units in the study area was estimated to be 2,600 in 1995, equivalent to a population of 6,700 based on 2.6 people per dwelling unit (County wide density), in comparison with the estimated population of 4,290 within the City limits.

2. From 1970 to 1990, the City of Madras had an annual population growth rate of 3.6 percent, comparing with 2.4 percent in the County. From 1980 to 1990, the City's population grew an average of 4.4 percent. After many workshop sessions among the City Council members and public works staff, County planners and ACE Consultants, an annual population growth rate of 4.5 percent for the 20 year planning period was established for this study. Based on this, the number of dwelling units is projected to reach 6,270 in 20 years, equivalent to a population of 16,300.

3. The existing wastewater collection system consists of approximately 27 miles of 6 to 18 inch diameter collection sewers (23.2 miles for the main system and 3.8 miles for the industrial area system). The wastewater from the main system flows by gravity into the "B" Street Pump Station where it is pumped through 3 miles of 10-inch diameter forcemain. The industrial area wastewater is collected into the Demers Street Pump Station and then pumped through two 4-inch diameter forcemains which connect to the "B" Street Pump Station forcemain.

4. The existing collection system has the capacity to serve the presently sewered area. The analysis indicates that the interceptors tributary to the "B" Street Pump Station are at 60 percent of their maximum capacity, whereas the pump station has reached its design capacity of 440 gallons per minute (gpm). The Demers Street Pump Station has an ample capacity to serve the present industrial development level.

5. The present Madras wastewater treatment plant is a zero discharge facility consisting of a five-cell facultative stabilization pond system followed by dissolved air flotation (DAF), filtration, and disinfection. The pond effluent is stored in a 25-acre storage lagoon during the winter and then pumped to the DAF system for further treatment. The disinfected reclaimed water from the

DAF system is subsequently pumped to the Nine Peaks Golf Course for irrigation.

6. The City of Madras has experienced an explosive growth in the last several years. The unexpected growth has caused a tremendous increase of wastewater flows and loading to the existing plant. Anaerobic conditions in the primary lagoons have been observed. Even though the City no longer accepts septage, the plant has reached its design capacity for treating an average wastewater flow of 450,000 gallons per day.

7. The analysis of the water meter readings and the metered wastewater flows indicated that approximately 91 percent of the industrial water usage and 82 percent of the other uses went into the wastewater collection system. Based on this analysis, the average wastewater flow of 240 gpd per dwelling unit was established and used for projecting future flows from residential areas.

8. The field monitored flows in the interceptor just prior to the existing pump station inlet at the "B" Street Pump Station showed that peak flows occurred between 8 A.M. and noon, matching the pump on-off chart recordings. The peaking factor at this station was calculated to be about 1.8, whereas the peaking factors for other stations vary from 2 to 3. To match the field monitored peaks, an overall peaking factor of 2.6 was used for the sizing of future sewers.

9. The present average wastewater flow fluctuates between 440,000 gpd and 500,000 gpd, which includes 160,000 gpd from the commercial users and 40,000 gpd from the industrial users. The flow will immediately increased to 825,000 gpd if services are provided to the estimated 1,200 dwelling units presently on septic systems within the study area.

10. Using the present wastewater flows and assuming the commercial and industrial flows increase at the same rate as the residential flows, the total projected average wastewater flow will reach 2 million gallon per day (mgd) in 20 years assuming an annual growth rate of 4.5 percent. The projected flow includes an estimated 1.5 mgd for 6,270 residential dwelling units, 0.38 mgd for commercial and 0.12 mgd for industrial. The flow was projected based on demands for sewer services to the existing 1,200 unsewered dwelling units and 3,670 new residential dwelling units and allowances of additional 215,000 gpd commercial and 75,000 gpd industrial flows.

11. Based on the Biological Oxygen Demand (BOD) concentration of 230 mg/l and total suspended solids (TSS) concentration of 230 mg/l, each 0.5 mgd wastewater flow will have a BOD loading of 960 pounds per day (ppd) and a TSS loading of

960 ppd. For a 2-mgd treatment plant, the total loadings to the treatment plant(s) will be 3,840 ppd of BOD and 3,840 ppd for TSS.

12. Additional treatment plant capacity must be provided to accommodate future growth of Madras. Several treatment processes have been investigated to provide the needed treatment and, because of the FAA policy restrictions on construction of new facilities at the airport and the extreme pumping head to deliver the wastewater to the present airport site, a second treatment plant site south of Madras has been included for evaluation.

13. The collection system improvements needed for providing services to the present unsewered and future growth areas depend on where the treatment plant expansion will take place. Two basic scenarios for the treatment plant locations have been considered.

    A Expand the existing 0.45 mgd plant at the existing North Treatment Plant to a 2.0 mgd plant.

    B Upgrade the existing North Treatment Plant to 0.5 mgd to treat present wastewater flows and construct a 1.5 mgd plant at the southeast end of the study boundary.

14. Based on the two basic scenarios for the treatment plant expansion, two alternatives for the collection system improvements have been used for screening wastewater system improvement alternatives.

    Alternative A:

    Wastewater from all areas except the north industrial area will be collected into a new or expanded pump station at the existing "B" Street Pump Station site. The collected wastewater will then be pumped some 200 feet up to the North Treatment Plant. The wastewater from the industrial area will be pumped into the same forcemain.

    Alternative B:

    Wastewater from the southeast area will flow by gravity into the new treatment plant. Flows from the rest of the area will be collected into a new or expanded pump station at the existing "B" Street Pump Station. The collected wastewater will then be pumped separately to the North and South treatment plants. The industrial area flows will be pumped into the existing 10-inch forcemain.

15. The proposed wastewater system improvements are divided into three phases with future average flows of 1.0 mgd for Phase 1, 1.5 mgd for Phase 2 and 2.0 mgd for Phase 3. The Phase 1 improvements can serve up to a total of 3,250 dwelling units (du), an increase of 1,820 du from the currently sewered du of 1,430. An additional 1,550 du and 1,480 du can be served in Phase 2 and Phase 3 respectively. The equivalent total population served would be 8,400 for Phase 1, 12,500 for Phase 2 and 16,300 for Phase 3.

16. In addition to the No-Build Alternative, ten wastewater system improvement alternatives have been evaluated. They are combinations of the Alternative A or B collection system improvements and various treatment /effluent disposal options. These alternatives can be categorized into the following schemes:

Alternative 0

The No-Build Alternative, which consists of modifying existing "B" Street Pump Station and existing Treatment Plant to a 0.5 mgd capacity.

Alternatives 1 through 3

Alternative A collection system improvements and phased expansion of the existing north treatment plant to 2 mgd with direct discharge into a receiving stream or effluent spray irrigation.

Alternatives 4 through 7

Alternative B collection system improvements, upgrading of the existing north treatment plant to 0.5 mgd capacity and phased construction of a 1.5 mgd south treatment plant with direct discharge into a receiving stream or effluent spray irrigation.

Alternatives 8 through 10

Alternative B collection system improvements, upgrading of the existing north treatment plant and immediate construction of a 1.5 mgd south treatment plant with direct discharge into a receiving stream or effluent spray irrigation.

17. The No-Build Alternative makes little provision for allowing Madras to grow and therefore is not viable. Alternative 1 postulates a 2.0 mgd lagoon treatment plant at the existing airport site. The FAA has indicated that no more lagoons may be constructed at that site to meet their criteria for airport operation. Furthermore, the cost of implementing this alternative is estimated to be about 32 million dollars, the highest among alternatives evaluated. Alternative 1 cannot be built, neither is cost effective.

18. The immediate construction of a 1.5 mgd south treatment plant (Alternatives 8 through 10) will require a **Phase 1 capital outlay** of 14 to 16 million dollars comparing with 8 to 9 million dollars for Alternatives 4 through 7 and 11 million dollars for Alternatives 2 and 3. Unless the City can finance the immediate construction of the south treatment plant, Alternatives 8 through 10 cannot be implemented. Besides, there are no clear advantages for building an oversized treatment plant now.

19. Alternatives 2 and 3 for expanding the existing north treatment plant have a **20 year present worth** of approximately 12 to 14 million dollars and will require a **total capital outlay** of approximately 21 to 22 million dollars whereas Alternatives 4 through 7 for upgrading the north treatment plant and constructing a south treatment plant have a 20 year present worth of approximately 10 to 12 million dollars and will have total capital costs of 17 to 20 million dollars. Alternatives 2 and 3 are not cost effective. Besides, expanding the north treatment plant at the airport will be strongly opposed by FAA.

20. The recently proposed changes in DEQ regulations for Alternative Prescription (DEQ letter dated January 9, 1996) may allow surface water discharge without meeting the standard mixing zone requirements provided overall environmental benefits can be demonstrated and no other practical alternatives to the discharge are available. Therefore several alternatives for discharging to a receiving stream have been evaluated. Alternatives 3, 6, and 7 anticipate year-round discharge of treated effluent to surface waters, avoiding major expenses of constructing effluent storage lagoons. Of these, only Alternatives 6 and 7 are competitive cost wise. Alternative 6, which relies solely on wetland treatment to further remove nitrogen and phosphorus to meet stringent effluent quality requirements, cannot guarantee producing effluent in full compliance with the permit conditions. Therefore only Alternative 7 is viable among the three direct discharge options evaluated.

21. The alternative ranking method used in the study considered many attributes including Net Present Worth Cost, Safety and Convenience, Wildlife and Environment, Growth Inducement, and Public/Agency Response. It ranked

Alternative 5 as the first choice. Given possible changes in DEQ regulations for the effluent discharge and the indicated support from regulatory agencies and environmental groups for the benefit of augmenting Willow Creek flow and enhancing wildlife habitats, Alternative 7 for year-long effluent discharge into Willow Creek deserves a closer examination.

22. Alternative 5 is the most viable alternative because it has the lowest Present Worth and ranks highest on the Multi-Attribute Analysis. It consists of the following components sized for incremental construction of a total of 2.0 mgd wastewater treatment and collection system capacity in 0.5 mgd increments as dictated by the growth within the study boundary.

Phase I

- Phase I, Alternative B Sewer System Improvements
- "B" Street PS Upgrade to 0.5 mgd Average Flow Capacity
- Upgrade of the Existing NWWTP (Airport) to 0.5 mgd by Aeration
- New SWWTP PS at "B" Street sized for 0.35 mgd average flow
- New 0.5 mgd Sequencing Batch Reactor DEQ Level II Plant at South site
  - Influent Pump Station
  - SBR units
  - Chlorine Disinfection
  - Aerobic Digestion
  - Sludge Drying Beds
- Off-site Level II Effluent Storage
  - Effluent Distribution Pumps
  - 1 mile 6" Effluent FM
  - 0.5 MGD Off-site Storage Lagoon
- Irrigation of privately owned land by others (property owner)

Phase II

- Phase II, Alternative B Sewer System Improvements
- Upgrade SWWTP PS at "B" Street sized for 0.70 mgd average flow
- Added 0.5 mgd Sequencing Batch Reactor DEQ Level II Plant at South site
  - Influent Pump Station Upgrade
  - 0.5 mgd SBR units
  - 0.5 mgd Chlorine Disinfection
  - Additional Aerobic Digestion
  - Additional Sludge Drying Beds

Off-site Level II Effluent Storage
Added Effluent Distribution Pumps
Second 1 mile 6" Effluent Forcemain
Second 0.5 MGD Off-site Storage Lagoon
Irrigation of privately owned land by others

Phase III

Phase III, Alternative B Sewer System Improvements
Upgrade SWWTP PS at "B" Street sized for 1.0 mgd average flow
Added 0.5 mgd Sequencing Batch Reactor DEQ Level II Plant at South site
Influent Pump Station Upgrade
0.5 mgd SBR units
0.5 mgd Chlorine Disinfection
Additional Aerobic Digestion
Additional Sludge Drying Beds
Off-site Level II Effluent Storage
Added Effluent Distribution Pumps
Third 1 mile 6" Effluent Forcemain
Third 0.5 MGD Off-site Storage Lagoon
Irrigation of privately owned land by others

The order-of-magnitude conceptual cost estimates are $8,000,000 for Phase 1, $5,300,000 for Phase 2 and $5,600,000 for Phase 3 with a total of $18,900,000.

23. Alternative 7 will require building filters to ensure removal of nitrogen and phosphorus to the acceptable limits and constructing wetlands to enhance wildlife habitats for the Willow Creek basin in addition to those three-phase elements as described above for Alternative 5, but without irrigation or winter storage. The order-of-magnitude conceptual cost estimates are $8,100,000 for Phase 1, $4,500,000 for Phase 2 and 4,800,000 for Phase 3 with a total 17,400,000.

Recommendations

Based on the screening and evaluation of 10 alternatives, ACE Consultants recommends,

1. Alternative 5 or Alternative 7 be implemented by the City of Madras depending on whether a NPDES permit for discharging into Willow Creek can be obtained from DEQ. Alternative 7 may take substantially longer to implement because of

the uncertainty in obtaining the necessary regulatory approval and possible oppositions from environmental groups or others.

2. Further study of constructed wetlands and mixing zones as well as beneficial use of the Willow Creek be conducted and DEQ approval as well as a NPDES permit be obtained before Alternative 7 can be implemented.

3. Additional effluent storage and irrigation sites be identified and arrangement for purchasing, leasing or irrigation contracts be made in order to successfully implement Alternative 5 treatment improvements.

4. Modification of the "B" Street Pump Station and upgrading of the existing north treatment plant to provide 0.5 mgd capacity as part of the Phase 1 improvements be implemented as soon as possible to alleviate the overloading conditions and provide additional capacity while financing is being arranged and the design and construction of the south treatment plant takes place. It is estimated that the Phase 1 improvements including financing, engineering and construction will take over two years to complete.

CHAPTER 2

INTRODUCTION

Authorization

On April 25, 1995, the Madras City Council approved the "Letter Agreement for Professional Engineering Services" with ACE Consultants for preparation of the Madras Wastewater System Master Plan. The Notice-to-proceed was issued on May 1, 1995.

Background

The existing waste stabilization lagoon system was constructed in 1974. Recently the City of Madras completed the addition of a 25 acre effluent storage lagoon and a dissolved air flotation unit (DAF) followed by filtration. The storage pond was added to provide up to 4 months of wintertime storage and the DAF system was designed to treat an average annual plant effluent of 0.5 mgd. The capacity of the lagoon system was not augmented, but the plant effluent quality was upgraded and the reclaimed water is being applied to the nearby golf course.

The City of Madras has experienced an explosive growth in the last several years. The unexpected growth has caused a tremendous increase of wastewater flows and loading to the existing plant. Anaerobic conditions in the primary lagoons have been observed. Even though the City no longer accepts septage, the plant has reached its design capacity. The main pump station at "B" Street is also approaching its maximum capacity. The existing wastewater system really needs to be expanded or upgraded to cope with the increasing demand.

Purpose and Scope

The purpose of this study is to provide a long range planning of the wastewater system improvement needs to meet the growing demand for sewer services. The scope of work includes:

1 Evaluate existing wastewater system including collection, pumping and treatment.

2. Project future needs for expansion.

3. Develop alternative conceptual layouts of the wastewater collection system improvements.

4. Perform screening of treatment alternatives and develop conceptual layout plans.

5. Prepare order-of-magnitude cost estimates for alternative comparison.

6. Address effluent and sludge disposal issues.

The detailed description of the scope of work is included in the proposal submitted by ACE Consultants, which is attached in the Appendices.

CHAPTER 3

EXISTING CONDITIONS

Study Area

Boundary

The study area of the wastewater system master plan was established by the City of Madras. The area consists of an industrial area to the north, the existing sewered area primarily within the city limits, and future growth areas to the east and the south. Figure 3-1 shows the study boundary with present City limits and urban growth boundary.

The study area encompass approximately 7.4 square miles (4,760 acres) comparing with 4.5 square miles (2,890 acres) within the present urban growth boundary. The area extends westerly to the Burlington Northern Railroad and Bear Drive, southerly to Colfax Lane, easterly to about Bean Drive, and northerly to the industrial park.

Topography

The City of Madras lies in a basin at the head of the Willow Creek Canyon which cuts through Agency Plains to the Deschutes River. The land is moderately sloping except on the north side of the Town where it slopes steeply up to the Agency Plains. Except for the Madras Industrial Park, which is located on Agency Plains and tends to slope to the west, both the south and north areas drain into the City to Willow Creek.

The elevation at the lowest part of Madras is about 2,230 feet. The elevation in the south area varies from 2,260 to 2420 feet. The elevation in the north area varies from 2,250 feet to 2,480 feet on Agency Plains.

Figure 3-1 shows the study area topography based on the USGS maps with contours in 20 foot intervals.

Hydrology

Most of the study area lies in the Willow Creek basin, a sub-basin of the Deschutes River basin. Willow Creek is an intermittent stream that normally flows from about mid-December through mid-July. During the summer and fall months, irrigation runoff and occasional heavy thunder showers are the only sources of flow to the creek.

The groundwater table occurs at an altitude of about 1,900 feet in the Madras area (approximately 300 feet below the ground surface) and appears to have a gradient to the northwest, under Agency Plains to the Deschutes River. Perched ground water can be found in a gravel layer on top of impermeable sandstone in some areas of Town. This water may be as shallow as 18 to 20 feet below the ground surface and appears to lie in old stream beds of willow Creek.

Climate

The Madras area lies in the weather shadow of the Cascade Range, causing a semi-arid climate. The area receives only about 10 inches of precipitation annually and experiences nearly 50 inches of evaporation. The area has an average annual snowfall of about 15 inches and a growing season of 100 days.

The climatological data is shown in Table 3-1

Table 3-1 Madras Area Climatological Data

Month	Mean Temperature F	Monthly Mean Precipitation Inches	Average Evaporation Inches
Jan	33.00	1.33	--
Feb	37.90	0.88	--
Mar	41.90	0.84	--
Apr	46.80	0.71	5.26
May	53.80	0.79	7.25
June	61.30	0.78	8.70
July	66.80	0.44	10.17
Aug	66.20	0.54	9.06
Sept	58.60	0.54	6.15
Oct	49.00	0.70	3.29
Nov	39.70	1.52	1.80
Dec	33.30	1.48	--
Year	49.00	10.89	51.67

Source: Oregon Climate Service, Oregon State University Record from 1961 to 1990

Geology

Madras lies in a small valley in a broad flat plain, which lies between the Cascade Mountain on the Ochoco Mountains on the east. This valley is rimmed on the west by the edge of a basaltic lava flow, sometimes called the "Rimrock Lavas".

The area is underlain by the Madras formation, composed of stratified lava flows. The sedimentary layers of this formation are fine grained and do not provide a good aquifer, but the gravel lenses and interbed volcanic material yield moderate to large supplies of groundwater.

Soils

The soils found in the area are predominately of Madras ad Metolius series. Metolius series are found in a narrow strip along Highway 97 north of Town and soils generally classified as Roughland, Scabland, Volcanic Ash, and Agency soils are found along the rim rock at the west side of the study area.

The metolius soil is a well drained, sandy loam soil formed from alluvial or aeolian materials. The permeability is moderately rapid, but the runoff is slow. Because of the potential to flooding, the soils have been given a moderate rating for septic installations. These soils are highly suited for agricultural crops having an effective rooting depth of 60 inches or more. The Soil Conservation Service has rated the Metolius series in Capability Classifications II and III, when irrigated.

The Madras series found in the study area consists of sandy loam soils formed in colluvium. The soils are relatively shallow, having a depth to hardpan of 20 to 30 inches and a depth to bedrock of 25 to 40 inches. Both the hardpan and bedrock are "rippable". The Soil Conservation Service has rated the Madras series soils in Capability Classifications II, III, and IV, with irrigation. Drainage varies from rapid through the surface layers to very slow through the hardpan. The Madras soils generally have moderately severe to severe limitations for the tilled crops use. The land is used primarily as range land and dry farming with a low yield of grain crops being produced.

The Roughland, Scabland, and Volcanic Ash and the Agency soils found along the "rimrock" are too stony to be tilled. Steep slopes limit irrigation, making this land unsuitable for agricultural uses.

Population and Land Use

Population

According to the Madras Transportation Plan developed by DEA in January 1995, the estimated 1994 population within the greater Madras area is 7,394. The number of dwelling units is estimated at 2,800, of which 1,683 are single family homes and 1,121 are multi-family units. As shown in Figure 3-2, the Transportation Plan study area is substantially larger than that of the Wastewater System Master Plan. Based on the information provided in the plan and by the City, the total number of residential dwelling units in this study area was estimated to be 2,600 as shown in Table 3-2 below. The equivalent 1994 population was approximately 6,700 based on 2.6 people per dwelling unit (County-wide density), in comparison with the estimated population of 4,290 within the City limits.

Table 3-2 Madras Area Existing Residential Dwelling Units

Year	1990			1994		
TAZ	SF du	MF du	Total	SF du	MF du	Total
1	20	52	72	24	63	87
2	20	20	40	Not within study area		
3	7	8	15	Not within study area		
4	50	38	88	61	46	107
5	90	13	103	109	16	125
6	21	11	32	Not within study area		
7	46	3	49	56	4	60
8	123	50	173	149	61	210
9	49	6	55	59	7	66
10	3	0	3	4	0	4
11	24	84	108	29	102	131
12	3	0	3	4	0	4
13	99	36	135	120	44	164
14	30	14	44	Not within study area		
15	9	55	64	11	67	78
16	90	60	150	109	73	182
17	73	37	110	89	45	134
18	6	58	64	7	70	77
19	118	43	161	143	52	195
20	27	4	31	33	5	38
21	81	4	85	98	5	103
22	16	2	18	19	2	21
23	55	21	76	67	25	92
24	21	42	63	25	51	76
25	18	41	59	22	50	72
26	5	4	9	6	5	11
27	2	0	2	2	0	2
28	17	55	72	21	67	88
29	48	23	71	58	28	86
30	12	20	32	15	24	39
31	18	45	63	22	55	77
32	54	20	74	46	17	63
33	104	34	138	126	41	167
34	20	14	34	24	17	41
35	8	7	15	Not within study area		
	1,387	**924**	**2,311**	**1,558**	**1,042**	**2,600**

Source: Madras Transportation System Plan, January 1995

Land Use

The Jefferson County is presently revising the land use plan. A preliminary plan attained from the County's consultants is shown in Figure 3-3. Basically the area north of Birch Lane is for industrial use with some residential housing by the Nine Peaks Golf Course. The area within the City limits is fairly built up, comprising of single and multiple family dwellings, mobile home parks and commercial establishments. The commercial use is concentrated in a strip along Highway 96 and Highway 26. The area west of the City limits is primarily vacant land or for agricultural use. The area east from the City limits to the study boundary is mostly undeveloped only with scattered housing development and a recently constructed Junior High School. The south end is also undeveloped.

Present Collection and Treatment Plant Conditions

General

The existing Madras wastewater system is shown in Figure 3-4A through Figure 3-4C. The collection system is divided into two gravity collection systems, one main system serving the area between Cedar Street and Bell Street south of Fairgrounds Road and one small system for the industrial park at the north end of the City. Sewage is pumped respectively from the "B" Street Pump Station and the Industrial Area Pump Station to the treatment plant near the Madras Airport through a common forcemain.

Collection System

The main collection system consists of approximately 3,600 feet of 10 to 18 inch diameter interceptor sewer and 119,000 feet of 8" and 6" diameter collector sewer, or a total of 23.2 miles of sewer. Sewage flows by gravity from the south to the north and discharges into the "B" Street Pump Station. The flow is then pumped over 200 feet up through 3-miles of 10-inch diameter forcemain to the treatment plant located at the Madras Airport.

The Industrial Park collection system consists of approximately 12,300 feet of 8" diameter sewer and 7,600 feet of 10" diameter sewer. Sewage is collected into the pump station located at Demers Drive and pumped to the treatment plant through two 4" diameter forcemains which are tied to the same 10" forcemain for the 'B" Street Pump Station.

The gravity sewer pipe constructed prior to the 1980's is asbestos cement pipe with rubber ring joints and the newer sewer is PVC. According to the City, there have been no reports of collection system failure or surcharge. No significant infiltration and inflow problems have been experienced. The collection system has the capacity to serve the presently sewered area.

The "B" Street pump Station has two sets of dry-pit Cornell sewage pumps, each with two pumps operating in series. Only one set of pumps is allowed to operate and the other set is used as standby. The Station was designed and built in the 1970's to pump 440 gallons per minute (gpm) at 240 feet of head with one set of pumps operating. The recent population explosion in the Madras area has caused a significant increase in the influent flows to the pump station. From the pump on-off recording charts, one of the two pump sets operates almost continuously during the morning peak three hour period. This clearly indicates that the pump station has reached its design capacity. Furthermore, the existing pumping equipment is obsolete and its long vertical motor drive shaft has been a maintenance problem. The previously planned expansion scheme of changing the pump impellers and adding two accumulators (surge cushion air chambers) to double its capacity is no longer feasible.

The existing industrial area pump station (Demers Drive Pump Station) has two submersible Flygt pumps. Based on the records obtained from the pump manufacturer's vendor - Queen Pump Company, the Station was designed with operating conditions of 150 gpm at 87.5 feet of head and 290 gpm at 76 feet of head. The field test performed by the City indicated a pumping rate of 270 gpm with one pump operating. Because its pump discharge is tied to the "B" Street Pump Station forcemain, the pumping capacity can fluctuate depending on the downstream hydraulic conditions. From the pump operating hour meter records, the existing Demers Drive Pump Station operates an average of 2 hours a day. Its capacity is more than adequate to meet the present industrial area demand. No significant operation and maintenance problems have been reported.

Treatment Facilities

Existing Effluent Limitations

The existing Water Pollution Control Facilities Permit (WPCF) expiring on August 31, 1997 disallows discharging of effluent into state waters. Land application of effluent is allowed provided the practice meets the requirements of OAR 340-55. Either Level II or Level IV treatment is acceptable for the land application. Presently Level IV reclaimed water is produced and used for irrigation at the Nine Peaks Golf Course. The existing WPCF permit is included in the Appendices.

Existing Plant Performance

The present Madras wastewater treatment plant is a zero discharge facility consisting of a five-cell facultative stabilization pond system followed by dissolved air flotation (DAF), filtration, and disinfection. The lagoon system includes two 10-acre primary ponds, two 2-1/2 acre secondary ponds and a 2-1/2 acre polishing pond. The pond effluent is stored in a 25-acre storage lagoon during the winter and then pumped to the DAF system for further treatment. The disinfected reclaimed water from the DAF system is subsequently pumped to the nearby golf course for irrigation.

The stabilization pond system was originally designed for an average flow of 450,000 gallons per day (gpd). The increased flows and loadings to the plant in recent years have resulted in the reported anaerobic conditions in the primary lagoons. The calculations confirm that the lagoon system is at its design biological capacity even without septage load. The City used to allow dumping of septage into the existing headworks at the treatment plant. Because of the prevailing anaerobic conditions in the lagoons, the City no longer accepts septage disposal at the plant.

The recently completed DAF system has a design capacity of 1 million gallons per day (mgd). During the irrigation season, it treats not only the lagoon effluent but also the effluent stored during the winter months. Because the DAF plant only operates 6 to 8 months in a year, it has a flow capacity equivalent to an annual average of 0.5 mgd. The DAF system is capable of producing effluent meeting the Level IV requirements as defined in Chapter 340, Division 55 of Oregon Administrative Rules for irrigation of the golf course with contiguous residences. DAF is a fairly expensive system to operate. Heavy algal growth in the polishing pond contributes to the high consumption of chemicals, reported at $800 a day.

The solids from the DAF system is stored in a 700,000 gallon, 8 feet deep storage lagoon. Presently the sludge lagoon is close to full and needs to be dredged and hauled to DEQ approved disposal sites. Preliminary estimates indicate the need for sludge removal once a year.

The 1993 surveys of the sludge depth blanket in the primary ponds indicated an average accumulation of 12 to 18 inches over the last 20 years. The sludge will soon need to be dredged to regain the lost hydraulic capacity.

CHAPTER 4

FUTURE CONDITIONS

Population and Land Use Projections

Population projections for the study area are not readily available. The U.S. Census figures for the City of Madras and Jefferson County as shown in Table 4-1 provide some basis for the population forecast in the area. From 1970 to 1990, the City of Madras had an annual population growth rate of 3.6 percent, comparing with 2.4 percent in the County. From 1980 to 1990, the City's population grew an average of 4.4 percent. The recent unofficial growth rate is said to be over 5 percent. After many workshop sessions among the City Council members and public works staff, County planners and ACE Consultants, an annual population growth rate of 4.5 percent for the 20 year planning period was established for this study.

Table 4 - 1 Historical Population Growth Trend

	Jefferson County			City of Madras		
Year	Population	Growth Rate 1980-90	Growth Rate 1970-90	Population	Growth Rate 1980-90	Growth Rate 1970-90
1970	8,548			1,689		
1980	11,599	3.1%		2,235	2.8%	
1990	13,676	1.7%	2.4%	3,443	4.4%	3.6%

Source : US Census

Although the population projections are useful for master planning, the residential dwelling unit projections coupled with the projected commercial and industrial growth are more applicable for the wastewater system planning. Within the study area, there are estimated 2,600 dwelling units both sewered and unsewered (i.e. with septic system). Based on this and 4.5 percent growth rate, the number of dwelling units is projected to reach 6,270 in 20 years, equivalent to a population of 16,300.

The distribution of these dwelling units in the study area is based on the preliminary land use plan yet to be adopted by the County and has been revised to reflect the comments from the City's review committee. Table 4-2 shows the dwelling unit projections in the Transportation System Plan versus those in this study.

Table 4 - 2 Dwelling Unit Projection Comparison

Year TAZ	Transportation System Plan Projection 1994 SF du	MF du	Total	2015 SF du	MF	Total	% Allocated to Study or du/Acre	Master Plan Projection 2015 SF du	MF du	Total
1	24	63	87	24	63	87	100%	24	63	87
2		Not within Study Area								
3		Not within Study Area								
4	61	46	107	112	121	233	100%	82	46	128
5	109	16	125	165	16	181	4 /ac	68		68
6		Not within Study Area								
7	56	4	60	199	4	203	100%	200	0	200
8	149	61	210	262	61	323	Note 1	324	61	385
9	59	7	66	362	7	369	100%	352	0	352
10	4	0	4	38	0	38	100%	38	0	38
11	29	102	131	29	102	131	100%	29	67	96
12	4	0	4	4	0	4	100%	27	0	27
13	120	44	164	257	44	301	Note 1	362	44	406
14		Not within Study Area								
15	11	67	78	204	127	331	Notes 2 & 5	346	127	473
16	109	73	182	128	133	261	100%	126	133	259
17	89	45	134	89	45	134	100%	99	76	175
18	7	70	77	7	70	77	100%	37	0	37
19	143	52	195	206	52	258	100%	282	0	282
20	33	5	38	33	5	38	100%	46	0	46
21	98	5	103	136	5	141	100%	178	0	178
22	19	2	21	26	2	28	100%	27	0	27
23	67	25	92	82	25	107	100%	101	0	101
24	25	51	76	132	51	183	Note 2	200	116	316
25	22	50	72	22	50	72	100%	22	23	45
26	6	5	11	6	5	11	100%	6	0	6
27	2	0	2	37	0	37	Note 3	523		523
28	21	67	88	36	67	103	100%	63	22	85
29	58	28	86	58	28	86	Notes 2 & 4	948		948
30	15	24	39	83	94	177	100%	143	0	143
31	22	55	77	34	55	89	100%	39	30	69
32	46	17	63	172	17	189	None			
33	126	41	167	126	41	167	100%	142	0	142
34	24	17	41	399	17	416	Note 4	631	0	631
35		Not within Study Area								
	1,558	1,042	2,600	3,468	1,30	4,775		**5,462**	**808**	**6,270**

Note 1: Allowed a total of 300 du for the recently proposed development at Lakeside Dr. & Loucks
Note 2: Added a total of 300 du for the recently proposed development, units distributed in proportion to each tributary area
Note 3: Added 500 du for the recently proposed subdivision
Note 4: Added 700 du for Zone 29 (SW Study Area) and 190 du for Zone 34 (East Study Area), projecting higher growth
Note 5: Added 64 unit apartment complex at Madison St. and M St.

Some units projected in the Transportation Plan have been reduced or removed and reallocated because the area within the zone cannot accommodate the number of units projected, or the existing topography does not allow further development or the area has been fully developed. Several recently proposed or future major development listed in the following have been added to the appropriate zones.

1. 300 units at Lakeside Drive and Loucks Road
2. 300 units west of Culver Highway and around Belmont Lane
3. 500 units east of Adam Drive and south of Tracie Street
4. 700 units west of SW Sunset Drive and south of Belmont Lane
5. 190 units east of Grizzly Road and south of Ashwood
6. 64 unit apartment complex at Madison Street and M street

Wastewater Flow and Loading Projections

Wastewater Flow Analysis

In order to reasonably project wastewater flows, analysis was first carried out to determine the average wastewater flow for a typical household (or an equivalent dwelling unit).

Based on the meter readings from the City and Deschutes Water District, total water usage was separated into four categories, i.e. single family, multiple family, commercial and industrial uses. The total average water consumption was then compared with the average wastewater flow to the existing treatment plant. The analysis indicated that approximately 91 percent of the industrial water usage and 82 percent of the other uses went into the wastewater collection system.

Excluding multiple family, commercial and industrial uses, the average water consumption for a single family dwelling was estimated to be about 230 gallons per day (gpd). Using the 82 percent ratio, the resulting sewage flow per dwelling unit was calculated to be 190 gpd or equivalent to 73 gallon per capita per day (gpcd) based on an average of 2.6 persons per dwelling. This is somewhat lower than the 85 gpd average used in the previous Wastewater Facilities Plan. Without in-depth study and monitoring of the water usage and wastewater flows in the system, an average wastewater flow of 240 gpd per equivalent dwelling unit has been used in this master plan to ensure proper sizing of the proposed wastewater system improvements.

Table 4-3 on the following page summarize the results of the Madras area wastewater flow analysis.

Table 4 -3 Madras Wastewater Flow Analysis

1. Number of Water Service Connections

	Madras	Deschutes	Total
Single Family	669	258	927
Multiple Family	17	10	27
Commercial	183	37	220
Industrial		30	30
Total	869	335	1,204

2. Average Water Consumption, gpd

	Madras	Deschutes	Total
Single Family	131,720	69,492	201,212
Multiple Family	59,509	31,416	90,925
Commercial	146,417	46,675	193,092
Industrial		44,182	44,182
Total	337,646	191,765	529,411

3. Average Dry Weather Watewater Flow Projections

	Water Consumptions gpd		Wastewater Flow gpd		Ration Wastewater/Water
	Total	Per Connection	Total	Per Connection	
Industrial Park	44,182	1,473	40,400	1,347	0.91
Others	485,229	413	400,000	341	0.82
Total	529,411	1,886	440,400	1,687	

Single Family: (Excluding 50 connections with zero water consumption)

	Water		Wastewater
Per Connection	230 gpd		190 gpd
	Add	25%	50 gpd
For this study, use			240 gpd

Flow Projections

Table 4-4 shows the population and wastewater flow projections with various growth rates.

Table 4-4 Population and Wastewater Flow Projections

	Assume	2.6 persons/du						
	Planning Period	20 years						
Year	Projected Growth Rate	# of Projected Dwelling Units	Population	**Projected** Residential gpd	**Average** Commercial gpd	**Wastewater** Industrial gpd	**Flows** Total gpd
1995	Existing Sewered Area	1,430	4,290	300,300	160,273	40,404	500,977
Base	Existing Dwellings	2,600	6,760	624,000	160,273	40,404	824,677
2015	3.0%	4,696	12,209	1,127,013	289,471	72,975	1,489,459
2015	3.5%	5,173	13,451	1,241,628	318,909	80,396	1,640,934
2015	4.0%	5,697	14,812	1,367,261	351,178	88,531	1,806,970
2015	4.5%	6,270	16,303	1,505,000	375,000	117,000	1,997,000

Using the present wastewater flows and assuming the commercial and industrial flows increase at the same rate as the residential flows, the total projected wastewater flows range from 1.5 mgd with a 3 percent growth to 2 mgd with a 4.5 percent growth. The population projections in turn range from 12,200 people to 16,300 people in comparison with the estimated present population of 6,760 in the study area. The 2 mgd wastewater flow includes an estimated 1.5 mgd for 6,270 residential dwelling units, 0.38 mgd for commercial and 0.12 mgd for industrial. This will allow an increase of residential flows equivalent to 3,670 residential dwelling units, 215,000 gpd commercial flows and 75,000 gpd industrial flows.

Loading Projections

The City has been collecting and testing influent samples for Biological Oxygen Demand (BOD) and total suspended solids (TSS) at the existing plant. The results indicated an average BOD concentration of 230 mg/l and TSS concentration of 230 mg/l. Each 0.5 mgd wastewater flow will have a BOD loading of 960 pounds per day (ppd) and a TSS loading of 960 ppd. For a 2-mgd treatment plant, the total loadings to the plant will be 3,840 ppd of BOD and 3,840 ppd for TSS.

CHAPTER 5

COLLECTION SYSTEM IMPROVEMENTS

Existing System Modeling/Review

A sanitary sewer program developed by Eagle Point Software was first evaluated jointly by ACE Consultants and the City for a period of one month. The City subsequently purchased a stand-alone version of the Sanitary Sewer program. The City staff, assisted by ACE Consultants, prepared the sewer system base models to facilitate analysis of the existing sewer system and planning of future collection system improvements. The diameter, length of each sewer between manholes and orientation, pipe invert and manhole rim elevations were coded into the model. The model preparation took a tremendous amount of time to complete, but now the City can use the model to pinpoint the required improvements for any proposed development.

In order to calibrate the computer models to fit the field conditions, sewer flows were monitored and measured with flumes in manholes at the following five locations.

1. MH I1 - 18" interceptor at 1st and "B" Street
2. MH 1.2.3-3 - 8" sewer at 2nd and L St.
3. MH A.2-9 - 8" sewer at 5th and Snook
4. MH A.8-4 - 8" sewer at 8th and "E" Street
5. MH A3 - 8" sewer at 11th and "C" Street

The monitoring results are shown in figures at the end of this Chapter. The flows measured in the interceptor just prior to the existing pump station inlet showed that the peak flow held fairly steady from 8 A.M. to about noon hour, matching the pump on-off chart recordings. A diurnal curve was drawn through the data points. The calculated total flow was about 437,000 gpd, very close to the reported average flow. The peak flow measured was 780,000 gpd or 540 gpm. This shows that the existing pumps are operating at or over the design capacity. The peaking factor at this station was calculated to be about 1.8, whereas the peaking factors for other stations vary from 2 to 3. The peaking factor was adjusted to 2.6 to match the peak flows measured at the other monitoring stations.

The modeling results indicated that the existing system would have sufficient hydraulic capacity to serve the presently sewered area. The interceptors are presently at 60 percent of its maximum capacity and can accommodate an additional average flow of about 250,000 gpd.

Although the Madras experience little infiltration, a 3,500 gpd per mile of sewer was used in the model as an allowance for minor infiltration.

Collection System Improvement Alternatives

The collection system improvements needed for providing services to the present unsewered and future growth areas depend on where the treatment plant expansion will take place. Two scenarios for the treatment plant locations considered are,

1. Expand the existing 0.45 mgd plant at the existing North Treatment Plant to a 2.0 mgd plant.

2. Upgrade the existing North Treatment Plant to 0.5 mgd and construct a 1.5 mgd plant at the southeast end of the study boundary.

The targeted treatment plant capacity is 1.0 mgd for the Phase 1, 1.5 mgd for the Phase 2 and 2.0 mgd for the Phase 3. The detailed screening of the above treatment plant alternatives and phasing is presented in Chapter 7.

To accommodate the above scenarios, two alternatives for the collection system improvements used for screening are described in general as follows.

Alternative A - Wastewater from all areas except the north industrial area will be collected into a new or expanded pump station at the existing "B" Street Pump Station site. The collected wastewater will then be pumped some 200 feet up to the North Treatment Plant. The wastewater from the industrial area will be pumped into the same forcemain.

Alternative B - Wastewater from the southeast area will flow by gravity into the new treatment plant. Flows from the rest of the area will be collected into a new or expanded pump station at the existing "B" Street Pump Station. The collected wastewater will then be pumped separately to the North and South treatment plants. The industrial area flows will be pumped into the existing 10-inch forcemain.

Alternative A and Alternative B collection system improvements are shown in Figures 5-1A through 5-1C and Figures 5-2A through 5-2B respectively. These improvement alternatives are made based on the USGS contours at 20 foot intervals. Some adjustment may be necessary during the detail design when the more accurate surveys are available.

Collection System Improvement Phases

During the workshop sessions, the future growth areas were ranked based the growth trend and goals as well as the present land use plan. The ranking of potential growth areas is as follows.

1. East of Adams Street and south of Ashwood Road.

2. East of Lakeside Drive and south of Loucks Road.

3. West of Culver Highway and south of Belmont Lane.

4. East of Highway 97 and north of Colfax Lane, zoned County Commercial at the south end of the study area. This area is least likely to be developed soon.

Based on the above criteria, various combinations of sewer flow routing were modeled. The results of the modeling are summarized in the following.

1. The commercial flows allocated for the south end area east of Highway 97 could not be routed through the existing sewers along Celilo Street without causing surcharging conditions in 2nd Street sewer. Because this area may not be developed soon, it will be cost effective to pump the flows into the south interceptor avoiding the need to construct an interceptor through the downtown area.

2. The area west of Culver Highway cannot be served by the existing sewer system along the highway and through 1st Street. When the area develops, a 10" interceptor along the Highway to the "B" Street will need to be installed.

3. For the north area, the existing 8" sewer along Highway 97 can accommodate flows from the new development south of Loucks and east of Lakeside Drive. Further development to the east or additional industrial flows from the north will require the construction of a 10" interceptor along Highway 97 to "B" Street and a 12" interceptor to the proposed pump station addition.

4. The industrial area sewers have capacities to accommodate the projected 55,000 gpd flows. Flows up to 20,000 gpd from the industrial development east can flow by gravity to the "B" Street Pump Station without pumping.

The proposed improvements as modeled in the Sanitary Sewer program are divided into the following three phases.

Phase 1 - The phase 1 improvements will allow development north of "J" around Marshall street, 64 unit apartment complex at Madison Street and M street, additional dwelling units around Juniper and "A" Street. This will also serve the recently proposed 500 unit subdivision east of Adam Drive and south of Tracie Street, and 300 units at Lakeside Drive and Loucks Road. A flow of 12,000 gpd is included for the commercial development along Highway 97 between Chestnut and Jefferson. A 20,000 gpd is reserved for the industrial development at Cherry Lane and Mill Street area.

Phase 2 - The proposed improvements will extend the Phase 1 collection system southeasterly from Loucks to serve the development south of Bean Drive and provides sewer services to the residents and future development at north end of town west of Highway 26. This will also serve the area northeast of Grizzly Lane, including 190 units east of Grizzly Road and south of Ashwood. Additional commercial flows of 15,000 gpd are included for future development at the north end of Highway 97. An additional reserve of 35,000 gpd is also provided for the industrial park development. The projected flow of 7,200 gpd from the new middle school will be diverted into the new collection system.

Phase 3 - This phase basically serves the remaining areas, primarily west of the Culver Highway. This includes 300 units west of Culver Highway and around Belmont Lane, 700 units west of SW Sunset Drive and south of Belmont Lane, and the County commercial area at the south end. A flow of 20,000 gpd is included for the industrial development east of Highway 26.

Table 5-1 summarizes the flows and the population served by the phased collection system improvements. The Phase 1 improvements can serve a total of 3,250 dwelling units (du), an increase of 1,820 du from the current sewered du of 1,430. An additional 1,550 du and 1,480 du can be served in Phase 2 and Phase 3 respectively.

Table 5 - 1
Wastewater Flows and Population Served by the Phased Collection System Improvements

	Phase 1	Phase 2	Phase 3	Total
Residential DU	3,247	1,546	1,477	6,270
Equiv. Population	8,442	4,020	3,840	16,302
Average Flows (gpd)				
Residential	779,280	371,040	354,480	1,504,800
Commercial	158,280	59,765	157,200	375,245
Industrial	62,181	35,000	20,000	117,181
Total (gpd)	999,741	465,805	531,680	1,997,226

Comparison of Alternatives

Listed in the following are the main components of each Alternatives.

Alternative A:

82,470 feet of 8"
12,800 feet of 10"
6,900 feet of 12"
200 feet of 15"
Addition of wet well capacity and modification of Pump Station, a new "B" Street Pump Station with superstructure, and 16,000 feet of forcemain
Grizzly Pump Station and 5,000 feet of 10" forcemain
Demers Drive Pump Station Modification
Celilo Pump Station and 2,300 feet of 6" forcemain

Alternative B:

76,430 feet of 8"
12,800 feet of 10"
280 feet of 12"
4,370 feet of 24"
Addition of wet well capacity and modification of Pump Station for pumping to the north WWTP, a new "B" Street Pump Station and 5,500 feet of 14" forcemain.
Celilo Pump Station and 2,300 feet of 6" forcemain

Alternative A and Alternative B basically have the same collection system layout, except the following:

1. Sewer System at Southeast Area

Without the South Treatment Plant, a pump station (Grizzly Pump Station) will be required for Alternative A. In addition the existing 8" sewer along Grizzly Lane and other sewers leading to the existing "B" Street Pump Station do not have the extra capacity to handle the increased flow. Therefore, a 12" gravity sewer will be required to carry future flows from this area to the existing pump station. Under the Alternative B scheme, no pump station will be required. Flows from the southeast area will be collected by gravity to the South Treatment Plant.

2. Pump Stations at 1st and "B" Street

For expanding the existing north treatment plant, a large pump station with a maximum capacity of 3,400 gpm and a 16,000' long 16" diameter forcemain paralleling the existing 10" forcemain will be required for Alternative A. Up to 4 sets of two pumps operating in series are needed to overcome a total head of 350 feet. In the contrary, the pump station for the Alternative B will have a capacity of 2,950 gpm at a total head of 60 feet, substantially lower than that of Alternative A. A 14" forcemain of about 5,500 feet long will be required. The existing pumps at "B" pump station will need to be replaced to increase the pumping capacity to 770 gpm.

3. Pump Station at Demers Drive (Industrial Area)

Under Alternative A, the existing submersible pumps will need to be replace with a set of higher head pumps, i.e. 200 gpm at 140 feet of head in Phase 2. No modifications will be required under Alternative B because the existing pumps can deliver about 180 gpm (comparing with 200 gpm required) under the higher head condition imposed by the new sets of pumps in the "B" Street Pump Station. The pump impellers at the "B" Street Pump Station may need to be trimmed to increase Demers Drive Pump Station capacity. These design details will need to be further investigated during the design stage.

Comparative Cost Estimates of Alternatives

The order of magnitude cost estimates for the gravity sewers and pump stations are summarized in Table 5-2. The total cost for Alternate A is $6.8 million and that for Alternate B is $5.0 Million.

Table 5-2 Comparative Cost Estimates

	Alternative A	Alternative B
Gravity Sewers	$3,369,000	$3,302,000
"B" Street Pump Station/Forcemain	$2,415,000	$1,379,000
Grizzly Rd. Pump Station/Forcemain	$470,000	
Celilo St. Pump Station/Forcamain	$284,000	$284,000
Demers Dr.. Pump Station	$221,000	
	$6,759,000	$4,965,000

The breakdown of each component in the three Phases is presented in Table 5-3 through 5-7.

Table 5-3
Alternatives A & B Collection System
Order-of -Magnitude Cost Estimates
Sewer System Improvements

Alternative A

Sewer Size	Phase 1			Phase 2			Phase 3		
8"	20,058	ft	$501,450	27,279	ft	$681,973	35,134	ft	$878,350
10"	2,285	ft	$68,550	2,394	ft	$71,820	8,128	ft	$243,840
12"	6,625	ft	$231,875	275	ft	$9,625			
15"	200	ft	$8,000						
Total			$809,875			$763,418			$1,122,190
Eng. & Cont.	25%		$202,469			$190,855			$280,548
Total	**Phase 1**		**$1,012,344**	**Phase 2**		**$954,273**	**Phase 3**		**$1,402,738**
Grand Total			**$3,369,355**						

Alternative B

Sewer Size	Phase 1			Phase 2			Phase 3		
8"	17,017	ft	$425,425	27,279	ft	$681,973	35,134	ft	$878,350
10"	2,285	ft	$68,550	2,394	ft	$71,820	8,128	ft	$243,840
12"		ft		275	ft	$9,625			
15"	4,366	ft	$261,960						
Total			$755,935			$763,418			$1,122,190
Eng. & Cont.	25%		$188,984			$190,855			$280,548
Total	**Phase 1**		**$944,919**	**Phase 2**		**$954,273**	**Phase 3**		**$1,402,738**
Grand Total			**$3,301,930**						

Table 5-4 Alternative A Collection System, Order-of-Magnitude Cost Estimates
"B" Street pump Station Modification/Expansion

Phase 1 - Modify Existing "B" Street Pump Station (3 sets of new pumps), expand wet well and add new 16" forcemain.
Phase 2 - Add superstructure and one set of pumps and electrical services/control.
Phase 3 - Add one set of pumps and electrical services/control.

	PHASE 1				PHASE 2				PHASE 3			
A. Pump Station	Qty.	Furnish	Install	Total	Qty.	Furnish	Install	Total	Qty.	Furnish	Install	Total
Removal of Existing Pumping Equipment												
Pumps/Motors/Shafts	1 LS	$5,000		$5,000								
Beams/Piping/Misc.Items	1 LS	$3,000		$3,000								
Diesel Fuel Tank	1 LS	$5,000		$5,000								
Replacement of Pumps												
Pumps/Motors	6	$13,000	$5,200	$109,200	2	$13,000	$5,200	$36,400	2	$13,000	$5,200	$36,400
Piping/Fittings	3	$5,000	$2,000	$21,000	1	$5,000	$2,000	$7,000	1	$5,000	$2,000	$7,000
Floor Doors	3	$3,000	$1,200	$12,600	1	$3,000	$1,200	$4,200	1	$3,000	$1,200	$4,200
Pump Pads	3	$1,500	$600	$6,300	1	$1,500	$600	$2,100	1	$1,500	$600	$2,100
Surge Accumulators												
Accumulators	6	$14,400	$5,760	$120,960	2	$14,400	$5,760	$40,320	2	$14,400	$5,760	$40,320
Piping/Fittings	3	$2,000	$800	$8,400	1	$2,000	$800	$2,800	1	$2,000	$800	$2,800
6" Knife Gate Valves	6	$800	$320	$6,720	2	$800	$320	$2,240	2	$800	$320	$2,240
Dry Well Ventilation												
Enlarge Wall Openings	2		$500	$1,000								
Headers/Sills	1 LS		$3,000	$3,000								
Demolish Exist. Heating/Ventilating	1 LS		$3,000	$3,000								
Louvers	2	$2,000	$800	$5,600	2	$2,000	$800	$5,600				
Exhaust Fans	1	$10,000	$4,000	$14,000	1	$10,000	$4,000	$14,000				
Unit Heaters	2	$1,500	$600	$4,200	2	$1,500	$600	$4,200				
Duct Work	1 LS	$3,000	$1,200	$4,200	1 LS	$3,000	$1,200	$4,200				
Generator Building												
Structure	1 LS	$30,000		$30,000								
Ventilation	1 LS	$20,000	$8,000	$28,000								
Diesel Fuel Tank	1 LS	$40,000		$40,000								
Generator	1 LS	$200,000		$200,000								
Electrical												
Services	3 LS	$15,000		$45,000	1 LS	$5,000		$5,000	1 LS	$5,000		$5,000
MCC/Starters/Circuit Breakers	6	$5,000	$2,000	$42,000	2	$5,000	$2,000	$14,000	2	$5,000	$2,000	$14,000
Control/Instrumentation	1 LS	$15,000		$15,000	1 LS	$5,000		$5,000	1 LS	$5,000		$5,000
Structures												
Wet Well Addition	1	50,000		$50,000	1	$30,000		$30,000				
Dry Well Expansion					1	$45,000		$45,000				
Superstructure					1	$50,000		$50,000				
Site Work/Yard Piping	1	$10,000		$10,000								
Misc.												
Hoist					1	$10,000		$10,000				
	Total			$793,180	Total			$282,060	Total			$119,060
	Eng. & Cont.		25%	$198,295	Eng. & Cont.		25%	$70,515	Eng. & Cont.		25%	$29,765
	Total Pump Station			**$991,475**	**Total Pump Station**			**$352,576**	**Total Pump Station**			**$148,825**
B. Forcemain												
One 16" Line	16,000 ft	$29	$17	$736,000								
	Total			$736,000								
	Eng. & Cont.		25%	$184,000								
	Total Forcemain			**$920,000**								
	Total Phase 1			**$1,912,150**	**Total Phase 2**			**$353,400**	**Total Phase 3**			**$149,400**
	Grand Total (1+2+3)			**$2,414,950**								

Table 5-5
Alternative A
Order-of-Magnitude Cost Estimates
Grizzly Road Pump Station and Demers Drive Pump Station

Grizzly Road Pump Station	PHASE 1				PHASE 2				PHASE 3			
	Qty	Furnish	Install	Total	Qty	Furnish	Install	Total	Qty	Furnish	Install	Total
Pumping Equipment	2	$5,750	$2,300	$16,100	1	$5,750	$2,300	$8,050	1	$5,750	$2,300	$8,050
Piping	2	$1,500	$600	$4,200	1	$1,500	$600	$2,100	1	$1,500	$600	$2,100
Electrical												
Services	2	$10,000		$20,000	1	$5,000		$5,000	1	$5,000		$5,000
MCC/Starters/Circuit B	2	$2,500	$1,000	$7,000	1	$2,500	$1,000	$3,500	1	$2,500	$1,000	$3,500
Control/Instrumentatior	1	$20,000		$20,000	1	$5,000		$5,000	1	$5,000		$5,000
Generator Building												
Structure	1	$30,000		$30,000								
Ventilation	1	$10,000		$10,000								
Diesel Fuel System	1	$10,000		$10,000								
Generator	1	$60,000		$60,000								
Structures												
Wet Well	1	$50,000		$50,000								
	Total			$227,300	Total			$23,650	Total			$23,650
	Eng. & Cont.		25%	$56,825	Eng. & Cont.		25%	$5,913	Eng. & Cont.		25%	$5,913
	Total - Pump Station			$284,125	Total - Pump Station			$29,563	Total - Pump Station			$29,563
Forcemain												
One 10" Line	5,000 ft	$15	$10	$125,000								
	Total			$125,000								
	Eng. & Cont.		25%	$31,250								
	Total - Forcemain			$156,250								
	Total - Phase 1			**$440,375**	**Total - Phase 2**			**$29,563**	**Total - Phase 3**			**$29,563**
	Grand Total - Grizzly Rd. PS			**$469,938**								

Demers Drive Pump Station	PHASE 2			
	Qty	Furnish	Install	Total
Pumping Equipment	2	$9,200	$3,680	$25,760
Piping	2	$1,500	$600	$4,200
Electrical				
Services	2	$10,000		$20,000
MCC/Starters/Circuit Breakers	2	$2,500	$1,000	$7,000
Control/Instrumentation	1	$10,000		$10,000
Generator Building				
Structure	1	$30,000		$30,000
Ventilation	1	$10,000		$10,000
Diesel Fuel System	1	$10,000		$10,000
Generator	1	$60,000		$60,000
	Total			$176,960
	Eng. & Cont.		25%	$44,240
	Grand Total - Demers Dr. PS			**$221,200**

Table 5-6 Alternative B, Order-of-Magnitude Cost Estimates

Modification of Existing Pump Station

Phase 1 - Expand existing pump station for pumping 770 gpm to existing north WWTP.

	PHASE 1			
	Qty	Furnish	Install	Total
Removal of Existing Equipment				
Pumps/Motors/Shafts	1 LS	$5,000		$5,000
Beams/Piping/Misc.Items	1 LS	$3,000		$3,000
Diesel Fuel Tank	1 LS	$5,000		$5,000
Replacement of Pumps				
Pumps/Motors	4 EA	$13,000	$5,200	$72,800
Piping/Fittings	2 EA	$5,000	$2,000	$14,000
Floor Doors	3 EA	$3,000	$1,200	$12,600
Pump Pads	2 EA	$1,500	$600	$4,200
Surge Accumulators				
Accumulators	2 EA	$14,400	$5,760	$40,320
Piping/Fittings	1 EA	$2,000	$800	$2,800
6" Knife Gate Valves	2 EA	$800	$320	$2,240
Generator Building				
Structure	1 LS	$30,000		$30,000
Ventilation	1 LS	$20,000	$8,000	$28,000
Diesel Fuel Tank	1 LS	$30,000		$30,000
Generator	1 LS	$150,000		$150,000
Electrical				
Services	2 EA	$10,000		$20,000
MCC/Starters/Circuit Breakers	4 EA	$5,000	$2,000	$28,000
Control/Instrumentation	1 LS	$15,000		$15,000
	Total			$462,960
	Eng. & Cont.		25%	$115,740
	Total - Exist. PS Mod.			**$578,700**

New Pump Station at "B" Street

Phase 1 - Add a new pump station for pumping 650 gpm to the proposed South WWTP.

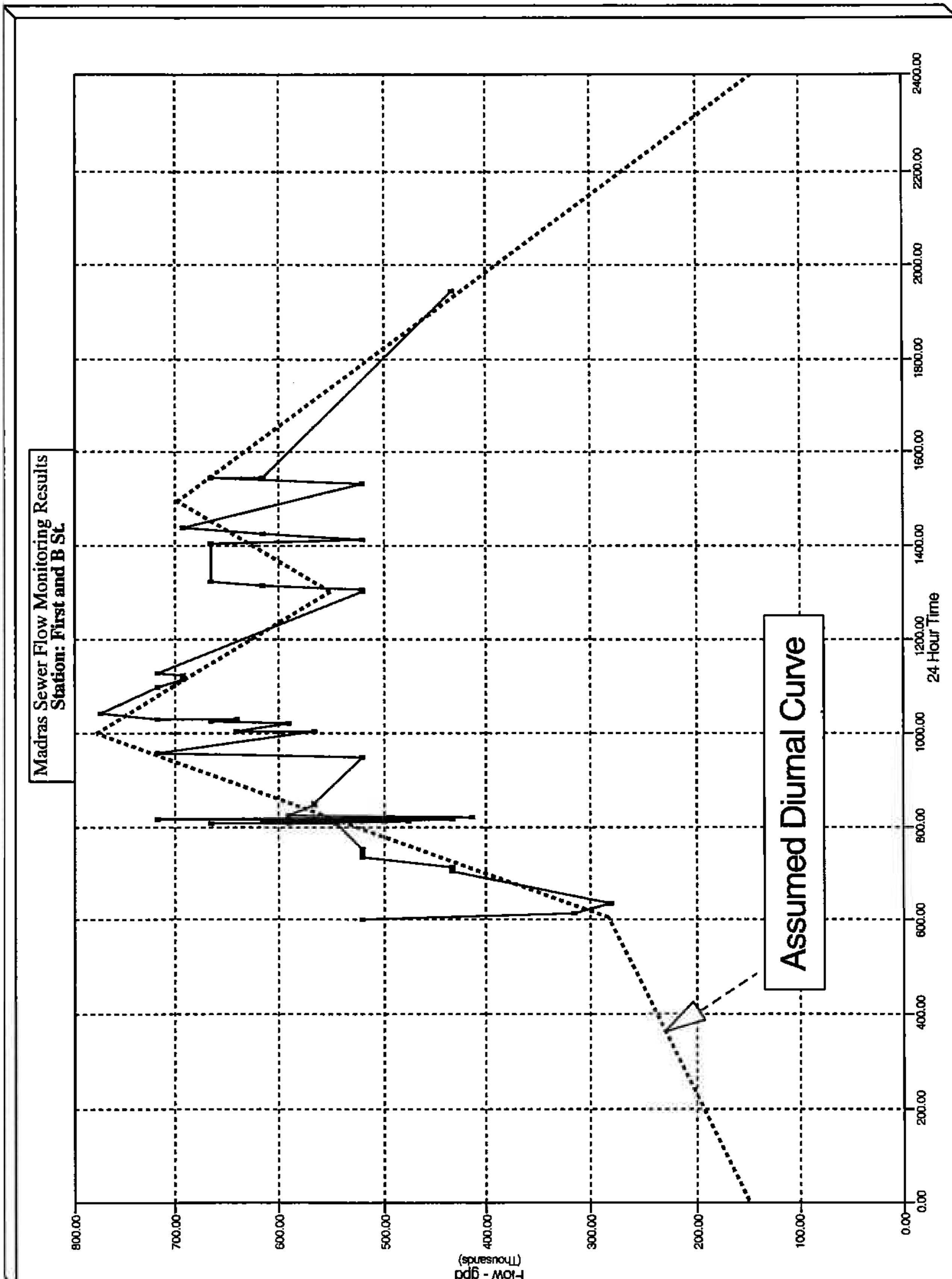
Phase 2 - Add one pump and electrical services/control to increase the pumping capacity to 1,300 gpm.

Phase 3 - Add one pump and electrical services/control to increase the pumping capacity to 1,950 gpm.

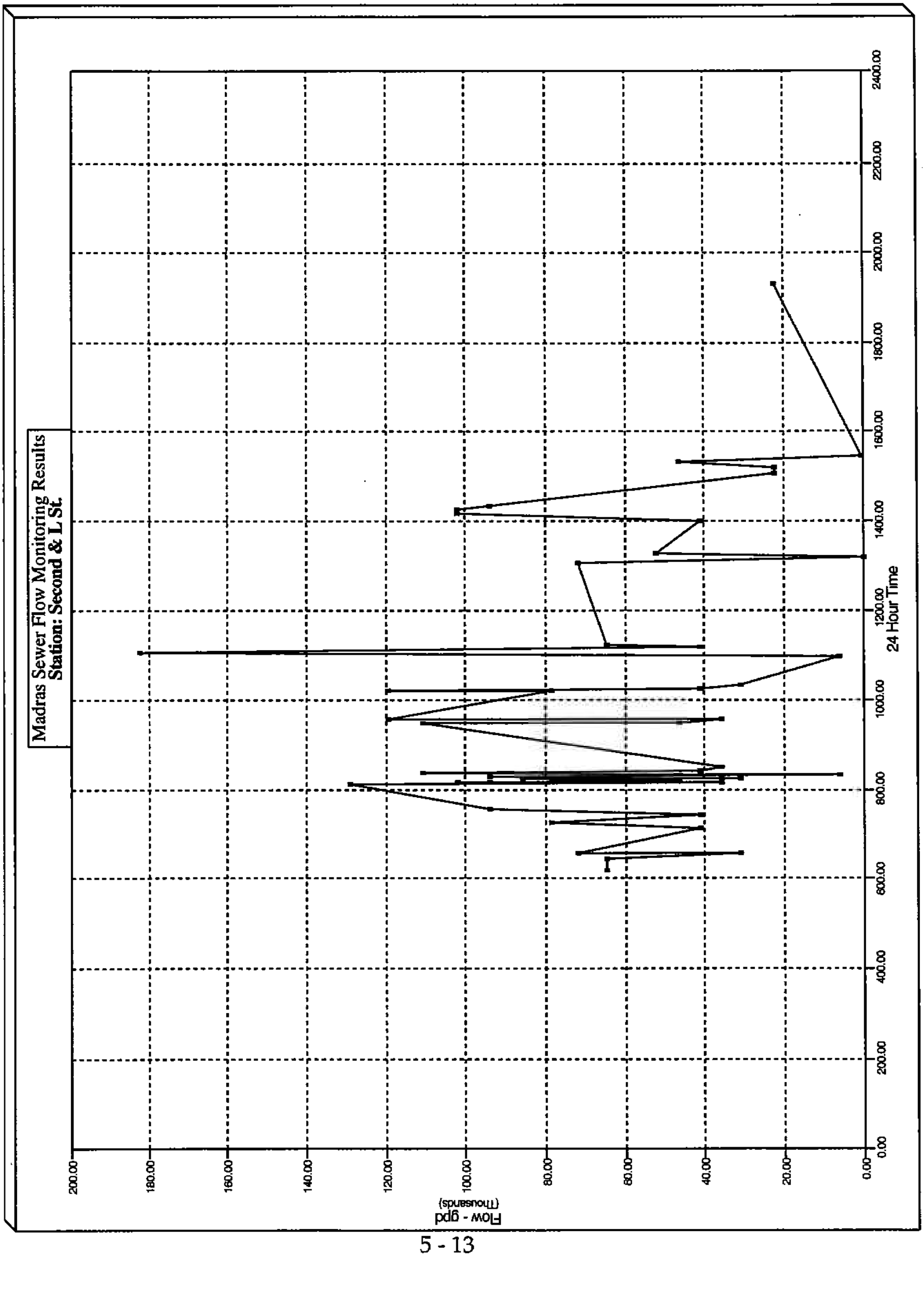
	PHASE 1				PHASE 2				PHASE 3			
	Qty	Furnish	Install	Total	Qty	Furnish	Install	Total	Qty	Furnish	Install	Total
Pumping Equipment	2	$17,250	$6,900	$48,300	1	$17,250	$6,900	$24,150	1	$17,250	$6,900	$24,150
Pump Station Piping	2	$2,000	$800	$5,600	1	$2,000	$800	$2,800	1	$2,000	$800	$2,800
Site Work/Yard Piping	1			$10,000								
Electrical												
Services	2	$15,000		$30,000	1	$5,000		$5,000	1	$5,000		$5,000
MCC	2	$5,000	$2,000	$14,000	1	$5,000	$2,000	$7,000	1	$5,000	$2,000	$7,000
Control/Instrumentation	1	$20,000		$20,000	1	$5,000		$5,000	1	$5,000		$5,000
Structures												
Wet Well	1	$80,000		$80,000								
Superstructure	1	$100,000		$100,000								
Wet Well Ventilation	1			$10,000								
Misc. - Hoist	1	$10,000		$10,000								
	Total			$327,900	Total			$43,950	Total			$43,950
	Eng. & Cont.		25%	$81,975	Eng. & Cont.		25%	$10,988	Eng. & Cont.		25%	$10,988
	Total - Pump Station			$409,875	Total Pump Station			$54,938	Total Pump Station			$54,938
Forcemain												
One 14" Lines	5,600 ft	$25	$15	$224,000								
	Total			$224,000								
	Eng. & Cont.		25%	$56,000								
	Total - Forcemain			$280,000								
	Total - New PS & Forcemain			**$689,875**								
	Total Phase 1			**$1,268,575**	**Total Phase 2**			**$54,938**	**Total Phase 3**			**$54,938**
	Grand Total			**$1,378,450**								

Table 5-7
Alternatives A & B
Order-of-Magnitude Cost Estimates
Celilo Street Pump Station Plus Forcemain
No Phase 1 and Phase 2

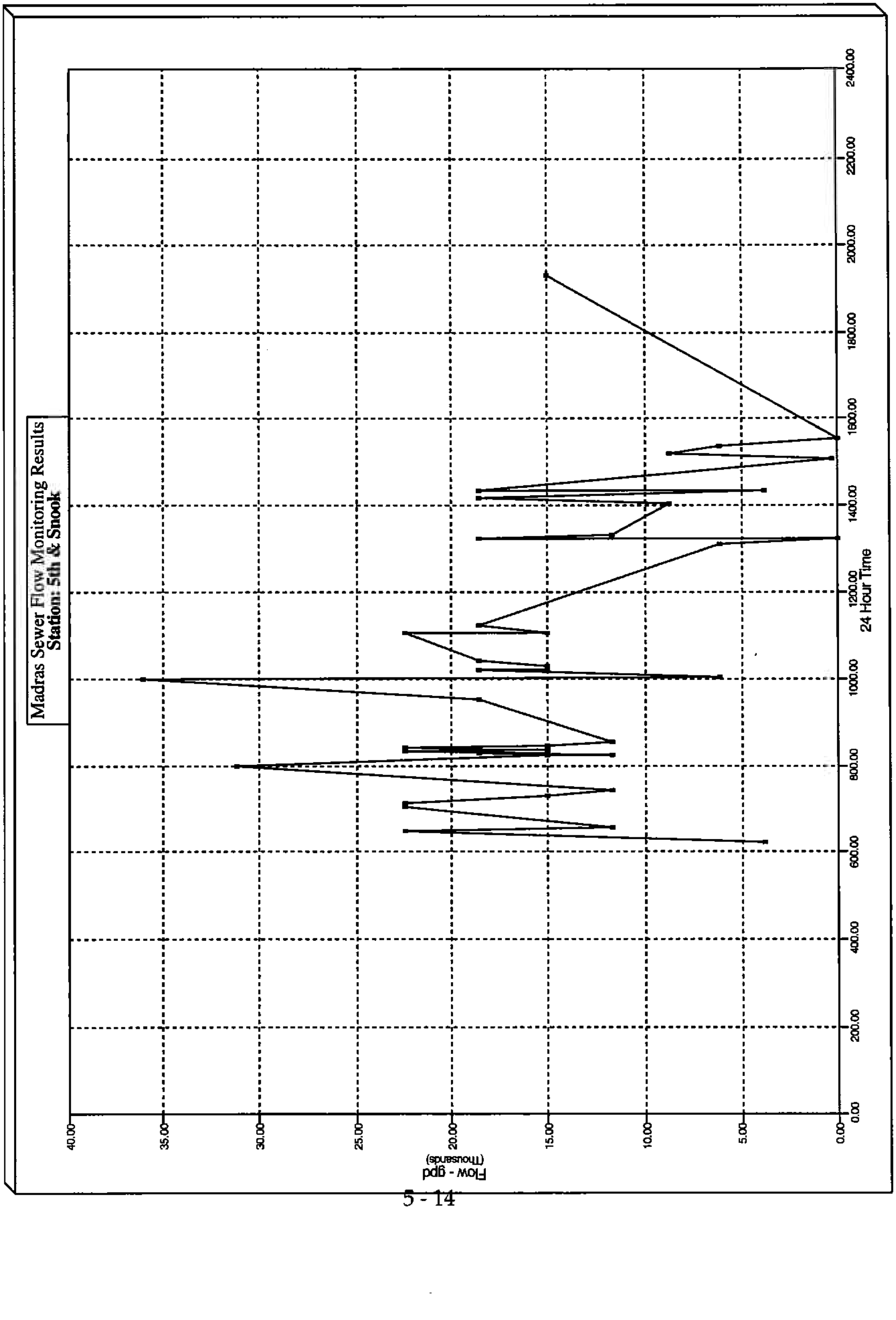
	PHASE 3			
A. Pump Station	Qty	Furnish	Install	Total
Pumping Equipment	2	$9,000	$3,600	$25,200
Piping	2	$1,500	$600	$4,200
Electrical				
Services	2	$10,000		$20,000
MCC/Starters/Circuit Breakers	2	$2,500	$1,000	$7,000
Control/Instrumentation	1	$10,000		$10,000
Generator Building				
Structure	1	$20,000		$20,000
Ventilation	1	$10,000		$10,000
Diesel Fuel System	1	$10,000		$10,000
Generator	1	$50,000		$50,000
Structures				
Wet Well	1	$25,000		$25,000
	Total			$181,400
	Eng. & Cont.		25%	$45,350
	Total - Pump Station			**$226,750**
B. Forcemain				
One 6" Line	2,300 ft	$12	$8	$46,000
	Total			$46,000
	Eng. & Cont.		25%	$11,500
	Total - Forcemain			**$57,500**
	Total - Phase 3			**$284,250**

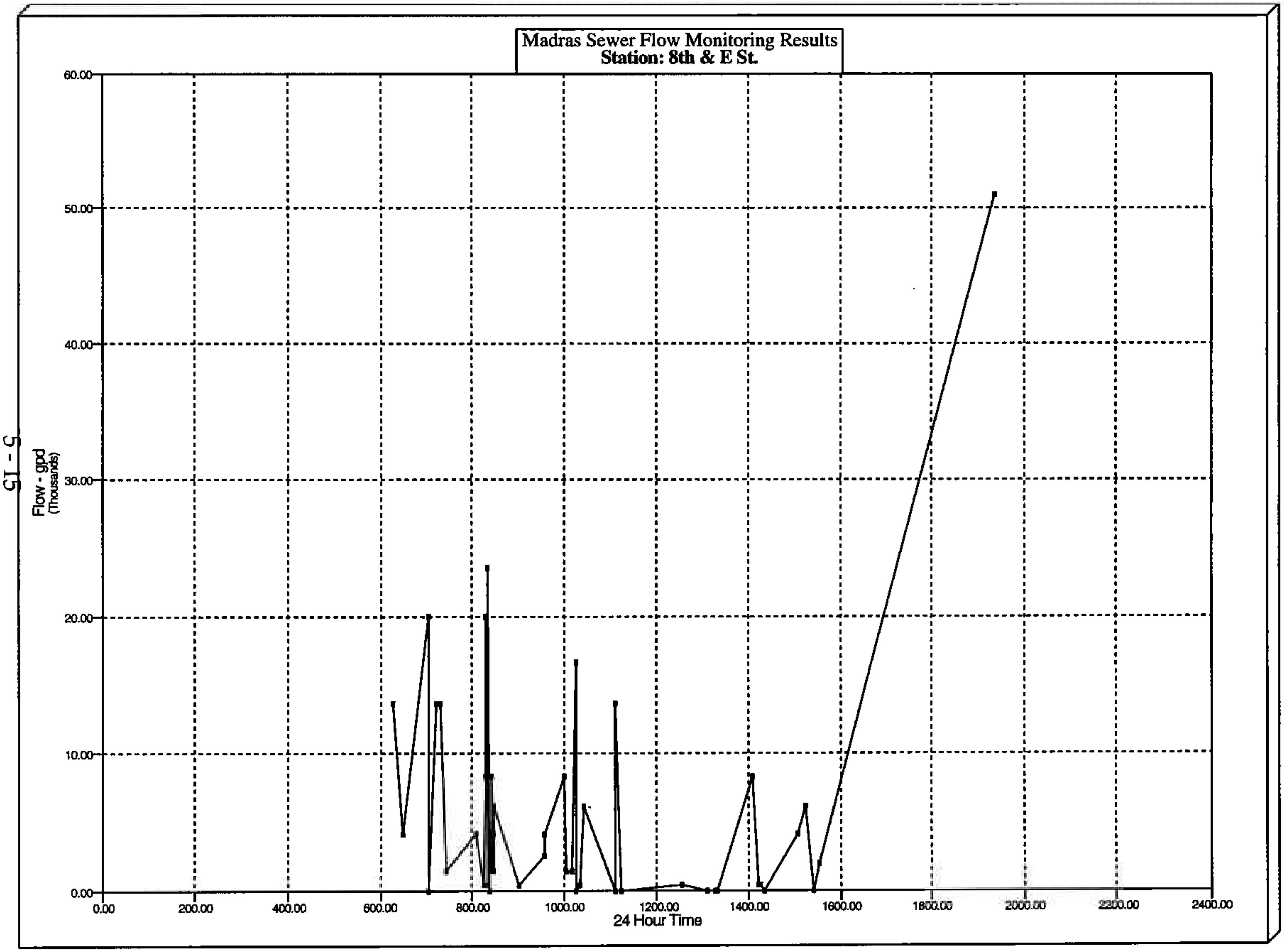


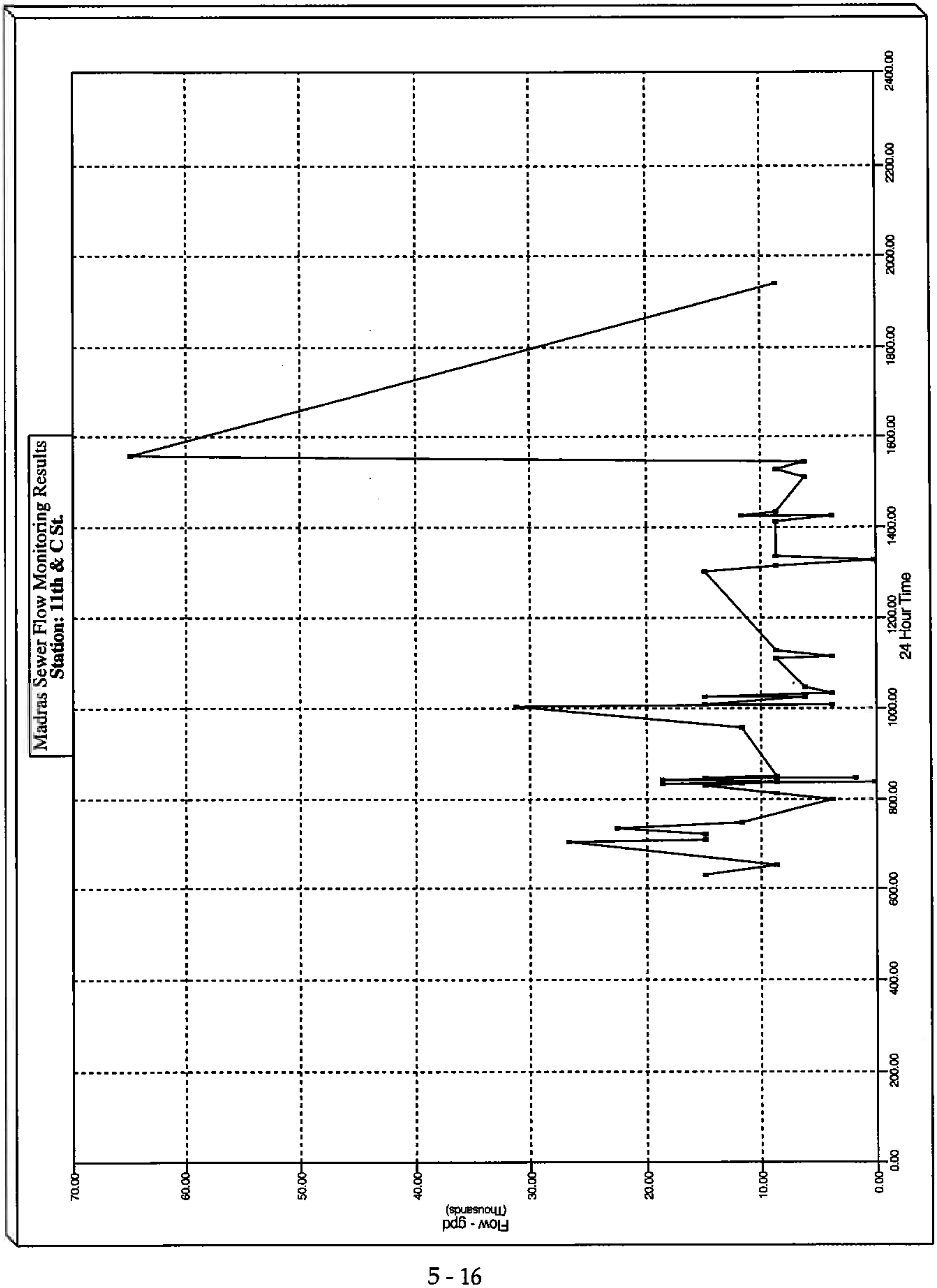
Madras Sewer Flow Monitoring Results
Station: First and B St.
Assumed Diurnal Curve
Flow - gpd
(Thousands)
24 Hour Time
0.00
100.00
200.00
300.00
400.00
500.00
600.00
700.00
800.00
0.00
200.00
400.00
600.00
800.00
1000.00
1200.00
1400.00
1600.00
1800.00
2000.00
2200.00
2400.00



Madras Sewer Flow Monitoring Results
Station: Second & L St.
Flow - gpd
(Thousands)
24 Hour Time
200.00
180.00
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
0.00
200.00
400.00
600.00
800.00
1000.00
1200.00
1400.00
1600.00
1800.00
2000.00
2200.00
2400.00


Madras Sewer Flow Monitoring Results
Station: 5th & Snook
Flow - gpd
(Thousands)
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
0.00
200.00
400.00
600.00
800.00
1000.00
1200.00
1400.00
1600.00
1800.00
2000.00
2200.00
2400.00
24 Hour Time


Madras Sewer Flow Monitoring Results
Station: 8th & E St.
Flow - gpd
(Thousands)
0.00
10.00
20.00
30.00
40.00
50.00
60.00
0.00
200.00
400.00
600.00
800.00
1000.00
1200.00
1400.00
1600.00
1800.00
2000.00
2200.00
2400.00
24 Hour Time


Madras Sewer Flow Monitoring Results
Station: 11th & C St.
Flow - gpd
(Thousands)
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
0.00
200.00
400.00
600.00
800.00
1000.00
1200.00
1400.00
1600.00
1800.00
2000.00
2200.00
2400.00
24 Hour Time

CHAPTER 6

WASTEWATER TREATMENT & EFFLUENT DISPOSAL

Introduction

Treatment and disposal of wastewater is regulated by the Oregon Department of Environmental Quality (DEQ). Wastewater treatment plants must provide a minimum of secondary treatment in most cases, and higher levels of treatment where required by the DEQ in order to protect the environment. Depending on whether the effluent from a wastewater treatment plant is discharged into a receiving water body or is disposed of by reuse, the DEQ issues each wastewater treatment plant a National Pollutant Discharge Elimination System (NPDES) permit or a Water Pollution Control Facility (WPCF) permit which establishes the treatment parameters to which the system must be operated. The permits are periodically renewed about every five years.

In accordance with its WPCF permit expiring on August 31, 1997, the existing Madras wastewater treatment system treats raw wastewater in facultative lagoons, stores it during the winter "non-irrigation" months, and then polishes stored wastewater together with the current lagoon effluent to Oregon DEQ Level IV quality standards for spray irrigation on a nearby golf course. The City has a long-term agreement with the golf course operator to provide him with the treated effluent from the wastewater plant. No discharge to the waters of the State occurs, and no waste load allocation for discharge to surface waters currently exists for the City to utilize. A copy of the WPCF Permit is included in Appendix A. A copy of the City's Golf Course Lease and Irrigation agreement with Kevin O'Meara is included in Appendix B.

Alternative systems for waste treatment and effluent disposal to provide Madras with wastewater treatment for present flows and to permit continued growth are presented below.

Treatment Requirements

Treatment requirements depend on whether effluent is discharged to a receiving body of water or disposed of by re-use, generally irrigation. Detailed requirements have been established by DEQ to for discharges to particular water courses, or for application of effluent water to various re-use sites. The requirements for treatment prior to discharge or re-use determine the type of wastewater treatment plant a community must construct and operate.

Reclaimed Water Reuse

Madras currently disposes of wastewater effluent by reclaimed water re-use (irrigation) and will likely continue to utilize this form of disposal in the future. Several levels of treatment are established as adequate for re-use depending on what use is made of the reclaimed wastewater and how much human contact is involved in that use. The following table shows the DEQ treatment level classifications for reclaimed water.

Table 6 - 1 Reclaimed Water Treatment & Monitoring Requirements

Category	Level I	Level II	Level III	Level IV
Biological Treatment	X	X	X	X
Disinfection		X	X	X
Clarification				X
Coagulation				X
Filtration				X
Total Coliform (Organisms / 100 ml)				
Two Consecutive Samples	N/L	240.00	N/L	N/L
7-day Median	N/L	23.00	2.20	2.20
Maximum	N/L	N/L	23.00	23.00
Sampling Frequency	N/R	1 per	3 per	1 per day
Turbidity (NTU)				
24-hour Mean	N/L	N/L	N/L	2.00
5% of Time During 24-hour	N/L	N/L	N/L	5.00
Sampling Frequency				Hourly

From Table 1 (OAR 340-55-015)

Level I treatment consists of biological treatment where bacterial or biochemical reactions are promoted to produce an oxidized wastewater. The existing lagoon system without the disinfection and sand-float units would qualify as Level I.

Level II treatment consists of biological treatment plus disinfection and is equivalent to "secondary" treatment. The existing lagoon system without the Sand-Float unit would qualify as Level II.

Level III treatment is the same as Level II except that special disinfection procedures are required to produce additional coliform reductions. The existing plant most likely does not meet the Level III criteria.

Level IV treatment consists of Level II treatment plus clarification, coagulation, and filtration. The existing Madras plant produces Level IV effluent when the Sand-Float unit is operated.

As can be seen in the table below, Madras currently must treat its wastewater effluent to DEQ Level IV because it is used to irrigate the golf course. Also evident from the table is that less costly Level II quality effluent can be used as reclaimed water with certain restrictions.

Table 6 - 2 Reclaimed Water Contact Controls

GENERAL	**Level I**	**Level II**	**Level III**	**Level IV**
Public Access	Prevented (fences, gates, locks)	Controlled (signs, rural or nonpublic lands)	Controlled (signs, rural or nonpublic lands)	No direct public contact during irrigation
Buffers for Irrigation	Surface: 10 ft. Spray: site	Surface: 10 ft. Spray: 70 ft.	10 ft.	None required
Agricultural				
Food Crops	N/A	N/A	N/A	Unrestricted
Processed Food Crops	N/A	**1**	**1**	Unrestricted
Fodder, Fiber, and Seed Crops	**3**	**1**	**1**	Unrestricted
Pasture for Animals	N/A	**4**	**4**	Unrestricted
Sod	N/A	**1**	**1**	Unrestricted
Ornamental Nursery Stock	N/A	**1**	**1**	Unrestricted
Parks, Playgrounds, School yards,	N/A	N/A	N/A	**5, 6**
Golf Courses without Contiguous	N/A	**5, 7**	**5, 7**	**5. 6**

From Table 1 (OAR 340-55-015) the bold numbers in the Table refer to the numbered comments on the next page.

1. OSHD Recommends no irrigation for 3 days before harvesting
2. Surface irrigation where crops do not touch ground
   Fruit & nuts shall not be harvested off the ground.
3. Department may permit spray irrigation if aerosols are not an issue.
   OSHD recommends no irrigation for 30 days before harvest.
4. Surface or spray irrigation: No animals shall be on the pasture during irrigation.
5. Warning signs required.
6. Reclaimed water applied so as not to be applied where food is prepared or served.
7. Reclaimed water applied so as not to be applied within 100 ft of where food is prepared or served

Discharge to Surface Water

Madras is located in the Deschutes Basin, and discharge to surface water would be to a tributary of the Deschutes River, a stream which is highly prized for its fishery and classified as water quality limited. Madras currently has no Waste Load Allocation (WLA) for discharge to the Deschutes or its tributaries, and an action of the Oregon Environmental Quality Commission supported by extensive water quality studies will be required to obtain a Waste Load Allocation. Upon receiving a Waste Load Allocation, the City could obtain an NPDES permit and design wastewater treatment facilities to meet the standards for the Deschutes.

OAR Chapter 340 - 41 - 565 establishes water quality standards which may not be exceeded for the Deschutes Basin streams as follows:

No wastes shall be discharged and no activities shall be conducted which either alone or in combination with other wastes or activities will cause violation of the following standards in the Deschutes River Basin:

1. Dissolved Oxygen concentrations not less than 90% of saturation at the seasonal low or not less than 95% of saturation in spawning areas during spawning, incubation, hatching, and fry stages of salmon fishes.

2. No measurable increase in temperature outside of the assigned mixing zone, as measured relative to a control point immediately upstream from a discharge when stream temperatures are 58 degrees F or greater; or more than 0.5 degrees F when receiving waters are 57.5 degrees F or less; or more than 2 degrees F when stream temperatures are 56 degrees F or less.

3. No more than a 10% cumulative increase in natural stream turbidities shall be allowed as measured relative to a control point immediately upstream of the turbidity causing activity.

4. pH values shall not fall outside of the 6.5 - 8.5 range

5. Bacteria from fecal sources and enterococci groups: a geometric mean of less than 33 enterococci per 100 ml based on at least 5 samples collected over 30 days.

Several additional parameters are also included prohibiting the discharge of wastes causing condition deleterious to fish, aquatic life, or interfering with beneficial use of the streams.

As of November, 1995, the Environmental Quality Commission is evaluating revisions to the water quality standards for dissolved oxygen, temperature, pH, and bacteria. If the new standards are adopted, some flexibility in temperature and pH parameters will be gained, but it will not make the discharge of wastewater effluent to the Deschutes Basin streams very much easier. The main reason being that the streams available for discharge are intermittent so the effluent discharged to them must meet stream water quality standards directly without dilution. Normal wastewater treatment plants do not accomplish treatment to those levels. Much higher levels of treatment are required to attain stream standard quality without dilution. As can be seen in Table 6 - 3 and 6 -4 below, if there is no dilution water in the stream, the BOD must be infinitely small to qualify for discharge. The recently proposed changes in DEQ regulations for Alternative Prescription (DEQ letter dated January 9, 1996 attached in Appendix C) may allow surface water discharge without meeting the standard mixing zone requirements provided overall environmental benefits can be demonstrated and no other practical alternatives to the discharge are available. For the surface discharge option, more studies as to existing stream quality and mixing will need to be conducted and the DEQ's approval of the proposed discharge option will be required.

OAR Chapter 340-41-575 sets forth Minimum Design Criteria for Treatment and Control of Wastes in the Deschutes. The following effluent quality is required, depending where in the river system discharge occurs.

Table 6 - 3 Deschutes River Effluent Quality Requirements above Pelton
Deschutes River Basin Bend Diversion Dam to Pelton Reregulating Dam

Apr.-Oct.. Low Stream Flow	
BOD_5 - mg/l	<= 10 mg/l
SS - mg/l	<= 10 mg/l
Nov.-Mar. High Stream Flow	Secondary Treatment
Dilution	BOD mg/l / Dilution Factor < 1
CL_2 Residual	1 ppm after 60 min Contact Time
Bypassing	Positive protection from bypass

Table 6-4 Deschutes River Effluent Quality Requirements Below Pelton
Deschutes River Basin Below Pelton Reregulating Dam

Apr.-Oct.. Low Stream Flow BOD_5 - mg/l SS - mg/l	 <= 20 mg/l <= 20 mg/l
Nov.-Mar. High Streamflow	Secondary Treatment
Dilution	BOD mg/l / Dilution Factor < 1
CL_2 Residual	1 ppm after 60 min Contact Time
Bypassing	Positive protection from bypass

Sludge Disposal Requirements

In order to continue applying treated sewage sludge to the land it is necessary to sample the sludge and track the cumulative amounts of the 10 pollutants applied to the site if continued utilization of a sludge disposal site is to be allowed.
The Pollutant Limits presented below shall not be exceeded in applying bulk sewage sludge to the land disposal site subsequent to July 20, 1993.

Pollutant	Table 1 Ceiling Conc. mg / kg	Table 2 Cum. Loading Total kg / hectare	Table 3 Pollutant Conc. Monthly Ave mg / kg	Table 4 Annual Loading Rate kg / hectare / yr
Arsenic	75.00	41.00	41.00	2.0
Cadmium	85.00	39.00	39.00	1.9
Chromium	3000.00	3000.00	1200.00	150.00
Copper	4300.00	1500.00	1500.00	75.00
Lead	840.00	300.00	300.00	15.00
Mercury	57.00	17.00	17.00	0.85
Molybdenum	75.00	18.00	18.00	0.90
Nickel	420.00	420.00	420.00	21.00
Selenium	100.00	100.00	36.00	5.0
Zinc	7500.00	2800.00	2800.00	140.00

Notice must be given to the DEQ as the State of Oregon permitting prior to applying sludge to the land on or after July 20, 1993. The notice must include:

1. The location of the land application site.
2. The name, address, telephone number, and NPDES permit # of the sludge applicator.

The monitoring, reporting, and record keeping requirements of the Standard must be met.

Bulk sludge must not be applied to a frozen, snow covered, or flooded site; nor within 10 meters (32.81 feet) from a surface water body.

Sludge must be applied at or below the rate to provide nitrogen for the cover crop and limit the amount of nitrogen passing through the root zone to groundwater (Agronomic Rate).

The sludge must meet Class A or Class B Pathogen Requirements, and must be treated with additional vector attraction reduction measures prior to being disposed of on the land. If Class B sludge is produced, additional restrictions must be placed on use of and access to the disposal site.

In order to reliably be classified as Class B sludge relative to pathogens it must be treated by one of the listed processes in Appendix B of Part 503 which include:

1. Aerobic digestion for 40 days at a temperature of 20 degrees Celsius or 60 days at a temperature of 15 degrees Celsius.

2. Air drying on drying beds for three months above 0 degrees Celsius.

3. Anaerobic digestion for 15 days at 35 to 55 degrees Celsius or for 60 days at 20 degrees Celsius.

4. Composted at 40 degrees Celsius or higher for five days and at least 4 hours at 55 degrees Celsius.

5. Lime Stabilized to raise its pH to 12 after two hours of contact.

In order to meet the vector attraction reduction requirements the sludge must also be treated to meet one of the following:

1. Reduce the mass of volatile solids in the sludge by a minimum of 38 % by aerobic or anaerobic digestion.

2. Reduce the specific oxygen uptake rate in an aerobic process to less than or equal to 1.5 mg of Oxygen per hour per gram of total dry solids.

3. Aerobically treat the sludge at a temperature higher than 40 degrees Celsius and averaging higher than 45 degrees Celsius for 14 days or longer.

4. Raising the pH of the sludge o 12 or higher for 2 hours and then 11.5 or higher for an additional 22 hours.

5. Drying sludge which is free of unstabilized primary treatment solids to 75% solids or higher.

6. Drying sludge that contains unstabilized primary treatment solids to 90 % solids or higher.

7. Injecting sewage sludge below the surface of the land.

8. Incorporating sewage sludge spread on land into the soil within 6 hours.

Effluent Disposal

Theoretically, wastewater treatment plant effluents may be discharged to surface water, where the effluent is diluted by the receiving water and assimilated by natural processes in the water body, or applied to crop land, where it is removed by evaporation-transpiration by growing vegetation. Madras has historically disposed of its treated effluent as reclaimed water used for irrigation.

In planning for future wastewater treatment plant effluent disposal in Madras, the following alternatives will be included:

1. Continued winter storage of treated effluent followed by summer irrigation of effluent treated to DEQ Level IV standards on the Nine Peaks Golf Course or other land available for such irrigation use.

2. Winter storage of treated effluent followed by summer irrigation of effluent treated to DEQ Level II standards on farmland with controlled access and crop selection as may be available.

3. Treatment to at least DEQ Level IV standards followed by year round discharge to a tributary of the Deschutes River as may be allowed by DEQ.

Due to there being intermittent flow in the water courses near the existing Madras wastewater treatment plant and near the proposed south treatment plant site, discharge of wastewater effluent to those streams an creeks is prohibitive. We believe that continuation and expansion of the irrigation disposal is the preferred liquid disposal process.

CH2M's 1993 Effluent Reuse Plan for Madras made an extensive investigation of the requirements for irrigation of the Level IV effluent produced at the NWWTP site

(Airport). They concluded that during an average water year (5 out of 10 years) about 169 acres are needed for each 0.45 mgd of wastewater to be irrigated at a gross irrigation rate of about 40" for turf and pasture grass. This converts to a need for about 188 acres of irrigable grassland per 0.5 mgd expansion.

Effluent storage for six months for every 0.5 mgd treatment plant module requires about 48 acres of storage ponds, 12 feet deep. Neither the existing NWWTP (airport) site nor the new SWWTP site are large enough and/or suitable for the on-site storage and irrigation. The FAA has indicated in private meetings that they will oppose further construction of wastewater plants on or adjacent to the airport (Refer to FAA Policy in Appendix D). The previous expansion was the last. FAA will no longer permit any further plant expansion on the site.

The recently acquired south treatment plant site is only 70 acres. The usable land (i.e. excluding flood plains) is not large enough to accommodate on-site storage. Therefore, the irrigation alternatives anticipate the construction of effluent storage ponds on irrigation sites obtained from the end water users. Each 0.5 mgd flow increase phase includes the construction of effluent distribution pumps, one mile of distribution pipe, and an off-site effluent storage pond.

Because producing Level IV effluent is considerably more expensive than Level II effluent, it is recommended that the City locate agricultural sites for controlled Level II irrigation of pasture grasses or turf grass if possible. If others are irrigated, then acreage commensurate with those crops will be needed.

Wastewater Treatment Processes

The minimum requirements established by DEQ for either re-use or discharge to surface waters determine the unit processes and design criteria which must be incorporated into a given wastewater treatment plant design. All treatment plants consist of combinations of unit processes arranged in order to operate properly and provide the necessary treatment level as economically as possible.

All of the alternatives evaluated for the Madras wastewater treatment will include: preliminary treatment in the form of screening, biological treatment by means of the complete mix activated sludge process or by sequencing batch reactors, and disinfection by chlorination for irrigation disposal or chlorination / dechlorination for discharge to surface waters. Alternatives requiring higher levels of treatment than biological treatment alone can produce will also include physical - chemical coagulation, settling, and filtration. Alternatives making use of irrigation for reclaimed water re-use will also include storage lagoons for about six months of winter storage prior to the irrigation season. The sludge produced by the treatment processes will be treated by aerobic digestion, lime stabilization, and liquid land disposal for the mechanical treatment plant options.

The major process which will be evaluated include:

Liquid Waste Treatment Processes

Municipal wastewater treatment plants most commonly use a combination of biological, physical, and chemical processes to provide secondary treatment.

Biological processes provide environments where bacteria and other organisms are cultured (grown) in reactor tanks, using nutrients in the waste as substrate (food), and producing biological solids (sludge) which can be physically separated from the liquid to produce high quality treated effluent. Common biological reactors are of either the fixed film type, where the waste is distributed over a thin layer of biological slime supported by rock or plastic media; or the suspended culture type, where the biological organisms are suspended in the wastewater mixture. Trickling filter units and rotating biological contactors are examples of fixed film reactors. Activated sludge tanks, including aeration basin, and Madras' existing sewage lagoons are examples of suspended culture reactors.

Physical processes are used for removal of solids from the wastewater. Clarifiers (settling basins) use the force of gravity as a physical process to separate solids in the liquid waste from treated effluent. Primary clarifiers settle out large particles contained in the wastewater prior to biological treatment and secondary clarifiers settle out the biological solids grown in the biological reactor from the liquid effluent prior to discharge. Flow equalization basins and chlorine contact tanks are other examples of physical processes which provide detention time during the treatment of wastewater. Filtration and centrifugation are other physical processes sometimes used in treatment plants to remove solids.

Chemical processes use chemical reactions to treat wastewater. The most commonly used chemical process in secondary treatment plants is chlorination of the effluent, which oxidizes the organisms in the effluent for disinfection purposes prior to its discharge from treatment.

Many combinations of waste treatment processes are available to provide secondary treatment for municipal wastes. In the size range of the treatment facility required by the City of Madras, the complete mix activated sludge process, sequencing batch reactors, and the facultative lagoon system are considered to be the most viable and will be used to develop waste treatment alternatives for this facility plan.

Facultative Lagoons

Facultative lagoons are large, relatively shallow earthen ponds where raw sewage is treated using primarily natural means. The term "facultative" is used because the ponds are usually stratified into layers, with aerobic conditions near the surface, an intermediate "mixed" layer, and anaerobic conditions at the bottom. The stratification is caused by a combination of settling solids and temperature related variations in wastewater density. Oxygen for the aerobic "stabilization" portion of the ponds is provided by a combination of photosynthetic algae and oxygen transfer across the pond - air interface. The aerobic surface layer serves to reduce odors and provide treatment for soluble organics produced by the anaerobic decomposition of solids on the pond bottom.
Facultative lagoons produce effluent meeting secondary treatment criteria if the proper loading criteria are used in their design and if at least three lagoon cells are provided operating in series. Detention times in the facultative ponds range from 20 to 180 days.

The residual settled solids from the bottom of ponds may need to be cleaned out once every 10 to 20 years, but sludge disposal operations are greatly reduced from other treatment processes.

Facultative lagoon systems operate primarily by gravity and require no energy other than that needed to pump the influent wastewater into the initial cell. Little operator expertise is required and the process is very stable. However they do require a large land area and they are susceptible to odor problems if overloaded.

Complete Mix Activated Sludge

The activated sludge process is a treatment process which uses millions of micro-organisms suspended in the wastewater to remove soluble and particulate organic matter in the wastewater by using it as food and producing new cell growth and by-products. Activated sludge develops when the growing organisms are allowed to collide together and produce clumps of floc which are heavy enough to settle and be removed from the liquid as sludge. The other by products of the cell metabolism are gases, which are released to the atmosphere, and water, which becomes part of the liquid effluent.

The activated sludge plant would produce DEQ Level II effluent quality.

Sequencing Batch Reactors

As opposed to the flow through activated sludge process, sequencing batch reactors (SBRs) are a fill and draw process where wastewater is added to a reactor tank, treated to remove undesirable components, and then discharged. Each SBR reactor is a self-sufficient treatment system including equalization, aeration, and clarification. The actual treatment process is similar to that utilized in the activated sludge process with the following claimed advantages:

Improved effluent quality
Elimination of separate clarifiers and sludge return pumps
Increased settling area
A quiescent settling environment
Demand controlled energy consumption
Elimination of short-circuiting
High organic and hydraulic loading capability
Equalization of flows and loads

The process operates on a fill and draw principle following the basic steps of fill, react, settle, and decant; all within a single tank. The cycle time is varied with the effluent quality required. A series of SBR tanks are constructed to accommodate the incoming wastewater flows and strengths.

The initial 500,000 gpd module will consist of two concrete tanks approximately 67 feet square with a maximum water depth of 21 feet. One basin will serve as an equalization basin, and be fitted with a surface aerator. The second basin will be an SBR basin and carry out the treatment process. As the plant is expanded to 1.0 mgd, the equalization basin will be converted to a second SBR basin. Subsequent expansions will add additional SBR reactors.

Effluent Polishing

Coagulation / Filtration

Dual media filtration following coagulation is one of the most economical means of polishing effluents to DEQ Level IV standards. The effluent is first conditioned by chemical coagulation and settling, and then passed through the filter bed which strains out the solids.

Effluent polishing at Madras' existing plant is carried out by chemical coagulation, settling, and filtration. Some irrigation alternatives include systems similar to those presently used for producing Level IV effluent.

Constructed Wetlands

Effluent polishing for some alternatives includes the construction of an artificial wetland or marsh as an effluent polishing measure. Wetlands make use of an aquatic eco-system of plants, fish, algae, invertebrates, and microorganisms to provide pH control, nutrient reduction, BOD and SS removal, heavy metal removal, fecal coliform and pathogen reduction by natural means.

The wetlands propose for Madras will be a series of long, narrow shallow channels planted with emergent and non-emergent aquatic plants to form the basis of the eco-system. About 30 acres of wetlands per mgd of wastewater for effluent polishing are proposed due to the altitude, temperature, and high level of treatment required; whereas only 10 acres of wetlands per mgd of wastewater will be provided for enhancement of wildlife habitats when tertiary treatment is being proposed.

Disinfection Options

Municipal wastewater effluents are disinfected to protect humans from water borne diseases resulting from pathogens contained in sewage discharges. These diseases can result from drinking contaminated water, recreational contact with contaminated water, or by ingestion of fish, shellfish, or other food from contaminated water. The incidence of illness caused by contaminated water has been greatly reduced since the late 1800's as a result of the disinfection of wastewater and treatment and chlorination of drinking water.

As opposed to sterilization, which destroys all of the living organisms, disinfection is designed to kill harmful organisms to acceptable levels as measured by coliform indicator organisms. Madras currently uses chlorination to disinfect the wastewater.

Chlorination

Because chlorination a proven technology and chlorine is readily available at reasonable cost, it is used at the existing Madras wastewater treatment plant and most other plants in the united states. Chlorination of wastewater effluents with gaseous chlorine has been the predominant means of disinfection sewage for many years. Historical data over many years has shown that dosing the wastewater with enough chlorine to maintain a chlorine residual of 0.5 mg/l after 1 hour of contact time is sufficient to disinfect it to meet DEQ standards. Chlorine gas is stored on-site in 150 lb pressurized containers.

Chlorine gas is a toxic substance which must be handled carefully and with respect by knowledgeable operators. In some jurisdictions Fire Marshals have been interpreting the Article 80 of the Uniform Fire Code as requiring that special containment and scrubbers be installed at chlorination facilities, greatly increasing the cost of gaseous chlorination facilities. So far this has not been required in Madras, which stores a relatively small amount of chlorine in a non-occupied building located well away from the site boundaries and other occupied structures.

Sodium Hypochlorite

Sodium Hypochlorite (chlorine bleach) in the form of aqueous solutions may be manufactured on-site or purchased from manufacturer's. It may be stored for 60 to 90 days before use. Hypochlorous acid is formed in the wastewater upon dosage which accomplishes the disinfection, but higher doses of hypochlorite are required than chlorine. Some large plants are using sodium hypochlorite in order to avoid the hazards of gaseous chlorine and the costs of compliance with their Fire Marshall's interpretation of the Uniform Fire Code.

The chlorine residual from Sodium Hypochlorite has the same effects as that of chlorine, but the equivalent chlorine costs more in hypochlorite form. The chlorine available for disinfection decreases with the length of time of storage of the hypochlorite.

Ozonation

Ozone is a form of oxygen which is a powerful oxidant and has been used since the early 1900's for odor control, color removal and as a disinfectant of potable water supplies in Europe and Canada. Ozone was once considered the most promising alternative to chlorine as a wastewater disinfectant because it's non-toxic to aquatic organisms, is a good viricide, contributes to high dissolved oxygen levels in treated effluent and is highly reactive with constituents in wastewater.

The major drawback of using ozone as a disinfectant is high cost of generation coupled with the need to generate it at the point of use. Other drawbacks are that it can be unreliable as a bactericide, it iron and manganese interfere with its disinfection effectiveness, and it is difficult to match ozone production proportionally to a variable flow. Ozonation is not considered viable for Madras' needs.

Ultraviolet Radiation

The use of ultraviolet (UV) light is currently the most popular alternative to chlorine for wastewater disinfection. Under the proper conditions it has proven to be very successful as a disinfectant. UV disinfection is a physical rather than a chemical process where the energy of ultraviolet radiation is used to destroy the microorganisms. It has been shown that if sufficient dosages of ultraviolet energy reach the organisms, water and wastewater can be treated to any degree required. UV effectiveness is reduced as suspended solids in the effluent increase and probably will not achieve satisfactory disinfection if TSS is above 30 mg/l. Plants based on the contact stabilization process is expected to meet the 30 mg/l criteria almost continuously, while facultative lagoon systems are probably not candidates for the use of ultraviolet disinfection because their effluent solids will be higher some of the time.

Ultraviolet light is produced on-site by mercury vapor lamps and is used at high levels to penetrate the wastewater. Comparatively large amounts of electrical energy are required, but additional chemicals are not needed. Because UV is not itself a chemical agent, there is no lasting toxic residual imparted to the treated effluent. This gives it the ability to overdose without worry of affecting the receiving water , but also affords no measurement to correlate with disinfection levels as a control measure. In addition, the ultraviolet radiation poses a danger to the eyesight of operators performing bulb changes and maintenance on the units, requiring special training and precautions.

Ultraviolet disinfection becomes a cost effective alternative to chlorination if a containment and scrubbing system is required for a gaseous chlorine installation or dechlorination of the chlorinated effluent prior to discharging into a receiving stream is required.

Dechlorination

If discharge options are utilized, the chlorine dosage needed to attain the disinfection limits mandated by a NPDES Permit will produce Total Residual Chlorine levels on the order of 0.5 mg/l. After the effluent has been disinfected by chlorine or sodium hypochlorite, dechlorination will be required to lower the residual chlorine to within future permit limits for discharge into the receiving stream. Dechlorination is sometimes accomplished by treatment with Sodium Metabisulfite or by filtering the effluent through activated carbon; but the most common dechlorination process is by treating the disinfected effluent with Sulfur Dioxide. Sulfur dioxide has been shown to eliminate the toxic effects of residual chlorine to aquatic species, and has no toxic effects of its own up to dosages of 10 mg/l. Sulfur dioxide is handled similarly to chlorine, is relatively inexpensive, reacts quickly and quantitatively with residual chlorine.

Chlorination is the most proven and economical method of disinfection, even with the addition of sulfur dioxide dechlorination to reduce chlorine toxicity effects of effluent. Continuation of the existing chlorination with the addition of sulfur dioxide dechlorination be included as the disinfection method in each wastewater treatment alternative.

Sludge Treatment Processes

The following paragraphs describe sludge treatment processes which might be used to treat Madras' sewage sludge for disposal complying with the 503 regulations:

Wastewater treatment produces solids residuals in the form of sludge which must be disposed of in a safe and economical manner. Madras currently stores its sludge in a sludge lagoon and disposes of it on land periodically. Sludge settling in the lagoons is stored and digested there.

U.S. EPA issued 40 CFR Part 503 "Standards for the Use or Disposal of Sewage Sludge" in February of 1993. This regulation established requirements, pollutant limits, management practices, and operational standards which must be met by the city when applying sewage sludge on land. Compliance was required by February 19, 1995.

Aerobic Digestion

Aerobic digestion is a long term extension of the activated sludge process in which the solids produced in secondary treatment are aerated in an open suspended growth reactor tank without of additional substrate until the microbiological activity enters the endogenous respiration phase, where the cells feed on and oxidize themselves forming CO_2, H_2O, and NO_3 as by products. After an extended periods generally lasting from 15 to 20 days. Typical reductions of volatile solids range from 35% to 45% and pathogens are reduced by up to 85%. The process is energy intensive and only is cost effective in smaller plants where contact stabilization or extended aeration variants of activated sludge are used for waste treatment.

Anaerobic Digestion

Anaerobic digestion is a process where the residual solids from wastewater treatment are reduced to methane, CO_2, and by microbial action in the absence of oxygen in a two stage sealed mixed and heated digester tanks. Many treatment plants in the range of 1 mgd and higher use anaerobic digestion and some of the larger plants use the methane produced as an energy source. Anaerobic digestion generally reduces volatile solids by 35% to 50 % pathogens from 85% to 100%. The process is temperature dependent, requiring detention times of from 20 to 55 days as temperature is reduced from 40 degrees Celsius to 18 degrees Celsius. Most anaerobic digesters are heated so the operation is maintained at the higher end of the temperature range.

Anaerobic digestion is not considered viable for Madras due to cost and complexity.

Sludge Drying Beds

Sludge drying beds are used to dewater and dry digested sludge to increase its solids content for more effective handling and to further reduce the volatile content and pathogen concentrations. Drying in smaller plants are generally underdrained sand beds with drying times of two to six weeks producing cake of 40% to 45% solids.

Drying beds sized for a three month drying period will be required to comply with the Part 503 regulations and should produce much drier cake.

Composting

Composting of digested sewage sludge by aerobic microbial degradation in open piles or windrows built on a paved surface is a viable method of stabilizing the sludge. The sludge is mixed with additional organic matter such as wood chips, yard debris, or straw as a bulking agent and piled into windrows. The piles are periodically turned to provide oxygen to the microbial process and to release some of the heat produced by the composting activity. The center of the windrows rises spontaneously as a result of microbial decomposition to between 60 and 70 degrees Celsius, killing pathogens, insect larvae, and weed seeds in the process. over a period of about 6 weeks the compost piles convert the sewage sludge and bulking agents into a stable soil amendment.

Composting is not considered necessary in Madras' at the present time and would add some cost to the treatment process if used. It could be added to the treatment process at a future date if a suitable sludge disposal site cannot be provided.

Lime Stabilization

Lime stabilization involves the addition of lime to the sewage sludge in high enough dosage to raise the pH high enough to kill pathogenic bacteria and stabilize the sludge. Lime stabilization is used to minimize odor problems which sometimes occur with drying beds or land application. In the case of the Part 503 regulations lime stabilization to a pH of 12 for 2 hours and 11.5 for 22 hours is one of the approved processes to Significantly Reduce Pathogens.

Sludge disposal options for small treatment plants such as Madras must be simple and economical. The most cost effective sludge treatment processes to be used in conjunction with activated sludge or sequencing batch reactor wastewater treatment alternatives to meet 503 regulations will be a combination of aerobic digestion followed by lime stabilization and liquid disposal. If a suitable site for liquid disposal cannot be found, then drying beds are the next best option. The facultative lagoon alternatives will utilize storage and decomposition of the solids in the lagoons and no further treatment is expected except for residual sludge removal at an interval or every 15 to 20 years.

Principal Alternatives

Given that the present average wastewater flow is approaching 0.5 mgd and that it is projected to grow to about 2.0 mgd by 2015, we plan to phase the wastewater treatment plant expansion in 0.5 mgd modules. The first phase of the project will include upgrade of the existing treatment facilities to a 0.5 mgd capacity and the construction of a new 0.5 mgd module to allow for growth resulting in doubling the average wastewater flow to 1.0 mgd. Increases in wastewater treatment capacity will be accommodated by constructing two additional 0.5 mgd modules in phases as dictated by the flows. This will fit the capacity available to the actual flows rather than the projected flows in a set year. Funds will only be spent when necessary to keep up with the growth. In addition to the alternatives of phased treatment plant expansion, alternatives for construction of the entire treatment plant capacity in a single phase are also included for comparison purposes.

Existing Plant Capacity Upgrade

The existing wastewater treatment is operating at its design biological capacity and must be upgraded immediately just to treat current wastewater flows. The plant is at times treating 0.5 mgd flow, about 11% above its design capacity of 0.45 mgd. The polishing filter and chlorination systems are adequate for present flows, but the treatment ponds and the effluent storage pond are at times being loaded above their design capacity. The use of part of the stabilization ponds as storage further reduces the system's treatment capacity and efficiencies.

Because of the FAA policy against wastewater treatment facilities on or near airports, the possibilities for expansion of the existing lagoon system are strictly limited. Construction of new lagoons or treatment plant on the present site will be opposed by FAA based on its policy (Refer to Appendix D).

Two alternatives have been developed to upgrade the existing facility to treat 0.5 mgd flow with minimal construction.

Upgrade Alternative 1 - Add Aeration to the Primary Ponds

The existing facultative ponds are used partly for storage and can only provide marginal biological treatment at the current wastewater loadings. One method of increasing the lagoon's biological treatment effectiveness is to add mechanical aeration to the primary ponds to provide sufficient aeration, meeting the influent biological oxygen demand without relying on algae growth for treatment. Both surface aerators and aspirator type aerators have been considered. Because of the potential ice built-up problems associated with the spray from conventional surface aerators, aspirator aerators are chosen for the existing Madras treatment plant.

The two existing primary ponds (A and B) will be converted into aerated ponds and Ponds C, D, and E will continue to provide facultative treatment. Each aerated pond will have a total of ten 5-horsepower aerators operating in the partial mix regime. The aerators will be sized for providing sufficient oxygen to meet the secondary treatment requirements. The aeration will result in increase of sludge production even in the partially mixed aerated pond system, but less algae will grow. Solids will continue to settle at the pond bottom undergoing anaerobic treatment and the digested sludge will need to be dredged and disposed of eventually.

In order to achieve as good oxygen transfer efficiencies as possible and avoid scouring of pond bottom, a minimum operating depth of 5 feet has to be maintained in the aerated ponds. The current practice of lowering Primary Ponds A and B levels to provide storage capacity can no longer continue. Additional storage will be needed to compensate for the lost volume. The existing effluent storage pond has a volume of 46 million gallons with a water depth of 6 feet. A 6 month storage, taking precipitation and evaporation into account, amounts to 79 million gallons. The required additional storage volume can be accomplished by raising the existing dike by about 3 feet and operating the storage pond with a maximum water depth of 10 feet and a freeboard of 2 feet.

The supplemental aeration should enable the aerated ponds to treat an average flow of 0.5 mgd, producing effluent of suitable quality to be stored and then polished in the existing SandFloat unit (DAF System) prior to irrigation. The existing plant does not allow routing Polishing Pond E effluent to the Storage Pond during the irrigation season. Pond E effluent laden with algae is usually blended with the Storage Pond effluent to lower its solid/turbidity level. The mixture is then pumped into DAF for further treatment to the Level IV effluent. The plant operation experience indicates that the storage pond effluent is usually of better quality. Therefore, a floating lagoon pumper in Pond E with a forcemain should be added to allow optional pumping to the storage pond for further polishing.

The existing sludge line from the DAF system to the sludge storage pond was intended to flow by gravity. Because of insufficient head available, sludge and foams have backed up into the SandFloat even with thin, soupy sludge. To allow production of thicker sludge, a sludge pump should be installed adjacent to the SandFloat to pump sludge into the sludge storage pond.

Presently sludge stored in the sludge storage pond is pumped out annually for land disposal at a cost of about $20,000 per year. To reduce the operation and maintenance costs of sludge disposal, sludge drying beds should be constructed at the existing treatment plant site.

Land for irrigation of Level II effluent should be developed for use when the Level IV treatment required for the golf course irrigation is not being attained.

In summary, the existing treatment plant upgrade under the aeration option will include,

1. Installation of Aspirator Aerators in Ponds A and B.
2. Addition of a Lagoon Pumper in Pond E.
3. Storage Pond modifications to increase volume.
4. Addition of a Sludge Pump and piping modifications.
5. Construction of sludge drying beds.

The order of magnitude estimates of this aeration option is $1,104,000 with a present worth estimate of $1,325,000.

Upgrade Alternative 2 - Lemna System Retrofit

The Lemna System is a patented treatment system which utilizes floating duckweed to provide cost effective natural treatment to wastes. The process is ideally suited to a retrofit addition to the existing lagoon system, because it uses earthen basin components and the upstream lagoon cells for initial secondary treatment, and then produces polished secondary effluent to meet specific treatment requirements through the use of aquatic duckweed, floating barrier grids, hydraulic baffles, and harvesting equipment in the final cells of the lagoon system.

The existing treatment plant upgrade under the Lemna system option will include,

1. Installation of two 7.5 horsepower aerators in each of Ponds A and B.
2. Addition of Lemna system in Ponds C, D, and E.
3. Storage Pond modifications to increase volume.
4. Addition of a Sludge Pump and piping modifications.
5. Construction of sludge drying beds.

Again, land for irrigation of Level II effluent should be developed for use when the Level IV treatment required for the golf course irrigation is not being attained.

The order of magnitude estimates of the Lemna system option is $1,490,000 with a present worth estimate of $1,337,000.

Evaluation of Upgrade Alternatives

Comparing the aeration system with the Lemna system for the existing north treatment plant upgrade, implementation of the aeration system is recommended for the following reasons.

1. Lower capital cost, 1.1 million vs. 1.5 million dollars for Lemna system.
2. Lower present worth cost.
3. Predictable performance (Lemna system's performance in the region unknown)
4. Aerator maintenance simpler than harvesting and disposal of duckweed.

Therefore, the cost of Aeration option has been used in the evaluation of various alternatives for the treatment plant expansions and phasing.

Wastewater Treatment Plant Alternatives

Additional treatment plant capacity must be provided to accommodate future growth of Madras. Several treatment processes have been investigated to provide the needed treatment and, because of the FAA policy restrictions on construction of new facilities at the airport and the extreme pumping head to deliver the wastewater to the present airport site, a second treatment plant site south of Madras has been included for evaluation.

Table 6 - 5 on the following pages presents a list of the wastewater treatment alternatives evaluated in the analysis presented in Chapter 7.

Table 6- 5 Description of Alternatives

0. No-Build Alternative - Minimum improvements to treat present flows
"B" Street Pump Station upgrade to 0.5 mgd (average flow)
Existing lagoon aeration addition and storage increase to 0.5 mgd capacity
Winter storage and summer irrigation of Level IV effluent, limiting flow to 0.5 mgd
(No growth or expansion)

1. Phased Expansion of Existing NWWTP to 2.0 mgd Lagoons/Filtration with Irrigation
Alternative A wastewater collection system improvements in three phases including,
"B" Street Pump Station upgrade to 2.0 mgd in three phases
New 16" forcemain from "B" Street to Airport
Grizzly Pump Station and new 10" forcemain
Demers Drive Pump Station Modification
Existing lagoon aeration addition and storage increase to 0.5 mgd capacity
Expansion of lagoons, filtration, and storage in 0.5 mgd increments to 2.0 mgd
Winter storage and summer irrigation of Level IV effluent

2. Phased Expansion of Existing NWWTP to 2.0 mgd SBR with Irrigation
Alternative A wastewater collection system improvements in three phases including,
"B" Street Pump Station upgrade to 2.0 mgd in three phases
New 16" forcemain from "B" Street to Airport
Grizzly Pump Station and new 10" forcemain
Demers Drive Pump Station Modification
Existing lagoon aeration addition and storage increase to 0.5 mgd capacity
Continuing Level IV irrigation for 0.5 mgd (1.0 mgd irrigation flow)
New SBR treatment and storage in 0.5 mgd increments to 1.5 mgd
Level II irrigation for flows exceeding 0.5 mgd (1.0 mgd irrigation flow)

3. Phased Expansion of Existing NWWTP to 2.0 Mgd SBR/Filtration Plant and Wetlands for Discharge to a Receiving Stream
Alternative A wastewater collection system improvements in three phases including,
"B" Street Pump Station upgrade to 2.0 mgd in three phases
New 16" forcemain from "B" Street to Airport
Grizzly Pump Station and new 10" forcemain
Demers Drive Pump Station Modification
Existing lagoon aeration addition and storage increase to 0.5 mgd capacity
Continuing Level IV irrigation for 0.5 mgd (1.0 mgd irrigation flow)
New SBR/Filtration treatment in 0.5 mgd increments to 1.5 mgd
Constructed wetlands for wildlife habitat enhancement
Year-round discharge of flows exceeding 0.5 mgd

4. **NWWTP Operated at 0.5 mgd with Phased Construction of 1.5 mgd Activated Sludge SWWTP and Irrigation**
   - Alternative B wastewater collection system improvements in three phases including,
     - "B" Street Pump Station upgrade to 0.5 mgd (average flow)
     - New SWWTP Pump Station at "B" Street in three phases
     - New 14" forcemain from "B" Street to Grizzly Lane and "E" Street
   - NWWTP - Existing lagoon aeration addition and storage increase to 0.5 mgd capacity
   - Winter storage and summer Level IV irrigation for 0.5 mgd (1.0 mgd irrigation flow)
   - SWWTP - Activated Sludge treatment and storage in 0.5 mgd increments to 1.5 mgd
   - Off-site winter storage and summer Level II irrigation for SWWTP effluent

5. **NWWTP Operated at 0.5 mgd with Phased Construction of 1.5 mgd SBR SWWTP and Irrigation**
   - Alternative B wastewater collection system improvements in three phases including,
     - "B" Street Pump Station upgrade to 0.5 mgd (average flow)
     - New SWWTP Pump Station at "B" Street in three phases
     - New 14" forcemain from "B" Street to Grizzly Lane and "E" Street
   - NWWTP - Existing lagoon aeration addition and storage increase to 0.5 mgd capacity
   - Winter storage and summer Level IV irrigation for 0.5 mgd (1.0 mgd irrigation flow)
   - SWWTP - SBR treatment and off-site storage in 0.5 mgd increments to 1.5 mgd
   - Winter storage and summer Level II irrigation for SWWTP effluent

6. **NWWTP Operated at 0.5 mgd with Phased Construction of 1.5 mgd SBR/Wetland SWWTP and Discharge to Willow Creek**
   - Alternative B wastewater collection system improvements in three phases including,
     - "B" Street Pump Station upgrade to 0.5 mgd (average flow)
     - New SWWTP Pump Station at "B" Street in three phases
     - New 14" forcemain from "B" Street to Grizzly Lane and "E" Street
   - NWWTP - Existing lagoon aeration addition and storage increase to 0.5 mgd capacity
   - Winter storage and summer Level IV irrigation for 0.5 mgd (1.0 mgd irrigation flow)
   - SWWTP - SBR treatment in 0.5 mgd increments to 1.5 mgd
   - Constructed wetlands for effluent polishing
   - Year-round discharge of effluent to Willow Creek

7. **NWWTP Operated at 0.5 mgd with Phased Construction of 1.5 mgd SBR/Filtration SWWTP, Wetlands, and Discharge to Willow Creek**
   - Alternative B wastewater collection system improvements in three phases including,
     - "B" Street Pump Station upgrade to 0.5 mgd (average flow)
     - New SWWTP Pump Station at "B" Street in three phases
     - New 14" forcemain from "B" Street to Grizzly Lane and "E" Street
   - NWWTP - Existing lagoon aeration addition and storage increase to 0.5 mgd capacity
   - Winter storage and summer Level IV irrigation for 0.5 mgd (1.0 mgd irrigation flow)
   - SWWTP - SBR/Filtration treatment in 0.5 mgd increments to 1.5 mgd
   - Constructed wetlands for wildlife habitat enhancement
   - Year-round discharge of effluent to Willow Creek

8. NWWTP Operated at 0.5 mgd with Immediate Construction of a New 1.5 mgd SBR SWWTP and Irrigation

Alternative B wastewater collection system improvements in three phases including,
"B" Street Pump Station upgrade to 0.5 mgd (average flow)
New SWWTP Pump Station at "B" Street in three phases
New 14" forcemain from "B" Street to Grizzly Lane and "E" Street
NWWTP - Existing lagoon aeration addition and storage increase to 0.5 mgd capacity
Winter storage and summer Level IV irrigation for 0.5 mgd (1.0 mgd irrigation flow)
SWWTP - Immediate construction of 1.5 mgd SBR treatment and off-site storage
Winter storage and summer Level II irrigation for SWWTP effluent

9. NWWTP Operated at 0.5 mgd with Immediate Construction of a New 1.5 mgd SBR/Wetland SWWTP and Discharge to Willow Creek

Alternative B wastewater collection system improvements in three phases including,
"B" Street Pump Station upgrade to 0.5 mgd (average flow)
New SWWTP Pump Station at "B" Street in three phases
New 14" forcemain from "B" Street to Grizzly Lane and "E" Street
NWWTP - Existing lagoon aeration addition and storage increase to 0.5 mgd capacity
Winter storage and summer Level IV irrigation for 0.5 mgd (1.0 mgd irrigation flow)
SWWTP - Immediate construction of 1.5 mgd SBR treatment plant
Constructed wetlands for effluent polishing
Year-round discharge of effluent to Willow Creek

10. NWWTP Operated at 0.5 mgd with Immediate Construction of a New 1.5 mgd SBR/Filtration SWWTP, Wetlands, and Discharge to Willow Creek

Alternative B wastewater collection system improvements in three phases including,
"B" Street Pump Station upgrade to 0.5 mgd (average flow)
New SWWTP Pump Station at "B" Street in three phases
New 14" forcemain from "B" Street to Grizzly Lane and "E" Street
NWWTP - Existing lagoon aeration addition and storage increase to 0.5 mgd capacity
Winter storage and summer Level IV irrigation for 0.5 mgd (1.0 mgd irrigation flow)
SWWTP - Immediate construction of 1.5 mgd SBR/Filtration treatment plant
Constructed wetlands for wildlife habitat enhancement
Year-round discharge of effluent to Willow Creek

CHAPTER 7

EVALUATION OF ALTERNATIVES

Overview of Alternatives

In addition to the No-Build Alternative, ten wastewater system improvement alternatives as outlined in Chapter 6 have been evaluated. They are combinations of the Alternative A (Phased Expansion of North WWTP to 2 mgd) or Alternative B (North WWTP at 0.5 mgd and Phased Construction of South WWTP to 1.5 mgd) collection system improvements and various treatment /effluent disposal options. These alternatives can be categorized into the following schemes:

1. Alternative 0

   The No-Build Alternative, which consists of modifying existing "B" Street Pump Station and existing Treatment Plant to a 0.5 mgd capacity.

2. Alternatives 1 through 3

   Alternative A collection system improvements and phased expansion of the existing north treatment plant to 2 mgd with direct discharge into a receiving stream or effluent spray irrigation.

3. Alternatives 4 through 7

   Alternative B collection system improvements, upgrading of the existing north treatment plant to 0.5 mgd capacity and phased construction of a 1.5 mgd south treatment plant with direct discharge into a receiving stream or effluent spray irrigation.

4. Alternatives 8 through 10

   Alternative B collection system improvements, upgrading of the existing north treatment plant to 0.5 mgd capacity and immediate construction of a 1.5 mgd south treatment plant with direct discharge into a receiving stream or effluent spray irrigation.

Capital Costs and Present Worth Analysis

The order-of-magnitude capital cost estimates for each of the eleven alternatives have been made using a combination of equipment vendor estimates, published cost curve data, and our experience. Cost data from varying time frames have been adjusted to 1995 costs basis by multiplying them by the ratio of the 1995 Engineering News Record Construction Cost Index of 5500 and the Engineering News Record Construction Cost Index for the time that the original cost data were developed. In addition, estimates for operation and maintenance costs were made from published cost curves by a similar method. Basic cost curves were taken from <u>Handbook of Wastewater Treatment Processes</u> by Arnold S. Vernick and Elwood C. Walker. A present worth analysis was then made for each alternative using wastewater collection system cost estimates, the previously developed wastewater treatment construction cost and operation and maintenance cost estimates, a 20 year time frame and an 8.5% interest rate.

The total capital cost and present worth ($1995 in Millions) are presented below.

Alt No	Description	Total Capital Cost	Present Worth
0	No-Build Alternative - Minimum improvements to treat present flows	$ 1.68	$ 1.90
1	Phased Expansion of Existing NWWTP to 2.0 mgd Lagoons/Filtration with Irrigation	$31.63	$13.65
2	Phased Expansion of Existing NWWTP to 2.0 mgd SBR with Irrigation	$22.33	$11.98
3	Phased Expansion of Existing NWWTP to 2.0 Mgd SBR/Filtration Plant and Wetlands for Discharge to a Receiving Stream	$21.07	$14.22
4	NWWTP Operated at 0.5 mgd with Phased Construction of 1.5 mgd Activated Sludge SWWTP and Irrigation	$19.99	$10.06
5	NWWTP Operated at 0.5 mgd with Phased Construction of 1.5 mgd SBR SWWTP and Irrigation	$18.86	$ 9.62
6	NWWTP Operated at 0.5 mgd with Phased Construction of 1.5 mgd SBR/Wetland SWWTP and Discharge to Willow Creek	$19.22	$10.92
7	NWWTP Operated at 0.5 mgd with Phased Construction of 1.5 mgd SBR/Filtration SWWTP, Wetlands, and Discharge to Willow Creek	$17.41	$11.60
8	NWWTP Operated at 0.5 mgd with Immediate Construction of a New 1.5 mgd SBR SWWTP and Irrigation	$18.04	$12.80
9	NWWTP Operated at 0.5 mgd with Immediate Construction of a New 1.5 mgd SBR/Wetland SWWTP and Discharge to Willow Creek	$16.98	$13.25
10	NWWTP Operated at 0.5 mgd with Immediate Construction of a New 1.5 mgd SBR/Filtration SWWTP, Wetlands, and Discharge to Willow Creek	$15.85	$13.94

A 25% factor for engineering and contingency was used in the capital cost estimates for all alternatives except a 30% factor was used for alternatives with the surface water discharge option because of more studies and permitting likely to be required by regulatory agencies. Tables 7-1 and 7-2 at the end of this chapter summarize the order-of-magnitude Capital Cost Estimates in phases (i.e. Comparative Capital Cost Estimates) and the 20-year Present Worth for each of those alternatives outlined in Chapter 6. Detailed comparative capital cost estimates with respective 20-year present worth are presented in Table 7-3.

Multi-Attribute Alternative Analysis

In order to quantitatively factor values other than the monetary costs into the evaluation of the alternatives, a multi-attribute analysis was conducted using a matrix of values and ranking the alternatives based on the total of the scores each attained.

The summary attributes used for ranking the alternatives included:

1. Net Present Worth Cost
2. Safety and Convenience
3. Wildlife and Environment
4. Growth Inducement
5. Public/Agency Response

Each of the summary attributes was expanded in a matrix to several component values (for example - wildlife, farmland, endangered species, public safety, noise etc.) and each component value was assigned a rank between 0 and 10 based on opinion as to whether the alternative had a positive or negative impact on the component value. A rank of five was neutral, those below five connoting negative impact and those above five positive impact. The mean rank number for each summary attribute for each alternative was then calculated. The present worth cost in millions of dollars was used for the monetary value.

Each of the summary attributes was assigned a maximum weight such that the sum of the weights totaled 100. The weights were adjusted from the maximum over a straight line function over a range from 10 to 0 in the case of the non-monetary values by the ratio of the mean rank score over the 0 to 10 range. The higher the mean rank, the higher the weighted rank number assigned. The present worth costs were converted from dollars to a rank number by applying the ratio of the weight value based on the present worth cost to the 0 to 20 million dollars for the present worth costs. The higher the cost, the lower the weighted rank number assigned. The alternatives were then ranked with the highest total of weighted mean rank numbers selected as the most desirable project.

The results of the multi-attribute analysis are presented in Table 7-4 at the end of this chapter.

Analysis

The ranking of each alternative based on:

1. Phase I Capital Cost
2. Total Cost
3. Present Worth Cost
4. Multi-Attribute Analysis

is presented in the following.

Criteria	Alt. 0	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Alt. 7	Alt. 8	Alt. 9	Alt. 10
Capital Cost											
Phase 1	1	9	6	7	4	2	5	3	11	10	8
Total	1	11	10	9	8	6	7	4	5	3	2
Present Worth	1	9	6	11	3	2	4	5	7	8	10
Multi-Attribute	1	11	9	10	3	2	5	4	6	8	7

The numerical rankings alone, however, do not tell the entire story.

The No-Build Alternative makes little provision for allowing Madras to grow and therefore is not viable. Alternative 1 postulates a 2.0 mgd lagoon treatment plant at the existing airport site. The FAA has indicated that no more lagoons may be constructed at that site to meet their criteria for airport operation. Furthermore, the cost of implementing this alternative is estimated to be about 32 million dollars, the highest among alternatives evaluated. Alternative 1 cannot be built, neither is cost effective.

The immediate construction of a 1.5 mgd south treatment plant (Alternatives 8 through 10) will require a Phase 1 capital outlay of 14 to 16 million dollars comparing with 8 to 9 million dollars for Alternatives 4 through 7 and 11 million dollars for Alternatives 2 and 3. Unless the City can finance the immediate construction of the south treatment plant, Alternatives 8 through 10 cannot be implemented. Besides, there are no clear advantages for building an oversized treatment plant now.

Alternatives 2 and 3 for expanding the existing north treatment plant have a 20 year present worth of approximately 12 to 14 million dollars and will require a total capital outlay of approximately 21 to 22 million dollars whereas Alternatives 4 through 7 for upgrading the north treatment plant and constructing a south treatment plant have a 20 year present worth of approximately 10 to 12 million dollars and will have total capital costs of 17 to 20 million dollars. Alternatives 2 and 3 are not cost effective. Besides, expanding the north treatment plant at the airport is expected to be strongly opposed by FAA.

The recently proposed changes in DEQ regulations for Alternative Prescription (DEQ letter dated January 9, 1996) may allow surface water discharge without meeting the standard mixing zone requirements provided overall environmental benefits can be demonstrated and no other practical alternatives to the discharge are available. Therefore several alternatives for discharging to a receiving stream have been evaluated. Alternatives 3, 6, and 7 anticipate year-round discharge of treated effluent to surface waters, avoiding major expenses of constructing effluent storage lagoons. Of these, only Alternatives 6 and 7 are competitive cost wise. Alternative 6, which relies solely on wetland treatment to further remove nitrogen and phosphorus to meet stringent effluent quality requirements, cannot guarantee producing effluent in full compliance with the permit conditions. Therefore only Alternative 7 is viable among the three direct discharge options evaluated.

The alternative ranking method used in the study considered many attributes including Net Present Worth Cost, Safety and Convenience, Wildlife and Environment, Growth Inducement, and Public/Agency Response. For the reasons stated above, only Alternatives 4, 5, and 7 are viable alternatives which can be implemented. Based on the ranking of alternatives, they rank in the following order:

1. Alternative 5
2. Alternative 4
3. Alternative 7

Alternatives 4 and 5 are practically the same except Alternative 4 will be a conventional complete mix activated sludge plant and Alternative 5 will be a SBR plant. Since the SBR plant is simpler to operate and maintain and more cost effective than the activated sludge plant for the 1.5 mgd plant capacity, Alternative 5 would be the choice.

Alternative 7 is an environmentally friendly approach to revitalize Willow Creek Basin through the stream flow augmentation and riparian establishment. There have been several meetings held among the City of Madras, DEQ, Department of Fish and Wildlife, and environmental groups since the acceptance of Madras Wastewater System Master Plan in February 1996. The proposed discharge of tertiary effluent into Willow Creek to augment stream flows and the use of constructed wetlands to enhance wildlife habitats have received a favorable support from the participants. Given possible changes in DEQ regulations for the effluent discharge and the indicated support from regulatory agencies and environmental groups, Alternative 7 for year-long effluent discharge into Willow Creek, avoiding the major expense of effluent storage lagoons, deserves a closer examination.

South Wastewater Treatment Plant Site Evaluation

After the Master Plan was adopted by the Council on February 27, 1996, the City purchased a 75-acre land at the proposed treatment plant location south of future "J" Street between McTaggart Road and Grizzly Road as shown in Figure 5-2C and Figure 7-1. The site is divided into east and west sections by Willow Creek which flows through the middle. The area along the Creek within the floodway boundary as shown in Figure 7-1 can not be infringed by any structures or fills. In addition, structures of treatment facilities should not be located within the 100-year flood boundary to avoid having to carry a flood insurance and possible flood damage.

The proposed treatment plant will best be located at the southeast corner of the parcel for ease of access from Grizzly Road and away from the 100-year flood area. The remaining area could be used for building effluent storage lagoons to satisfy part of the storage requirements under the Alternative 5 treatment system. Additional land will still be needed for effluent storage. Under Alternative 7 treatment system (Discharge to Willow Creek), the remaining area can be used for the construction of an emergency storage lagoon and wetlands.

Table 7 - 1 Capital Costs of Alternatives

0. No-Build Alternative - Minimum Improvements to Treat Present Flows	
Phase I Collection System Improvements	$578,700
Total Collection System Capital Cost	$578,700
Phase I - NWWTP Capacity Modifications	$1,103,750
Total Treatment Capital Cost	$1,103,750
Alternative 0 Phase I Capital Cost	**$1,682,450**
Total Capital Cost	**$1,682,450**
1. Phased Expansion of Existing NWWTP to 2.0 mgd Lagoons/Filtration with Irrigation	
Phase I Collection System Improvements	$3,134,819
Phase II Collection System Improvements	$1,314,738
Phase III Collection System Improvements	$1,178,250
Total Collection System Capital Cost	$5,627,806
Phase I - NWWTP Capacity Modifications	$1,103,750
Phase I - 0.5 mgd NWWTP Expansion (Level II Effluent)	$9,923,357
Phase II - 0.5 mgd NWWTP Expansion (Level II Effluent)	$7,503,008
Phase III - 0.5 mgd NWWTP Expansion (Level II Effluent)	$7,503,008
Total Treatment Capital Cost	$26,033,124
Alternative 1 Phase I Capital Cost	**$14,161,926**
Total Capital Cost	**$31,660,930**
2. Phased Expansion of Existing NWWTP to 2.0 mgd SBR with Irrigation	
Phase I Collection System Improvements	$3,134,819
Phase II Collection System Improvements	$1,314,738
Phase III Collection System Improvements	$1,178,250
Total Collection System Capital Cost	$5,627,806
Phase I - NWWTP Capacity Modifications	$1,103,750
Phase I - 0.5 mgd NWWTP Expansion (Level II Effluent)	$6,841,850
Phase II - 0.5 mgd NWWTP Expansion (Level II Effluent)	$4,377,751
Phase III - 0.5 mgd NWWTP Expansion (Level II Effluent)	$4,377,751
Total Treatment Capital Cost	$16,701,101
Alternative 2 Phase I Capital Cost	**$11,080,418**
Total Capital Cost	**$22,328,908**

3. **Phased Expansion of Existing NWWTP to 2.0 mgd SBR/Filtration Plant and Wetlands For Discharge to A Receiving Stream**

Phase I Collection System Improvements	$3,134,819
Phase II Collection System Improvements	$1,314,738
Phase III Collection System Improvements	$1,178,250
Total Collection System Capital Cost	$5,627,806
Phase I - NWWTP Capacity Modifications	$1,103,750
Phase I - 0.5 mgd NWWTP Expansion (Level IV Effluent)	$7,125,298
Phase II - 0.5 mgd NWWTP Expansion (Level IV Effluent)	$3,607,241
Phase III - 0.5 mgd NWWTP Expansion (Level IV Effluent)	$3,607,241
Total Treatment Capital Cost	$15,443,530
Alternative 3 Phase I Capital Cost	**$11,363,866**
Total Capital Cost	**$21,071,336**

4. **NWWTP Operated at 0.5 mgd with Phased Construction of 1.5 mgd Activated Sludge SWWTP and Irrigation**

Phase I - Collection System Improvements	$1,984,169
Phase II - Collection System Improvements	$766,338
Phase III - Collection System Improvements	$1,054,800
Total Collection System Capital Cost	$3,805,306
Phase I - NWWTP Capacity Modifications	$1,103,750
Phase I - 0.5 mgd SWWTP Construction (Level II Effluent)	$5,281,903
Phase II - 0.5 mgd SWWTP Expansion (Level II Effluent)	$4,897,875
Phase III - 0.5 mgd SWWTP Expansion (Level II Effluent)	$4,897,875
Total Treatment Capital Cost	$16,181,404
Alternative 4 Phase I Capital Cost	**$8,369,822**
Total Capital Cost	**$19,986,710**

5. **NWWTP Operated at 0.5 mgd with Phased Construction of 1.5 mgd SBR SWWTP and Irrigation**

Phase I - Collection System Improvements	$1,984,169
Phase II - Collection System Improvements	$766,338
Phase III - Collection System Improvements	$1,054,800
Total Collection System Capital Cost	$3,805,306
Phase I - NWWTP Capacity Modifications	$1,103,750
Phase I - 0.5 mgd SWWTP Construction (Level II Effluent)	$4,936,779
Phase II - 0.5 mgd SWWTP Expansion (Level II Effluent)	$4,509,001
Phase III - 0.5 mgd SWWTP Expansion (Level II Effluent)	$4,509,001
Total Treatment Capital Cost	$15,058,531
Alternative 5 Phase I Capital Cost	**$8,024,698**
Total Capital Cost	**$18,863,837**

6. **NWWTP Operated at 0.5 mgd with Phased Construction of 1.5 mgd SBR / Wetland SWWTP and Discharge to Willow Creek**

Phase I - Collection System Improvements	$1,984,169
Phase II - Collection System Improvements	$766,338
Phase III - Collection System Improvements	$1,054,800
Total Collection System Capital Cost	$3,805,306
Phase I - NWWTP Capacity Modifications	$1,103,750
Phase I - 0.5 mgd SWWTP Construction (Level IV Effluent)	$5,618,674
Phase II - 0.5 mgd SWWTP Expansion (Level IV Effluent)	$4,347,692
Phase III - 0.5 mgd SWWTP Expansion (Level IV Effluent)	$4,347,692
Total Treatment Capital Cost	$15,417,808
Alternative 6 Phase I Capital Cost	**$8,706,592**
Total Capital Cost	**$19,223,115**

7. **NWWTP Operated at 0.5 mgd with Phased Construction of 1.5 mgd SBR/Filtration SWWTP, Wetlands, and Discharge to Willow Creek**

Phase I - Collection System Improvements	$1,984,169
Phase II - Collection System Improvements	$766,338
Phase III - Collection System Improvements	$1,054,800
Total Collection System Capital Cost	$3,805,306
Phase I - NWWTP Capacity Modifications	$1,103,750
Phase I - 0.5 mgd SWWTP Construction (Level IV Effluent)	$5,014,939
Phase II - 0.5 mgd SWWTP Expansion (Level IV Effluent)	$3,743,741
Phase III - 0.5 mgd SWWTP Expansion (Level IV Effluent)	$3,743,741
Total Treatment Capital Cost	$13,606,171
Alternative 7 Phase I Capital Cost	**$8,102,858**
Total Capital Cost	**$17,411,477**

8. **NWWTP Operated at 0.5 mgd with Immediate Construction of a New 1.5 mgd SBR SWWTP and Irrigation**

Phase I - Collection System Improvements	$1,984,169
Phase II - Collection System Improvements	$766,338
Phase III - Collection System Improvements	$1,054,800
Total Collection System Capital Cost	$3,805,306
Phase I - NWWTP Capacity Modifications	$1,103,750
Phase I - 1.5 mgd SWWTP Construction (Level II Effluent)	$13,133,628
Total Treatment Capital Cost	$14,237,378
Alternative 8 Phase I Capital Cost	**$16,221,546**
Total Capital Cost	**$18,042,684**

9. NWWTP Operated at 0.5 mgd with Immediate Construction of a New 1.5 mgd SBR / Wetland SWWTP and Discharge to Willow Creek

Phase I - Collection System Improvements	$1,984,169
Phase II - Collection System Improvements	$766,338
Phase III - Collection System Improvements	$1,054,800
Total Collection System Capital Cost	$3,805,306
Phase I - NWWTP Capacity Modifications	$1,103,750
Phase I - 1.5 mgd SWWTP Construction (Level IV Effluent)	$12,071,240
Total Treatment Capital Cost	$13,174,990
Alternative 9 Phase I Capital Cost	**$15,159,159**
Total Capital Cost	**$16,980,296**

10. NWWTP Operated at 0.5 mgd with Immediate Construction of a New 1.5 mgd SBR/Filtration SWWTP, Wetlands, and Discharge to Willow Creek

Phase I - Collection System Improvements	$1,984,169
Phase II - Collection System Improvements	$766,338
Phase III - Collection System Improvements	$1,054,800
Total Collection System Capital Cost	$3,805,306
Phase I - NWWTP Capacity Modifications	$1,103,750
Phase I - 1.5 mgd SWWTP Construction (Level II Effluent)	$10,945,323
Total Treatment Capital Cost	$12,049,073
Alternative 10 Phase I Capital Cost	**$14,033,242**
Total Capital Cost	**$15,854,380**

Table 7 - 2 Present Worth of Alternatives Summary

0. No-Build Alternative - Minimum Improvements to Treat Present Flows	
Phase I Collection System Improvements	$574,553
Total Collection System Present Worth	$574,553
Phase I - NWWTP Capacity Modifications	$1,324,907
Total Treatment Present Worth	$1,324,907
Alternative 0 Present Worth	**$1,899,460**
1. Phased Expansion of Existing NWWTP to 2.0 mgd Lagoons/Filtration with Irrigation	
Phase I Collection System Improvements	$2,182,033
Phase II Collection System Improvements	$613,012
Phase III Collection System Improvements	$104,738
Total Collection System Present Worth	$2,899,783
Phase I - NWWTP Capacity Modifications	$1,324,907
Phase I - 0.5 mgd NWWTP Expansion (Level II Effluent)	$6,675,378
Phase II - 0.5 mgd NWWTP Expansion (Level II Effluent)	$2,224,009
Phase III - 0.5 mgd NWWTP Expansion (Level II Effluent)	$525,033
Total Treatment Present Worth	$10,749,326
Alternative 1 Present Worth	**$13,649,109**
2. Phased Expansion of Existing NWWTP to 2.0 mgd SBR with Irrigation	
Phase I Collection System Improvements	$2,182,033
Phase II Collection System Improvements	$613,012
Phase III Collection System Improvements	$104,738
Total Collection System Present Worth	$2,899,783
Phase I - NWWTP Capacity Modifications	$1,324,907
Phase I - 0.5 mgd NWWTP Expansion (Level II Effluent)	$5,684,000
Phase II - 0.5 mgd NWWTP Expansion (Level II Effluent)	$1,725,620
Phase III - 0.5 mgd NWWTP Expansion (Level II Effluent)	$349,805
Total Treatment Present Worth	$9,084,332
Alternative 2 Present Worth	**$11,984,114**

3. Phased Expansion of Existing NWWTP to 2.0 mgd SBR/Filtration Plant and Wetlands For Discharge to A Receiving Stream

Phase I Collection System Improvements	$2,182,033
Phase II Collection System Improvements	$613,012
Phase III Collection System Improvements	$104,738
Total Collection System Present Worth	$2,899,783
Phase I - NWWTP Capacity Modifications	$1,324,907
Phase I - 0.5 mgd NWWTP Expansion (Level IV Effluent)	$7,350,950
Phase II - 0.5 mgd NWWTP Expansion (Level IV Effluent)	$2,241,936
Phase III - 0.5 mgd NWWTP Expansion (Level IV Effluent)	$400,778
Total Treatment Present Worth	$11,318,572
Alternative 3 Present Worth	**$14,218,354**

4. NWWTP Operated at 0.5 mgd with Phased Construction of 1.5 mgd Activated Sludge SWWTP and Irrigation

Phase I - Collection System Improvements	$1,453,620
Phase II - Collection System Improvements	$234,978
Phase III - Collection System Improvements	$72,617
Total Collection System Present Worth	$1,761,215
Phase I - NWWTP Capacity Modifications	$1,312,985
Phase I - 0.5 mgd SWWTP Construction (Level II Effluent)	$4,568,404
Phase II - 0.5 mgd SWWTP Expansion (Level II Effluent)	$1,974,441
Phase III - 0.5 mgd SWWTP Expansion (Level II Effluent)	$438,669
Total Treatment Present Worth	$8,294,499
Alternative 4 Present Worth	**$10,055,714**

5. NWWTP Operated at 0.5 mgd with Phased Construction of 1.5 mgd SBR SWWTP and Irrigation

Phase I - Collection System Improvements	$1,453,620
Phase II - Collection System Improvements	$234,978
Phase III - Collection System Improvements	$72,617
Total Collection System Present Worth	$1,761,215
Phase I - NWWTP Capacity Modifications	$1,324,907
Phase I - 0.5 mgd SWWTP Construction (Level II Effluent)	$4,344,379
Phase II - 0.5 mgd SWWTP Expansion (Level II Effluent)	$1,823,795
Phase III - 0.5 mgd SWWTP Expansion (Level II Effluent)	$366,785
Total Treatment Present Worth	$7,859,866
Alternative 5 Present Worth	**$9,621,081**

6. **NWWTP Operated at 0.5 mgd with Phased Construction of 1.5 mgd SBR / Wetland SWWTP and Discharge to Willow Creek**

Phase I - Collection System Improvements	$1,453,620
Phase II - Collection System Improvements	$234,978
Phase III - Collection System Improvements	$72,617
Total Collection System Present Worth	$1,761,215
Phase I - NWWTP Capacity Modifications	$1,324,907
Phase I - 0.5 mgd SWWTP Construction (Level IV Effluent)	$5,375,943
Phase II - 0.5 mgd SWWTP Expansion (Level IV Effluent)	$2,048,939
Phase III - 0.5 mgd SWWTP Expansion (Level IV Effluent)	$409,193
Total Treatment Present Worth	$9,158,982
Alternative 6 Present Worth	**$10,920,197**

7. **NWWTP Operated at 0.5 mgd with Phased Construction of 1.5 mgd SBR/Filtration SWWTP, Wetlands, and Discharge to Willow Creek**

Phase I - Collection System Improvements	$1,453,620
Phase II - Collection System Improvements	$234,978
Phase III - Collection System Improvements	$72,617
Total Collection System Present Worth	$1,761,215
Phase I - NWWTP Capacity Modifications	$1,324,907
Phase I - 0.5 mgd SWWTP Construction (Level IV Effluent)	$5,840,254
Phase II - 0.5 mgd SWWTP Expansion (Level IV Effluent)	$2,249,721
Phase III - 0.5 mgd SWWTP Expansion (Level IV Effluent)	$419,018
Total Treatment Present Worth	$9,833,900
Alternative 7 Present Worth	**$11,595,115**

8. **NWWTP Operated at 0.5 mgd with Immediate Construction of a New 1.5 mgd SBR SWWTP and Irrigation**

Phase I - Collection System Improvements	$1,453,620
Phase II - Collection System Improvements	$234,978
Phase III - Collection System Improvements	$72,617
Total Collection System Present Worth	$1,761,215
Phase I - NWWTP Capacity Modifications	$1,324,907
Phase I - 1.5 mgd SWWTP Construction (Level II Effluent)	$9,709,630
Total Treatment Present Worth	$11,034,537
Alternative 8 Present Worth	**$12,795,752**

9. NWWTP Operated at 0.5 mgd with Immediate Construction of a New 1.5 mgd SBR / Wetland SWWTP and Discharge to Willow Creek

Phase I - Collection System Improvements	$1,453,620
Phase II - Collection System Improvements	$234,978
Phase III - Collection System Improvements	$72,617
Total Collection System Present Worth	$1,761,215
Phase I - NWWTP Capacity Modifications	$1,324,907
Phase I - 1.5 mgd SWWTP Construction (Level IV Effluent)	$10,160,744
Total Treatment Present Worth	$11,485,651
Alternative 9 Present Worth	**$13,246,867**

10. NWWTP Operated at 0.5 mgd with Immediate Construction of a New 1.5 mgd SBR/Filtration SWWTP, Wetlands, and Discharge to Willow Creek

Phase I - Collection System Improvements	$1,453,620
Phase II - Collection System Improvements	$234,978
Phase III - Collection System Improvements	$72,617
Total Collection System Present Worth	$1,761,215
Phase I - NWWTP Capacity Modifications	$1,324,907
Phase I - 1.5 mgd SWWTP Construction (Level II Effluent)	$10,852,474
Total Treatment Present Worth	$12,177,381
Alternative 10 Present Worth	**$13,938,596**

Table 7 - 3 Order-of-Magnitude Capital Cost Estimates and Present Worth

0. No-Build Alternative - Minimum Improvements to Treat Present Flows

	Alternatives	Capital Cost $	O&M Cost $/yr	Salvage Value $
	Alternative A Wastewater Collection System			
	Phase I Collection System Improvements			
	"B" Street Pump Station	$462,960	$22,580	$169,752
	Non-Process Costs			
25%	Engineering & Contingency	$115,740	$0	$0
	Total	$578,700	$22,580	$169,752
	Present Worth Factor 1996	0.92	8.71	0.92
	Present Worth	$534,596	$196,772	$156,815
	Total Collection Capital Cost	**$578,700**		
	Total Collection Present Worth	**$574,553**		
	Wastewater Treatment			
	Phase I - NWWTP Capacity Modifications			
	Exist. Primary Pond Aeration	$229,538	$37,675	$84,164
	Sludge Pond Pumping/Sludge Drying Beds	$221,149	$33,172	$81,088
	Effluent Storage Pond Improvements	$228,543	$5,556	$141,697
	Non-Process Costs			
	Land Aquisition	$0	$0	$0
0%	Site Preparation	$0	$0	$0
5%	Piping	$33,962	$0	$21,056
20%	Electrical	$135,846	$0	$49,810
5%	Instrumentation	$33,962	$0	$12,453
25%	Engineering & Contingency	$220,750	$0	$0
	Total	$1,103,750	$76,403	$390,268
	Present Worth Factor 1996	0.92	8.71	0.92
	Present Worth	$1,019,630	$665,801	$360,525
	Total Treatment Capital Cost	**$1,103,750**		
	Total Treatment Present Worth	**$1,324,907**		
	Alternative 1 Phase 1 Capital Cost	**$1,682,450**		
	Alternative 1 Total Capital Cost	**$1,682,450**		
	Total Present Worth	**$1,899,460**		

1. **Phased Expansion of Existing NWWTP to 2.0 mgd Lagoons/Filtration with Irrigation**

Alternatives	Capital Cost $	O&M Cost $/yr	Salvage Value $
Alternative A Wastewater Collection System			
Phase I Collection System Improvements			
Sewer Lines	$626,375	$3,132	$388,353
NWWTP "B" Street PS Modification	$793,180	$39,257	$290,833
New 16" NWWTP Forcemain	$736,000	$3,680	$456,320
Grizzly Pump Station	$227,300	$8,809	$83,343
10" Grizzly Forcemain	$125,000	$625	$77,500
Non-Process Costs			
25% Engineering & Contingency	$626,964	$0	$0
Total	$3,134,819	$55,503	$1,296,349
Present Worth Factor 1996	0.92	8.71	0.92
Present Worth	$2,895,906	$483,677	$1,197,551
Phase II Collection System Improvements			
Sewer Lines	$569,120	$2,846	$432,531
NWWTP "B" Street PS Upgrade	$282,060	$54,479	$169,236
Grizzly PS Upgrade	$23,650	$10,096	$14,190
Existing Demers Drive PS Upgrade	$176,960	$8,287	$106,176
Non-Process Costs			
25% Engineering & Contingency	$262,948	$0	$0
Total	$1,314,738	$75,708	$722,133
Present Worth Factor 2003	0.53	3.95	0.53
Present Worth	$697,294	$298,714	$382,996
Phase III Collection System Improvements			
Sewer Lines	$572,490	$2,862	$549,590
NWWTP "B" Street PS Upgrade	$119,060	$63,877	$111,123
Grizzly PS Upgrade	$23,650	$11,582	$22,073
Celilo Pump Station	$181,400	$8,287	$169,307
6" Celilo Forcemain	$46,000	$230	$44,160
Non-Process Costs			
25% Engineering & Contingency	$235,650	$0	$0
Total	$1,178,250	$86,838	$896,253
Present Worth Factor 2013	0.24	0.43	0.24
Present Worth	$282,836	$37,046	$215,144
Total Collection Capital Cost	**$5,627,806**		
Total Collection Present Worth	**$2,899,783**		

Wastewater Treatment

	Phase I - NWWTP Capacity Modifications			
	Exist. Primary Pond Aeration	$229,538	$37,675	$84,164
	Sludge Pond Pumping/Sludge Drying Beds	$221,149	$33,172	$81,088
	Effluent Storage Pond Improvements	$228,543	$5,556	$141,697
	Non-Process Costs			
	Land Aquisition	$0	$0	$0
0%	Site Preparation	$0	$0	$0
5%	Piping	$33,962	$0	$21,056
20%	Electrical	$135,846	$0	$49,810
5%	Instrumentation	$33,962	$0	$12,453
25%	Engineering & Contingency	$220,750	$0	$0
	Total	$1,103,750	$76,403	$390,268
	Present Worth Factor 1996	0.92	8.71	0.92
	Present Worth	$1,019,630	$665,801	$360,525
	Phase I - 0.5 mgd NWWTP Expansion (Level II Effluent)			
	Facultative Lagoons Addition	$2,031,155	$13,333	$1,259,316
	Polishing Filter Addition	$561,000	$38,889	$205,700
	Chlorination / Chlorine Contact	$177,778	$20,000	$65,185
	Storage Lagoon Additions	$1,000,000	$5,556	$620,000
	Effluent Distribution Pumps	$178,889	$9,767	$65,593
	Effluent Distribution FM, 1 mile	$132,000	$19,800	$81,840
	Non-Process Costs			
	Land Aquisition	$289,256	$0	$289,256
5%	Site Preparation	$365,398	$0	$0
10%	Piping	$730,795	$0	$453,093
20%	Electrical	$1,461,591	$0	$535,917
5%	Instrumentation	$365,398	$0	$133,979
25%	Engineering & Contingency	$2,630,098	$0	$0
	Total	$9,923,357	$107,345	$3,709,879
	Present Worth Factor 1996	0.92	8.71	0.92
	Present Worth	$9,167,073	$935,444	$3,427,140

	Phase II - 0.5 mgd NWWTP Expansion (Level II Effluent)			
	Facultative Lagoons Addition	$2,031,155	$21,111	$1,543,678
	Polishing Filter Addition	$561,000	$38,889	$336,600
	Chlorination / Chlorine Contact	$177,778	$20,000	$106,667
	Storage Lagoon Additions	$1,000,000	$5,556	$760,000
	Effluent Distribution Pumps	$178,889	$9,767	$107,333
	Effluent Distribution FM, 1 mile	$132,000	$19,800	$100,320
	Non-Process Costs			
	Land Aquisition	$289,256	$0	$289,256
5%	Site Preparation	$204,041	$0	$0
10%	Piping	$408,082	$0	$310,142
20%	Electrical	$816,164	$0	$489,699
5%	Instrumentation	$204,041	$0	$122,425
25%	Engineering & Contingency	$1,500,602	$0	$0
	Total	$7,503,008	$115,123	$4,166,120
	Present Worth Factor 2003	0.53	3.95	0.53
	Present Worth	$3,979,350	$454,232	$2,209,574
	Phase III - 0.5 mgd NWWTP Expansion (Level II Effluent)			
	Facultative Lagoons Addition	$2,031,155	$24,444	$1,949,909
	Polishing Filter Addition	$561,000	$38,889	$523,600
	Chlorination / Chlorine Contact	$177,778	$20,000	$165,926
	Storage Lagoon Additions	$1,000,000	$5,556	$960,000
	Effluent Distribution Pumps	$178,889	$9,767	$166,963
	Effluent Distribution FM, 1 mile	$132,000	$19,800	$126,720
	Non-Process Costs			
	Land Aquisition	$289,256	$0	$289,256
5%	Site Preparation	$204,041	$0	$0
10%	Piping	$408,082	$0	$391,759
20%	Electrical	$816,164	$0	$761,753
5%	Instrumentation	$204,041	$0	$190,438
25%	Engineering & Contingency	$1,500,602	$0	$0
	Total	$7,503,008	$118,456	$5,526,325
	Present Worth Factor 2013	0.24	0.43	0.24
	Present Worth	$1,801,081	$50,534	$1,326,582

Total Treatment Capital Cost	**$26,107,624**
Total Treatment Present Worth	**$10,749,326**
Alternative 1 Phase 1 Capital Cost	**$14,161,926**
Alternative 1 Total Capital Cost	**$31,735,430**
Total Present Worth	**$13,649,109**

2. Phased Expansion of Existing NWWTP to 2.0 mgd SBR with Irrigation

Alternatives	Capital Cost $	O&M Cost $/yr	Salvage Value $
Alternative A Wastewater Collection System			
Phase I Collection System Improvements			
Sewer Lines	$626,375	$3,132	$388,353
NWWTP "B" Street Pump Station	$793,180	$39,257	$290,833
New 16" NWWTP Forcemain	$736,000	$3,680	$456,320
Grizzly Pump Station	$227,300	$8,809	$83,343
10" Grizzly Forcemain	$125,000	$625	$77,500
Non-Process Costs			
25% Engineering & Contingency	$626,964	$0	$0
Total	$3,134,819	$55,503	$1,296,349
Present Worth Factor 1996	0.92	8.71	0.92
Present Worth	$2,895,906	$483,677	$1,197,551
Phase II Collection System Improvements			
Sewer Lines	$569,120	$2,846	$432,531
NWWTP "B" Street PS Upgrade	$282,060	$54,479	$169,236
Grizzly PS Upgrade	$23,650	$10,096	$14,190
Existing Demers Drive PS Upgrade	$176,960	$8,287	$106,176
Non-Process Costs			
25% Engineering & Contingency	$262,948	$0	$0
Total	$1,314,738	$75,708	$722,133
Present Worth Factor 2003	0.53	3.95	0.53
Present Worth	$697,294	$298,714	$382,996
Phase III Collection System Improvements			
Sewer Lines	$572,490	$2,862	$549,590
NWWTP "B" Street PS Upgrade	$119,060	$63,877	$111,123
Grizzly PS Upgrade	$23,650	$11,582	$22,073
Celilo Pump Station	$181,400	$8,287	$169,307
6" Celilo Forcemain	$46,000	$230	$44,160
Non-Process Costs			
25% Engineering & Contingency	$235,650	$0	$0
Total	$1,178,250	$86,838	$896,253
Present Worth Factor 2013	0.24	0.43	0.24
Present Worth	$282,836	$37,046	$215,144
Total Collection Capital Cost	**$5,627,806**		
Total Collection Present Worth	**$2,899,783**		

Wastewater Treatment

	Phase I - NWWTP Capacity Modifications			
	Exist. Primary Pond Aeration	$229,538	$37,675	$84,164
	Sludge Pond Pumping/Sludge Drying Beds	$221,149	$33,172	$81,088
	Effluent Storage Pond Improvements	$228,543	$5,556	$141,697
	Non-Process Costs			
	Land Aquisition	$0	$0	$0
0%	Site Preparation	$0	$0	$0
5%	Piping	$33,962	$0	$21,056
20%	Electrical	$135,846	$0	$49,810
5%	Instrumentation	$33,962	$0	$12,453
25%	Engineering & Contingency	$220,750	$0	$0
	Total	$1,103,750	$76,403	$390,268
	Present Worth Factor 1996	0.92	8.71	0.92
	Present Worth	$1,019,630	$665,801	$360,525
	Phase I - 0.5 mgd NWWTP Expansion (Level II Effluent)			
	Sequencing Batch Reactors	$595,556	$88,889	$218,371
	Chlorination / Chlorine Contact	$177,778	$20,000	$65,185
	Aerobic Digester	$177,778	$11,111	$65,185
	Sludge Drying Beds	$159,571	$23,111	$58,510
	Storage Lagoon Additions	$1,000,000	$5,556	$620,000
	Effluent Distribution Pumps	$178,889	$9,767	$65,593
	Effluent Distribution FM, 1 mile	$132,000	$660	$81,840
	Non-Process Costs			
	Land Aquisition	$147,000	$0	$147,000
5%	Site Preparation	$282,435	$0	$0
10%	Piping	$564,870	$0	$350,220
20%	Electrical	$1,129,741	$0	$414,238
5%	Instrumentation	$282,435	$0	$103,560
25%	Engineering & Contingency	$2,013,796	$0	$0
	Total	$6,841,850	$159,094	$2,189,700
	Present Worth Factor 1996	0.92	8.71	0.92
	Present Worth	$6,320,415	$1,386,403	$2,022,818

	Phase II - 0.5 mgd NWWTP Expansion (Level II Effluent)			
	Sequencing Batch Reactors	$570,556	$88,889	$342,334
	Chlorination / Chlorine Contact	$177,778	$20,000	$106,667
	Aerobic Digester	$177,778	$11,111	$106,667
	Sludge Drying Beds	$159,571	$23,111	$95,743
	Storage Lagoon Additions	$1,000,000	$5,556	$760,000
	Effluent Distribution Pumps	$178,889	$9,767	$107,333
	Effluent Distribution FM, 1 mile	$132,000	$660	$100,320
	Non-Process Costs			
	Land Aquisition	$147,000	$0	$147,000
5%	Site Preparation	$119,829	$0	$0
10%	Piping	$239,657	$0	$182,139
20%	Electrical	$479,314	$0	$287,589
5%	Instrumentation	$119,829	$0	$71,897
25%	Engineering & Contingency	$875,550	$0	$0
	Total	$4,377,751	$159,094	$2,307,688
	Present Worth Factor 2003	0.53	3.95	0.53
	Present Worth	$2,321,816	$627,726	$1,223,923
	Phase III - 0.5 mgd NWWTP Expansion (Level II Effluent)			
	Sequencing Batch Reactors	$570,556	$88,889	$532,519
	Chlorination / Chlorine Contact	$177,778	$20,000	$165,926
	Aerobic Digester	$177,778	$11,111	$165,926
	Sludge Drying Beds	$159,571	$23,111	$148,933
	Storage Lagoon Additions	$1,000,000	$5,556	$960,000
	Effluent Distribution Pumps	$178,889	$9,767	$166,963
	Effluent Distribution FM, 1 mile	$132,000	$660	$126,720
	Non-Process Costs			
	Land Aquisition	$147,000	$0	$147,000
5%	Site Preparation	$119,829	$0	$0
10%	Piping	$239,657	$0	$230,071
20%	Electrical	$479,314	$0	$447,360
5%	Instrumentation	$119,829	$0	$111,840
25%	Engineering & Contingency	$875,550	$0	$0
	Total	$4,377,751	$159,094	$3,203,258
	Present Worth Factor 2013	0.24	0.43	0.24
	Present Worth	$1,050,869	$67,870	$768,935
	Total Treatment Capital Cost	**$16,701,101**		
	Total Treatment Present Worth	**$9,084,332**		
	Alternative 2 Phase 1 Capital Cost	**$11,080,418**		
	Alternative 2 Total Capital Cost	**$22,328,908**		
	Total Present Worth	**$11,984,114**		

3. **Phased Expansion of Existing NWWTP to 2.0 mgd SBR/Filtration Plant and Wetlands For Discharge to A Receiving Stream**

Alternatives	Capital Cost $	O&M Cost $/yr	Salvage Value $
Alternative A Wastewater Collection System			
Phase I Collection System Improvements			
Sewer Lines	$626,375	$3,132	$388,353
NWWTP "B" Street Pump Station	$793,180	$39,257	$290,833
New 16" NWWTP Forcemain	$736,000	$3,680	$456,320
Grizzly Pump Station	$227,300	$8,809	$83,343
10" Grizzly Forcemain	$125,000	$625	$77,500
Non-Process Costs			
25% Engineering & Contingency	$626,964	$0	$0
Total	$3,134,819	$55,503	$1,296,349
Present Worth Factor 1996	0.92	8.71	0.92
Present Worth	$2,895,906	$483,677	$1,197,551
Phase II Collection System Improvements			
Sewer Lines	$569,120	$2,846	$432,531
NWWTP "B" Street PS Upgrade	$282,060	$54,479	$169,236
Grizzly PS Upgrade	$23,650	$10,096	$14,190
Existing Demers Drive PS Upgrade	$176,960	$8,287	$106,176
Non-Process Costs			
25% Engineering & Contingency	$262,948	$0	$0
Total	$1,314,738	$75,708	$722,133
Present Worth Factor 2003	0.53	3.95	0.53
Present Worth	$697,294	$298,714	$382,996
Phase III Collection System Improvements			
Sewer Lines	$572,490	$2,862	$549,590
NWWTP "B" Street PS Upgrade	$119,060	$63,877	$111,123
Grizzly PS Upgrade	$23,650	$11,582	$22,073
Celilo Pump Station	$181,400	$8,287	$169,307
6" Celilo Forcemain	$46,000	$230	$44,160
Non-Process Costs			
25% Engineering & Contingency	$235,650	$0	$0
Total	$1,178,250	$86,838	$896,253
Present Worth Factor 2013	0.24	0.43	0.24
Present Worth	$282,836	$37,046	$215,144
Total Collection Capital Cost	**$5,627,806**		
Total Collection Present Worth	**$2,899,783**		

Wastewater Treatment

Phase I - NWWTP Capacity Modifications				
	Exist. Primary Pond Aeration	$229,538	$37,675	$84,164
	Sludge Pond Pumping/Sludge Drying Beds	$221,149	$33,172	$81,088
	Effluent Storage Pond Improvements	$228,543	$5,556	$141,697
	Non-Process Costs			
	Land Aquisition	$0	$0	$0
0%	Site Preparation	$0	$0	$0
5%	Piping	$33,962	$0	$21,056
20%	Electrical	$135,846	$0	$49,810
5%	Instrumentation	$33,962	$0	$12,453
25%	Engineering & Contingency	$220,750	$0	$0
	Total	$1,103,750	$76,403	$390,268
	Present Worth Factor 1996	0.92	8.71	0.92
	Present Worth	$1,019,630	$665,801	$360,525
Phase I - 0.5 mgd NWWTP Expansion (Level IV Effluent)				
	Sequencing Batch Reactors	$645,556	$88,889	$236,704
	Polishing Filter Addition	$330,000	$77,778	$121,000
	Wetlands for Wildlife Habitat Enhancement	$320,206	$32,021	$198,528
	Phase I Wetland Booster PS	$176,667	$11,898	$64,778
	Chlorination / Chlorine Contact	$177,778	$20,000	$65,185
	Dechlorination	$31,111	$11,111	$11,407
	Aerobic Digester	$177,778	$11,111	$65,185
	Sludge Drying Beds	$159,571	$23,111	$58,510
	Emergency Storage (one month)	$166,667	$8,333	$103,333
	Outfall Pump Station	$177,778	$9,767	$65,185
	Outfall FM, 1/2 mile	$66,000	$330	$40,920
	Non-Process Costs			
	Land Aquisition	$44,667	$0	$44,667
5%	Site Preparation	$282,812	$0	$0
10%	Piping	$565,624	$0	$350,687
20%	Electrical	$1,131,249	$0	$414,791
5%	Instrumentation	$282,812	$0	$103,698
30%	Engineering & Contingency	$2,389,022	$0	$0
	Total	$7,125,298	$294,349	$1,944,578
	Present Worth Factor 1996	0.92	8.71	0.92
	Present Worth	$6,582,261	$2,565,066	$1,796,377

	Phase II - 0.5 mgd NWWTP Expansion (Level IV Effluent)			
	Sequencing Batch Reactors	$645,556	$88,889	$236,704
	Polishing Filter Addition	$330,000	$77,778	$198,000
	Wetlands for Wildlife Habitat Enhancement	$320,206	$32,021	$198,528
	Phase II Wetland Booster PS	$75,000	$11,898	$64,778
	Chlorination / Chlorine Contact	$177,778	$20,000	$106,667
	Dechlorination	$31,111	$11,111	$18,667
	Aerobic Digester	$177,778	$11,111	$106,667
	Sludge Drying Beds	$159,571	$23,111	$95,743
	Outfall Pump Station	$50,000	$11,898	$30,000
	Non-Process Costs			
	Land Aquisition	$21,000	$0	$21,000
5%	Site Preparation	$98,350	$0	$0
10%	Piping	$196,700	$0	$149,492
20%	Electrical	$393,400	$0	$236,040
5%	Instrumentation	$98,350	$0	$59,010
30%	Engineering & Contingency	$832,440	$0	$0
	Total	$3,607,241	$287,817	$1,521,295
	Present Worth Factor 2003	0.53	3.95	0.53
	Present Worth	$1,913,163	$1,135,618	$806,845
	Phase III - 0.5 mgd NWWTP Expansion (Level IV Effluent)			
	Sequencing Batch Reactors	$645,556	$88,889	$602,519
	Polishing Filter Addition	$330,000	$77,778	$308,000
	Wetlands for Wildlife Habitat Enhancement	$320,206	$32,021	$243,357
	Phase III Wetland Booster PS	$75,000	$11,898	$70,000
	Chlorination / Chlorine Contact	$177,778	$20,000	$165,926
	Dechlorination	$31,111	$11,111	$29,037
	Aerobic Digester	$177,778	$11,111	$165,926
	Sludge Drying Beds	$159,571	$23,111	$148,933
	Outfall Pump Station	$50,000	$11,898	$46,667
	Non-Process Costs			
	Land Aquisition	$21,000	$0	$21,000
5%	Site Preparation	$98,350	$0	$0
10%	Piping	$196,700	$0	$188,832
20%	Electrical	$393,400	$0	$367,173
5%	Instrumentation	$98,350	$0	$91,793
30%	Engineering & Contingency	$832,440	$0	$0
	Total	$3,607,241	$287,817	$2,449,164
	Present Worth Factor 2013	0.24	0.43	0.24
	Present Worth	$865,910	$122,784	$587,916

Total Treatment Capital Cost $15,443,530
Total Treatment Present Worth $11,318,572

Alternative 3 Phase 1 Capital Cost $11,363,866
Alternative 3 Total Capital Cost $21,071,336
Total Present Worth $14,218,354

4. NWWTP Operated at 0.5 mgd with Phased Construction of 1.5 mgd Activated Sludge SWWTP and Irrigation

Alternatives	Capital Cost $	O&M Cost $/yr	Salvage Value $
Alternative B Wastewater Collection System			
Phase I - Collection System Improvements			
Sewer Lines	$572,435	$2,862	$354,910
"B" Street PS 0.5 mgd Upgrade	$463,000	$22,580	$169,767
SWWTP Pump Station	$327,900	$12,996	$120,230
14" SWWTP FM	$224,000	$1,120	$138,880
Non-Process Costs			
25% Engineering & Contingency	$396,834	$0	$0
Total	$1,984,169	$39,558	$783,786
Present Worth Factor 1996	0.92	8.71	0.92
Present Worth	$1,832,950	$344,722	$724,052
Phase II - Collection System Improvements			
Sewer Lines	$569,120	$2,846	$432,531
SWWTP PS Expansion	$43,950	$15,383	$26,370
Non-Process Costs			
25% Engineering & Contingency	$153,268	$0	$0
Total	$766,338	$18,229	$458,901
Present Worth Factor 2003	0.53	3.95	0.53
Present Worth	$406,440	$71,923	$243,386
Phase III - Collection System Improvements			
Sewer Lines	$572,490	$2,862	$549,590
SWWTP PS Expansion	$43,950	$17,762	$41,020
Celilo Pump Station	$181,400	$8,287	$169,307
6" Celilo Forcemain	$46,000	$230	$44,160
Non-Process Costs			
25% Engineering & Contingency	$210,960	$0	$0
Total	$1,054,800	$29,141	$804,077
Present Worth Factor 2013	0.24	0.43	0.24
Present Worth	$253,202	$12,432	$193,017
Total Collection Capital Cost	**$3,805,306**		
Total Collection Present Worth	**$1,761,215**		

Wastewater Treatment

	Phase I - NWWTP Capacity Modifications			
	Exist. Primary Pond Aeration	$229,538	$37,675	$84,164
	Sludge Pond Pumping/Sludge Drying Beds	$221,149	$33,172	$81,088
	Effluent Storage Pond Improvements	$228,543	$5,556	$141,697
	Non-Process Costs			
	Land Aquisition	$0	$0	$0
0%	Site Preparation	$0	$0	$0
5%	Piping	$33,962	$0	$33,962
20%	Electrical	$135,846	$0	$49,810
5%	Instrumentation	$33,962	$0	$12,453
25%	Engineering & Contingency	$220,750	$0	$0
	Total	$1,103,750	$76,403	$403,173
	Present Worth Factor 1996	0.92	8.71	0.92
	Present Worth	$1,019,630	$665,801	$372,446
	Phase I - 0.5 mgd SWWTP Construction (Level II Effluent)			
	SWWTP Influent PS	$294,444	$11,898	$107,963
	Complete Mix Activated Sludge	$792,770	$88,889	$290,682
	Chlorination / Chlorine Contact	$177,778	$20,000	$65,185
	Aerobic Digester	$177,778	$11,111	$65,185
	Sludge Drying Beds	$159,571	$23,111	$58,510
	Storage Lagoon Additions	$1,000,000	$5,556	$620,000
	Effluent Distribution Pumps	$178,889	$9,767	$65,593
	Effluent Distribution FM, 1 mile	$132,000	$660	$81,840
	Non-Process Costs			
	Land Aquisition	$147,000	$0	$147,000
5%	Site Preparation	$145,662	$0	$0
10%	Piping	$291,323	$0	$180,620
20%	Electrical	$582,646	$0	$213,637
5%	Instrumentation	$145,662	$0	$53,409
25%	Engineering & Contingency	$1,056,381	$0	$0
	Total	$5,281,903	$170,992	$1,949,624
	Present Worth Factor 1996	0.92	8.71	0.92
	Present Worth	$4,879,356	$1,490,086	$1,801,039

Phase II - 0.5 mgd SWWTP Expansion (Level II Effluent)				
	SWWTP Influent PS	$75,000	$15,567	$45,000
	Complete Mix Activated Sludge	$792,770	$88,889	$475,662
	Chlorination / Chlorine Contact	$177,778	$20,000	$106,667
	Aerobic Digester	$177,778	$11,111	$65,185
	Sludge Drying Beds	$159,571	$23,111	$58,510
	Storage Lagoon Additions	$1,000,000	$5,556	$760,000
	Effluent Distribution Pumps	$178,889	$9,767	$107,333
	Effluent Distribution FM, 1 mile	$132,000	$660	$100,320
	Non-Process Costs			
	Land Aquisition	$147,000	$0	$147,000
5%	Site Preparation	$134,689	$0	$0
10%	Piping	$269,379	$0	$204,728
20%	Electrical	$538,757	$0	$323,254
5%	Instrumentation	$134,689	$0	$80,814
25%	Engineering & Contingency	$979,575	$0	$0
	Total	$4,897,875	$174,661	$2,474,472
	Present Worth Factor 2003	0.53	3.95	0.53
	Present Worth	$2,597,673	$689,147	$1,312,379
Phase III - 0.5 mgd SWWTP Expansion (Level II Effluent)				
	SWWTP Influent PS	$75,000	$19,236	$70,000
	Complete Mix Activated Sludge	$792,770	$88,889	$739,919
	Chlorination / Chlorine Contact	$177,778	$20,000	$165,926
	Aerobic Digester	$177,778	$11,111	$65,185
	Sludge Drying Beds	$159,571	$23,111	$58,510
	Storage Lagoon Additions	$1,000,000	$5,556	$960,000
	Effluent Distribution Pumps	$178,889	$9,767	$166,963
	Effluent Distribution FM, 1 mile	$132,000	$660	$126,720
	Non-Process Costs			
	Land Aquisition	$147,000	$0	$147,000
5%	Site Preparation	$134,689	$0	$0
10%	Piping	$269,379	$0	$258,603
20%	Electrical	$538,757	$0	$502,840
5%	Instrumentation	$134,689	$0	$125,710
25%	Engineering & Contingency	$979,575	$0	$0
	Total	$4,897,875	$178,330	$3,387,376
	Present Worth Factor 2013	0.24	0.43	0.24
	Present Worth	$1,175,724	$76,077	$813,132
	Total Treatment Capital Cost	**$16,181,404**		
	Total Treatment Present Worth	**$8,294,499**		
	Alternative 4 Phase 1 Capital Cost	**$8,369,822**		
	Alternative 4 Total Capital Cost	**$19,986,710**		
	Total Present Worth	**$10,055,714**		

5. **NWWTP Operated at 0.5 mgd with Phased Construction of 1.5 mgd SBR SWWTP and Irrigation**

Alternatives	Capital Cost $	O&M Cost $/yr	Salvage Value $
Alternative B Wastewater Collection System			
Phase I - Collection System Improvements			
Sewer Lines	$572,435	$2,862	$354,910
"B" Street PS 0.5 mgd Upgrade	$463,000	$22,580	$169,767
SWWTP Pump Station	$327,900	$12,996	$120,230
14" SWWTP FM	$224,000	$1,120	$138,880
Non-Process Costs			
25% Engineering & Contingency	$396,834	$0	$0
Total	$1,984,169	$39,558	$783,786
Present Worth Factor 1996	0.92	8.71	0.92
Present Worth	$1,832,950	$344,722	$724,052
Phase II - Collection System Improvements			
Sewer Lines	$569,120	$2,846	$432,531
SWWTP PS Expansion	$43,950	$15,383	$26,370
Non-Process Costs			
25% Engineering & Contingency	$153,268	$0	$0
Total	$766,338	$18,229	$458,901
Present Worth Factor 2003	0.53	3.95	0.53
Present Worth	$406,440	$71,923	$243,386
Phase III - Collection System Improvements			
Sewer Lines	$572,490	$2,862	$549,590
SWWTP PS Expansion	$43,950	$17,762	$41,020
Celilo Pump Station	$181,400	$8,287	$169,307
6" Celilo Forcemain	$46,000	$230	$44,160
Non-Process Costs			
25% Engineering & Contingency	$210,960	$0	$0
Total	$1,054,800	$29,141	$804,077
Present Worth Factor 2013	0.24	0.43	0.24
Present Worth	$253,202	$12,432	$193,017
Total Collection Capital Cost	**$3,805,306**		
Total Collection Present Worth	**$1,761,215**		

Wastewater Treatment

	Phase I - NWWTP Capacity Modifications			
	Exist. Primary Pond Aeration	$229,538	$37,675	$84,164
	Sludge Pond Pumping/Sludge Drying Beds	$221,149	$33,172	$81,088
	Effluent Storage Pond Improvements	$228,543	$5,556	$141,697
	Non-Process Costs			
	Land Aquisition	$0	$0	$0
0%	Site Preparation	$0	$0	$0
5%	Piping	$33,962	$0	$21,056
20%	Electrical	$135,846	$0	$49,810
5%	Instrumentation	$33,962	$0	$12,453
25%	Engineering & Contingency	$220,750	$0	$0
	Total	$1,103,750	$76,403	$390,268
	Present Worth Factor 1996	0.92	8.71	0.92
	Present Worth	$1,019,630	$665,801	$360,525
	Phase I - 0.5 mgd SWWTP Construction (Level II Effluent)			
	SWWTP Influent PS	$294,444	$11,898	$107,963
	Sequencing Batch Reactors	$595,556	$88,889	$218,371
	Chlorination / Chlorine Contact	$177,778	$20,000	$65,185
	Aerobic Digester	$177,778	$11,111	$65,185
	Sludge Drying Beds	$159,571	$23,111	$58,510
	Storage Lagoon Additions	$1,000,000	$5,556	$620,000
	Effluent Distribution Pumps	$178,889	$9,767	$65,593
	Effluent Distribution FM, 1 miles	$132,000	$660	$81,840
	Non-Process Costs			
	Land Aquisition	$147,000	$0	$147,000
5%	Site Preparation	$135,801	$0	$0
10%	Piping	$271,602	$0	$168,393
20%	Electrical	$543,203	$0	$199,175
5%	Instrumentation	$135,801	$0	$49,794
25%	Engineering & Contingency	$987,356	$0	$0
	Total	$4,936,779	$170,992	$1,847,007
	Present Worth Factor 1996	0.92	8.71	0.92
	Present Worth	$4,560,535	$1,490,086	$1,706,242

	Phase II - 0.5 mgd SWWTP Expansion (Level II Effluent)			
	SWWTP Influent PS	$75,000	$15,567	$45,000
	Sequencing Batch Reactors	$570,556	$88,889	$342,334
	Chlorination / Chlorine Contact	$177,778	$20,000	$106,667
	Aerobic Digester	$177,778	$11,111	$106,667
	Sludge Drying Beds	$159,571	$23,111	$95,743
	Storage Lagoon Additions	$1,000,000	$5,556	$760,000
	Effluent Distribution Pumps	$178,889	$9,767	$107,333
	Effluent Distribution FM, 1 mile	$132,000	$660	$100,320
	Non-Process Costs			
	Land Aquisition	$147,000	$0	$147,000
5%	Site Preparation	$123,579	$0	$0
10%	Piping	$247,157	$0	$187,839
20%	Electrical	$494,314	$0	$296,589
5%	Instrumentation	$123,579	$0	$74,147
25%	Engineering & Contingency	$901,800	$0	$0
	Total	$4,509,001	$174,661	$2,369,638
	Present Worth Factor 2003	0.53	3.95	0.53
	Present Worth	$2,391,427	$689,147	$1,256,779
	Phase III - 0.5 mgd SWWTP Expansion (Level II Effluent)			
	SWWTP Influent PS	$75,000	$19,236	$70,000
	Sequencing Batch Reactors	$570,556	$88,889	$532,519
	Chlorination / Chlorine Contact	$177,778	$20,000	$165,926
	Aerobic Digester	$177,778	$11,111	$165,926
	Sludge Drying Beds	$159,571	$23,111	$148,933
	Storage Lagoon Additions	$1,000,000	$5,556	$960,000
	Effluent Distribution Pumps	$178,889	$9,767	$166,963
	Effluent Distribution FM, 1 miles	$132,000	$660	$126,720
	Non-Process Costs			
	Land Aquisition	$147,000	$0	$147,000
5%	Site Preparation	$123,579	$0	$0
10%	Piping	$247,157	$0	$237,271
20%	Electrical	$494,314	$0	$461,360
5%	Instrumentation	$123,579	$0	$115,340
25%	Engineering & Contingency	$901,800	$0	$0
	Total	$4,509,001	$178,330	$3,297,958
	Present Worth Factor 2013	0.24	0.43	0.24
	Present Worth	$1,082,376	$76,077	$791,668
	Total Treatment Capital Cost	**$15,058,531**		
	Total Treatment Present Worth	**$7,859,866**		
	Alternative 5 Phase 1 Capital Cost	**$8,024,698**		
	Alternative 5 Total Capital Cost	**$18,863,837**		
	Total Present Worth	**$9,621,081**		

6. **NWWTP Operated at 0.5 mgd with Phased Construction of 1.5 mgd SBR / Wetland SWWTP and Discharge to Willow Creek**

Alternatives	Capital Cost $	O&M Cost $/yr	Salvage Value $
Alternative B Wastewater Collection System			
Phase I - Collection System Improvements			
Sewer Lines	$572,435	$2,862	$354,910
"B" Street PS 0.5 mgd Upgrade	$463,000	$22,580	$169,767
SWWTP Pump Station	$327,900	$12,996	$120,230
14" SWWTP FM	$224,000	$1,120	$138,880
Non-Process Costs			
25% Engineering & Contingency	$396,834	$0	$0
Total	$1,984,169	$39,558	$783,786
Present Worth Factor 1996	0.92	8.71	0.92
Present Worth	$1,832,950	$344,722	$724,052
Phase II - Collection System Improvements			
Sewer Lines	$569,120	$2,846	$432,531
SWWTP PS Expansion	$43,950	$15,383	$26,370
Non-Process Costs			
25% Engineering & Contingency	$153,268	$0	$0
Total	$766,338	$18,229	$458,901
Present Worth Factor 1996	0.53	3.95	0.53
Present Worth	$406,440	$71,923	$243,386
Phase III - Collection System Improvements			
Sewer Lines	$572,490	$2,862	$549,590
SWWTP PS Expansion	$43,950	$17,762	$41,020
Celilo Pump Station	$181,400	$8,287	$169,307
6" Celilo Forcemain	$46,000	$230	$44,160
Non-Process Costs			
25% Engineering & Contingency	$210,960	$0	$0
Total	$1,054,800	$29,141	$804,077
Present Worth Factor 1996	0.24	0.43	0.24
Present Worth	$253,202	$12,432	$193,017
Total Collection Capital Cost	**$3,805,306**		
Total Collection Present Worth	**$1,761,215**		

Wastewater Treatment

Phase I - NWWTP Capacity Modifications				
	Exist. Primary Pond Aeration	$229,538	$37,675	$84,164
	Sludge Pond Pumping/Sludge Drying Beds	$221,149	$33,172	$81,088
	Effluent Storage Pond Improvements	$228,543	$5,556	$141,697
	Non-Process Costs			
	Land Aquisition	$0	$0	$0
0%	Site Preparation	$0	$0	$0
5%	Piping	$33,962	$0	$21,056
20%	Electrical	$135,846	$0	$49,810
5%	Instrumentation	$33,962	$0	$12,453
25%	Engineering & Contingency	$220,750	$0	$0
	Total	$1,103,750	$76,403	$390,268
	Present Worth Factor 1996	0.92	8.71	0.92
	Present Worth	$1,019,630	$665,801	$360,525
Phase I - 0.5 mgd SWWTP Construction (Level IV Effluent)				
	SWWTP Influent PS	$294,444	$11,898	$107,963
	Sequencing Batch Reactors	$645,556	$88,889	$236,704
	Wetland Polishing	$960,619	$30,000	$595,584
	Phase I Wetland Booster PS/Forcemain	$176,667	$11,898	$64,778
	Chlorination / Chlorine Contact	$177,778	$20,000	$65,185
	Dechlorination	$31,111	$11,111	$11,407
	Aerobic Digester	$177,778	$11,111	$65,185
	Sludge Drying Beds	$159,571	$23,111	$58,510
	Emergency Storage (one month)	$166,667	$8,333	$103,333
	Outfall Pump Station	$177,778	$11,898	$65,185
	Outfall FM, 1/2 mile	$66,000	$330	$40,920
	Non-Process Costs			
	Land Aquisition	$74,500	$0	$74,500
5%	Site Preparation	$151,698	$0	$0
10%	Piping	$303,397	$0	$188,106
20%	Electrical	$606,794	$0	$222,491
5%	Instrumentation	$151,698	$0	$55,623
30%	Engineering & Contingency	$1,296,617	$0	$0
	Total	$5,618,674	$228,580	$1,955,474
	Present Worth Factor 1996	0.92	8.71	0.92
	Present Worth	$5,190,461	$1,991,925	$1,806,443

Phase II - 0.5 mgd SWWTP Expansion (Level IV Effluent)				
	SWWTP Influent PS	$75,000	$15,567	$45,000
	Sequencing Batch Reactors	$645,556	$88,889	$387,334
	Wetland Polishing	$960,619	$30,000	$730,071
	Phase II Wetland Booster PS	$75,000	$11,898	$45,000
	Chlorination / Chlorine Contact	$177,778	$20,000	$106,667
	Dechlorination	$31,111	$11,111	$18,667
	Aerobic Digester	$177,778	$11,111	$106,667
	Sludge Drying Beds	$159,571	$23,111	$95,743
	Outfall Pump Station	$50,000	$11,898	$30,000
	Non-Process Costs			
	Land Aquisition	$51,000	$0	$51,000
5%	Site Preparation	$117,621	$0	$0
10%	Piping	$235,241	$0	$178,783
20%	Electrical	$470,483	$0	$282,290
5%	Instrumentation	$117,621	$0	$70,572
30%	Engineering & Contingency	$1,003,314	$0	$0
	Total	$4,347,692	$223,585	$2,147,793
	Present Worth Factor 2003	0.53	3.95	0.53
	Present Worth	$2,305,874	$882,184	$1,139,119
Phase III - 0.5 mgd SWWTP Expansion (Level IV Effluent)				
	SWWTP Influent PS	$75,000	$19,236	$70,000
	Sequencing Batch Reactors	$645,556	$88,889	$602,519
	Wetland Polishing	$960,619	$30,000	$922,195
	Phase III Wetland Booster PS	$75,000	$11,898	$70,000
	Chlorination / Chlorine Contact	$177,778	$20,000	$165,926
	Dechlorination	$31,111	$11,111	$29,037
	Aerobic Digester	$177,778	$11,111	$165,926
	Sludge Drying Beds	$159,571	$23,111	$148,933
	Outfall Pump Station	$50,000	$11,898	$46,667
	Non-Process Costs			
	Land Aquisition	$51,000	$0	$51,000
5%	Site Preparation	$117,621	$0	$0
10%	Piping	$235,241	$0	$225,832
20%	Electrical	$470,483	$0	$439,117
5%	Instrumentation	$117,621	$0	$109,779
30%	Engineering & Contingency	$1,003,314	$0	$0
	Total	$4,347,692	$227,254	$3,046,931
	Present Worth Factor 2013	0.24	0.43	0.24
	Present Worth	$1,043,654	$96,948	$731,409
	Total Treatment Capital Cost	**$15,417,808**		
	Total Treatment Present Worth	**$9,158,982**		
	Alternative 6 Phase 1 Capital Cost	**$8,706,592**		
	Alternative 6 Total Capital Cost	**$19,223,115**		
	Total Present Worth	**$10,920,197**		

7. **NWWTP Operated at 0.5 mgd with Phased Construction of 1.5 mgd SBR/Filtration SWWTP, Wetlands, and Discharge to Willow Creek**

Alternatives	Capital Cost $	O&M Cost $/yr	Salvage Value $
Alternative B Wastewater Collection System			
Phase I - Collection System Improvements			
Sewer Lines	$572,435	$2,862	$354,910
"B" Street PS 0.5 mgd Upgrade	$463,000	$22,580	$169,767
SWWTP Pump Station	$327,900	$12,996	$120,230
14" SWWTP FM	$224,000	$1,120	$138,880
Non-Process Costs			
25% Engineering & Contingency	$396,834	$0	$0
Total	$1,984,169	$39,558	$783,786
Present Worth Factor 1996	0.92	8.71	0.92
Present Worth	$1,832,950	$344,722	$724,052
Phase II - Collection System Improvements			
Sewer Lines	$569,120	$2,846	$432,531
SWWTP PS Expansion	$43,950	$15,383	$26,370
Non-Process Costs			
25% Engineering & Contingency	$153,268	$0	$0
Total	$766,338	$18,229	$458,901
Present Worth Factor 2003	0.53	3.95	0.53
Present Worth	$406,440	$71,923	$243,386
Phase III - Collection System Improvements			
Sewer Lines	$572,490	$2,862	$549,590
SWWTP PS Expansion	$43,950	$17,762	$41,020
Celilo Pump Station	$181,400	$8,287	$169,307
6" Celilo Forcemain	$46,000	$230	$44,160
Non-Process Costs			
25% Engineering & Contingency	$210,960	$0	$0
Total	$1,054,800	$29,141	$804,077
Present Worth Factor 2013	0.24	0.43	0.24
Present Worth	$253,202	$12,432	$193,017
Total Collection Capital Cost	**$3,805,306**		
Total Collection Present Worth	**$1,761,215**		

Wastewater Treatment

	Phase I - NWWTP Capacity Modifications			
	Exist. Primary Pond Aeration	$229,538	$37,675	$84,164
	Sludge Pond Pumping/Sludge Drying Beds	$221,149	$33,172	$81,088
	Effluent Storage Pond Improvements	$228,543	$5,556	$141,697
	Non-Process Costs			
	Land Aquisition	$0	$0	$0
0%	Site Preparation	$0	$0	$0
5%	Piping	$33,962	$0	$21,056
20%	Electrical	$135,846	$0	$49,810
5%	Instrumentation	$33,962	$0	$12,453
25%	Engineering & Contingency	$220,750	$0	$0
	Total	$1,103,750	$76,403	$390,268
	Present Worth Factor 1996	0.92	8.71	0.92
	Present Worth	$1,019,630	$665,801	$360,525
	Phase I - 0.5 mgd SWWTP Construction (Level IV Effluent)			
	SWWTP Influent PS	$294,444	$11,898	$107,963
	Sequencing Batch Reactors	$645,556	$88,889	$236,704
	Polishing Filter Addition	$330,000	$77,778	$121,000
	Wetlands for Wildlife Habitat Enhancement	$320,206	$32,021	$198,528
	Phase I Wetland Booster PS/Forcemain	$176,667	$11,898	$64,778
	Chlorination / Chlorine Contact	$177,778	$20,000	$65,185
	Dechlorination	$31,111	$11,111	$11,407
	Aerobic Digester	$177,778	$11,111	$65,185
	Sludge Drying Beds	$159,571	$23,111	$58,510
	Emergency Storage (one month)	$166,667	$8,333	$103,333
	Outfall Pump Station	$177,778	$11,898	$65,185
	Outfall FM, 1/2 mile	$66,000	$330	$40,920
	Non-Process Costs			
	Land Aquisition	$44,667	$0	$44,667
5%	Site Preparation	$136,178	$0	$0
10%	Piping	$272,356	$0	$168,860
20%	Electrical	$544,711	$0	$199,727
5%	Instrumentation	$136,178	$0	$49,932
30%	Engineering & Contingency	$1,157,294	$0	$0
	Total	$5,014,939	$308,378	$1,601,885
	Present Worth Factor 1996	0.92	8.71	0.92
	Present Worth	$4,632,738	$2,687,317	$1,479,801

Phase II - 0.5 mgd SWWTP Expansion (Level IV Effluent)				
	SWWTP Influent PS	$75,000	$15,567	$45,000
	Sequencing Batch Reactors	$645,556	$88,889	$387,334
	Polishing Filter Addition	$330,000	$77,778	$198,000
	Wetland for Wildlife Habitat Enhancement	$320,206	$32,021	$243,357
	Phase II Wetland Booster PS	$75,000	$11,898	$45,000
	Chlorination / Chlorine Contact	$177,778	$20,000	$106,667
	Dechlorination	$31,111	$11,111	$18,667
	Aerobic Digester	$177,778	$11,111	$106,667
	Sludge Drying Beds	$159,571	$23,111	$95,743
	Outfall Pump Station	$50,000	$11,898	$30,000
	Non-Process Costs			
	Land Aquisition	$21,000	$0	$21,000
5%	Site Preparation	$102,100	$0	$0
10%	Piping	$204,200	$0	$155,192
20%	Electrical	$408,400	$0	$245,040
5%	Instrumentation	$102,100	$0	$61,260
30%	Engineering & Contingency	$863,940	$0	$0
	Total	$3,743,741	$303,384	$1,758,925
	Present Worth Factor 2003	0.53	3.95	0.53
	Present Worth	$1,985,558	$1,197,039	$932,877
Phase III - 0.5 mgd SWWTP Expansion (Level IV Effluent)				
	SWWTP Influent PS	$75,000	$19,236	$70,000
	Sequencing Batch Reactors	$645,556	$88,889	$602,519
	Polishing Filter Addition	$330,000	$77,778	$308,000
	Wetland for Wildlife Habitat Enhancement	$320,206	$32,021	$243,357
	Phase III Wetland Booster PS	$75,000	$11,898	$70,000
	Chlorination / Chlorine Contact	$177,778	$20,000	$165,926
	Dechlorination	$31,111	$11,111	$29,037
	Aerobic Digester	$177,778	$11,111	$165,926
	Sludge Drying Beds	$159,571	$23,111	$148,933
	Outfall Pump Station	$50,000	$11,898	$46,667
	Non-Process Costs			
	Land Aquisition	$21,000	$0	$21,000
5%	Site Preparation	$102,100	$0	$0
10%	Piping	$204,200	$0	$196,032
20%	Electrical	$408,400	$0	$381,173
5%	Instrumentation	$102,100	$0	$95,293
30%	Engineering & Contingency	$863,940	$0	$0
	Total	$3,743,741	$307,052	$2,543,864
	Present Worth Factor 2013	0.24	0.43	0.24
	Present Worth	$898,677	$130,990	$610,649

Total Treatment Capital Cost	**$13,606,171**
Total Treatment Present Worth	**$9,833,900**
Alternative 7 Phase1 Capital Cost	**$8,102,858**
Alternative 7 Total Capital Cost	**$17,411,477**
Total Present Worth	**$11,595,115**

8. NWWTP Operated at 0.5 mgd with Immediate Construction of a New 1.5 mgd SBR SWWTP and Irrigation

Alternatives	Capital Cost $	O&M Cost $/yr	Salvage Value $
Alternative B Wastewater Collection System			
Phase I - Collection System Improvements			
Sewer Lines	$572,435	$2,862	$354,910
"B" Street PS 0.5 mgd Upgrade	$463,000	$22,580	$169,767
SWWTP Pump Station	$327,900	$12,996	$120,230
14" SWWTP FM	$224,000	$1,120	$138,880
Non-Process Costs			
25% Engineering & Contingency	$396,834	$0	$0
Total	$1,984,169	$39,558	$783,786
Present Worth Factor 1996	0.92	8.71	0.92
Present Worth	$1,832,950	$344,722	$724,052
Phase II - Collection System Improvements			
Sewer Lines	$569,120	$2,846	$432,531
SWWTP PS Expansion	$43,950	$15,383	$26,370
Non-Process Costs			
25% Engineering & Contingency	$153,268	$0	$0
Total	$766,338	$18,229	$458,901
Present Worth Factor 1996	0.53	3.95	0.53
Present Worth	$406,440	$71,923	$243,386
Phase III - Collection System Improvements			
Sewer Lines	$572,490	$2,862	$549,590
SWWTP PS Expansion	$43,950	$17,762	$41,020
Celilo Pump Station	$181,400	$8,287	$169,307
6" Celilo Forcemain	$46,000	$230	$44,160
Non-Process Costs			
25% Engineering & Contingency	$210,960	$0	$0
Total	$1,054,800	$29,141	$804,077
Present Worth Factor 1996	0.24	0.43	0.24
Present Worth	$253,202	$12,432	$193,017
Total Collection Capital Cost	**$3,805,306**		
Total Collection Present Worth	**$1,761,215**		

Wastewater Treatment

	Phase I - NWWTP Capacity Modifications			
	Exist. Primary Pond Aeration	$229,538	$37,675	$84,164
	Sludge Pond Pumping/Sludge Drying Beds	$221,149	$33,172	$81,088
	Effluent Storage Pond Improvements	$228,543	$5,556	$141,697
	Non-Process Costs			
	Land Aquisition		$0	$0
0%	Site Preparation	$0	$0	$0
5%	Piping	$33,962	$0	$21,056
20%	Electrical	$135,846	$0	$49,810
5%	Instrumentation	$33,962	$0	$12,453
25%	Engineering & Contingency	$220,750	$0	$0
	Total	$1,103,750	$76,403	$390,268
	Present Worth Factor 1996	0.92	8.71	0.92
	Present Worth	$1,019,630	$665,801	$360,525
	Phase I - 1.5 mgd SWWTP Construction (Level II Effluent)			
	SWWTP Influent PS	$444,444	$17,847	$162,963
	Sequencing Batch Reactors	$1,613,890	$133,333	$591,760
	Chlorination / Chlorine Contact	$355,556	$30,000	$130,370
	Aerobic Digester	$444,444	$16,667	$162,963
	Sludge Drying Beds	$398,929	$34,667	$146,274
	Storage Lagoon Additions	$3,000,000	$8,333	$1,860,000
	Effluent Distribution Pumps	$536,667	$14,651	$196,778
	Effluent Distribution FM	$396,000	$990	$245,520
	Non-Process Costs			
	Land Aquisition	$441,000	$0	$441,000
5%	Site Preparation	$359,497	$0	$0
10%	Piping	$718,993	$0	$445,776
20%	Electrical	$1,437,986	$0	$527,262
5%	Instrumentation	$359,497	$0	$131,815
25%	Engineering & Contingency	$2,626,726	$0	$0
	Total	$13,133,628	$256,488	$5,042,480
	Present Worth Factor 1996	0.92	8.71	0.92
	Present Worth	$12,132,681	$2,235,129	$4,658,180
	Total Treatment Capital Cost	**$14,237,378**		
	Total Treatment Present Worth	**$11,034,537**		
	Alternative 8 Phase 1 Capital Cost	**$16,221,546**		
	Alternative 8 Total Capital Cost	**$18,042,684**		
	Total Present Worth	**$12,795,752**		

9. NWWTP Operated at 0.5 mgd with Immediate Construction of a New 1.5 mgd SBR / Wetland SWWTP and Discharge to Willow Creek

Alternatives	Capital Cost $	O&M Cost $/yr	Salvage Value $
Alternative B Wastewater Collection System			
Phase I - Collection System Improvements			
Sewer Lines	$572,435	$2,862	$354,910
"B" Street PS 0.5 mgd Upgrade	$463,000	$22,580	$169,767
SWWTP Pump Station	$327,900	$12,996	$120,230
14" SWWTP FM	$224,000	$1,120	$138,880
Non-Process Costs			
25% Engineering & Contingency	$396,834	$0	$0
Total	$1,984,169	$39,558	$783,786
Present Worth Factor 1996	0.92	8.71	0.92
Present Worth	$1,832,950	$344,722	$724,052
Phase II - Collection System Improvements			
Sewer Lines	$569,120	$2,846	$432,531
SWWTP PS Expansion	$43,950	$15,383	$26,370
Non-Process Costs			
25% Engineering & Contingency	$153,268	$0	$0
Total	$766,338	$18,229	$458,901
Present Worth Factor 1996	0.53	3.95	0.53
Present Worth	$406,440	$71,923	$243,386
Phase III - Collection System Improvements			
Sewer Lines	$572,490	$2,862	$549,590
SWWTP PS Expansion	$43,950	$17,762	$41,020
Celilo Pump Station	$181,400	$8,287	$169,307
6" Celilo Forcemain	$46,000	$230	$44,160
Non-Process Costs			
25% Engineering & Contingency	$210,960	$0	$0
Total	$1,054,800	$29,141	$804,077
Present Worth Factor 1996	0.24	0.43	0.24
Present Worth	$253,202	$12,432	$193,017
Total Collection Capital Cost	**$3,805,306**		
Total Collection Present Worth	**$1,761,215**		

Wastewater Treatment

	<u>Phase I - NWWTP Capacity Modifications</u>			
	Exist. Primary Pond Aeration	$229,538	$37,675	$84,164
	Sludge Pond Pumping/Sludge Drying Beds	$221,149	$33,172	$81,088
	Effluent Storage Pond Improvements	$228,543	$5,556	$141,697
	Non-Process Costs			
	Land Aquisition	$0	$0	$0
0%	Site Preparation	$0	$0	$0
5%	Piping	$33,962	$0	$21,056
20%	Electrical	$135,846	$0	$49,810
5%	Instrumentation	$33,962	$0	$12,453
25%	Engineering & Contingency	$220,750	$0	$0
	Total	$1,103,750	$76,403	$390,268
	Present Worth Factor 1996	0.92	8.71	0.92
	Present Worth	$1,019,630	$665,801	$360,525
	<u>Phase I - 1.5 mgd SWWTP Construction (Level IV Effluent)</u>			
	SWWTP Influent PS	$444,444	$17,847	$162,963
	Sequencing Batch Reactors	$1,613,890	$133,333	$591,760
	Wetland Polishing	$2,401,548	$45,000	$1,488,960
	Wetland Booster PS	$441,667	$17,847	$161,944
	Chlorination / Chlorine Contact	$355,556	$30,000	$130,370
	Dechlorination	$62,222	$16,667	$22,815
	Aerobic Digester	$444,444	$16,667	$162,963
	Sludge Drying Beds	$398,929	$34,667	$146,274
	Outfall Pump Station	$277,778	$17,847	$101,852
	Outfall FM, 1/2 mile	$66,000	$330	$40,920
	Non-Process Costs			
	Land Aquisition	$176,500	$0	$176,500
5%	Site Preparation	$325,324	$0	$0
10%	Piping	$650,648	$0	$403,402
20%	Electrical	$1,301,296	$0	$477,142
5%	Instrumentation	$325,324	$0	$119,285
30%	Engineering & Contingency	$2,785,671	$0	$0
	Total	$12,071,240	$330,204	$4,187,150
	Present Worth Factor 1996	0.92	8.71	0.92
	Present Worth	$11,151,261	$2,877,520	$3,868,037
	Total Treatment Capital Cost	**$13,174,990**		
	Total Treatment Present Worth	**$11,485,651**		
	Alternative 9 Phase 1 Capital Cost	**$15,159,159**		
	Alternative 9 Total Capital Cost	**$16,980,296**		
	Total Present Worth	**$13,246,867**		

10. NWWTP Operated at 0.5 mgd with Immediate Construction of a New 1.5 mgd SBR/Filtration SWWTP, Wetlands, and Discharge to Willow Creek

Alternatives	Capital Cost $	O&M Cost $/yr	Salvage Value $
Alternative B Wastewater Collection System			
Phase I - Collection System Improvements			
Sewer Lines	$572,435	$2,862	$354,910
"B" Street PS 0.5 mgd Upgrade	$463,000	$22,580	$169,767
SWWTP Pump Station	$327,900	$12,996	$120,230
14" SWWTP FM	$224,000	$1,120	$138,880
Non-Process Costs			
25% Engineering & Contingency	$396,834	$0	$0
Total	$1,984,169	$39,558	$783,786
Present Worth Factor 1996	0.92	8.71	0.92
Present Worth	$1,832,950	$344,722	$724,052
Phase II - Collection System Improvements			
Sewer Lines	$569,120	$2,846	$432,531
SWWTP PS Expansion	$43,950	$15,383	$26,370
Non-Process Costs			
25% Engineering & Contingency	$153,268	$0	$0
Total	$766,338	$18,229	$458,901
Present Worth Factor 1996	0.53	3.95	0.53
Present Worth	$406,440	$71,923	$243,386
Phase III - Collection System Improvements			
Sewer Lines	$572,490	$2,862	$549,590
SWWTP PS Expansion	$43,950	$17,762	$41,020
Celilo Pump Station	$181,400	$8,287	$169,307
6" Celilo Forcemain	$46,000	$230	$44,160
Non-Process Costs			
25% Engineering & Contingency	$210,960	$0	$0
Total	$1,054,800	$29,141	$804,077
Present Worth Factor 1996	0.24	0.43	0.24
Present Worth	$253,202	$12,432	$193,017
Total Collection Capital Cost	**$3,805,306**		
Total Collection Present Worth	**$1,761,215**		

Wastewater Treatment

	Phase I - NWWTP Capacity Modifications			
	Exist. Primary Pond Aeration	$229,538	$37,675	$84,164
	Sludge Pond Pumping/Sludge Drying Beds	$221,149	$33,172	$81,088
	Effluent Storage Pond Improvements	$228,543	$5,556	$141,697
	Non-Process Costs			
	Land Aquisition	$0	$0	$0
0%	Site Preparation	$0	$0	$0
5%	Piping	$33,962	$0	$21,056
20%	Electrical	$135,846	$0	$49,810
5%	Instrumentation	$33,962	$0	$12,453
25%	Engineering & Contingency	$220,750	$0	$0
	Total	$1,103,750	$76,403	$390,268
	Present Worth Factor 1996	0.92	8.71	0.92
	Present Worth	$1,019,630	$665,801	$360,525
	Phase I - 1.5 mgd SWWTP Construction (Level II Effluent)			
	SWWTP Influent PS	$444,444	$17,847	$162,963
	Sequencing Batch Reactors	$1,613,890	$133,333	$591,760
	Polishing Filter Addition	$825,000	$116,667	$302,500
	Wetlands for Wildlife Habitat Enhancement	$970,413	$70,910	$749,885
	Wetland Booster PS/Forcemain	$326,667	$17,847	$179,778
	Chlorination / Chlorine Contact	$355,556	$30,000	$130,370
	Dechlorination	$62,222	$16,667	$22,815
	Aerobic Digester	$444,444	$16,667	$162,963
	Sludge Drying Beds	$398,929	$34,667	$146,274
	Emergency Storage (one month)	$166,667	$4,167	$103,333
	Outfall Pump Station	$277,778	$17,847	$101,852
	Outfall FM, 1/2 mile	$66,000	$330	$40,920
	Non-Process Costs			
	Land Aquisition	$86,667	$0	$86,667
5%	Site Preparation	$297,600	$0	$0
10%	Piping	$595,201	$0	$369,025
20%	Electrical	$1,190,402	$0	$436,481
5%	Instrumentation	$297,600	$0	$109,120
30%	Engineering & Contingency	$2,525,844	$0	$0
	Total	$10,945,323	$476,947	$3,696,705
	Present Worth Factor 1996	0.92	8.71	0.92
	Present Worth	$10,111,153	$4,156,290	$3,414,970
	Total Treatment Capital Cost	**$12,049,073**		
	Total Treatment Present Worth	**$12,177,381**		
	Alternative 10 Phase 1 Capital Cost	**$14,033,242**		
	Alternative 10 Total Capital Cost	**$15,854,380**		
	Total Present Worth	**$13,938,596**		

Table 7 - 4 Multi-Attribute Analysis of Alternatives

Table of Attributes

Attribute	**Scale**	**Weight**	**Range High**	**Range Low**	**Std**	**Utility**
Net Present Worth Cost	$M	40	0	20	12	St. Line
Safety & Convenience	Rel	5	10	0	7	St. Line
Wildlife & Environment	Rel	30	10	0	7	St. Line
Growth Inducement	Rel	10	10	0	5	St. Line
Public/ Agency Response	Rel	15	10	0	7	St. Line
		100				

Insert "Weight" values totaling 100 for attributes.
Insert a "Low" for PW Cost above maximum Alternative PW Cost.
Insert a "Standard" for PW Cost about average Alternative PW Cost.

Net Present Worth Cost

Element	**Alternative 0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Present Worth Cost	1.90	13.65	11.98	14.22	10.06	9.62	10.92	11.60	12.80	13.25	13.94
	Insert Present Worth Cost of Alternative in Million $.										
Mean	1.90	13.65	11.98	14.22	10.06	9.62	10.92	11.60	12.80	13.25	13.94
Standard Deviation	0	0	0	0	0	0	0	0	0	0	0
Assessment											
High	1.90	13.65	11.98	14.22	10.06	9.62	10.92	11.60	12.80	13.25	13.94
Mean	1.90	13.65	11.98	14.22	10.06	9.62	10.92	11.60	12.80	13.25	13.94
Low	1.90	13.65	11.98	14.22	10.06	9.62	10.92	11.60	12.80	13.25	13.94

Safety and Convenience

Element	**Alternative 0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Construction Impacts	5	5	5	5	5	5	5	5	5	5	5
Community Disruption	5	5	5	5	4	4	4	4	4	4	4
Safety	5	5	5	5	5	5	5	5	5	5	5
	Insert values between 0 and 10 in the above cells. Less than 5 implies negative effect and greater than 5 implies positive effect.										
Mean	5.00	5.00	5.00	5.00	4.67	4.67	4.67	4.67	4.67	4.67	4.67
Standard Deviation	0.00	0.00	0.00	0.00	0.58	0.58	0.58	0.58	0.58	0.58	0.58
Assessment											
High	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Mean	5.00	5.00	5.00	5.00	4.67	4.67	4.67	4.67	4.67	4.67	4.67
Low	5.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00

Wildlife & Environment Attributes

Element	0	1	2	3	4	5	6	7	8	9	10
					Alternative						
Esthetics	2	2	4	4	5	5	6	6	5	6	6
Air Quality	3	3	5	5	5	5	5	5	5	5	5
Energy	4	4	4	4	4	4	4	4	4	4	4
Farmlands (loss)	3	2	3	5	3	3	5	5	3	5	5
Hydrology (flooding)	5	5	5	5	4	4	4	4	4	4	4
Riparian	5	5	5	8	5	5	9	8	5	9	8
Wildlife	4	5	5	9	5	4	9	9	5	9	9
Noise	5	5	4	4	4	4	4	4	4	4	4
Water Quality	5	5	5	4	5	5	3	4	5	3	4
	Insert values between 0 and 10 in the above cells. Less than 5 implies negative effect and greater than 5 implies positive effect.										
Mean	4.00	4.00	4.44	5.33	4.44	4.33	5.44	5.44	4.44	5.44	5.44
Standard Deviation	1.12	1.32	0.73	1.87	0.73	0.71	2.19	1.88	0.73	2.19	1.88
Assessment											
High	5.00	5.00	5.00	9.00	5.00	5.00	9.00	9.00	5.00	9.00	9.00
Mean	4.00	4.00	4.44	5.33	4.44	4.33	5.44	5.44	4.44	5.44	5.44
Low	2.00	2.00	3.00	4.00	3.00	3.00	3.00	4.00	3.00	3.00	4.00

Growth & Development

Element	0	1	2	3	4	5	6	7	8	9	10
					Alternative						
Economic	0	6	6	6	6	6	6	6	8	8	8
Growth Inducument	0	6	6	6	6	6	6	6	8	8	8
	Insert values between 0 and 10 in the above cells. Less than 5 implies negative growth and greater than 5 implies positive growth.										
Mean	0.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	8.00	8.00	8.00
Standard Deviation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Assessment											
High	0.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	8.00	8.00	8.00
Mean	0.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	8.00	8.00	8.00
Low	0.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	8.00	8.00	8.00

Public Response

Element	Alternative 0	1	2	3	4	5	6	7	8	9	10
Public	0	6	6	5	6	6	4	4	6	4	4
DEQ	0	8	8	4	8	8	1	4	8	1	4
FAA	4	0	1	1	7	7	7	7	7	7	7
	Insert values between 0 and 10 in the above cells. Less than 5 implies negative response and greater than 5 implies positive response.										
Mean	1.33	4.67	5.00	3.33	7.00	7.00	4.00	5.00	7.00	4.00	5.00
Standard Deviation	2.31	4.16	3.61	2.08	1.00	1.00	3.00	1.73	1.00	3.00	1.73
Assessment											
High	4.00	8.00	8.00	5.00	8.00	8.00	7.00	7.00	8.00	7.00	7.00
Mean	1.33	4.67	5.00	3.33	7.00	7.00	4.00	5.00	7.00	4.00	5.00
Low	0.00	0.00	1.00	1.00	6.00	6.00	1.00	4.00	6.00	1.00	1.00

Attribute Means

Element	Alternative 0	1	2	3	4	5	6	7	8	9	10
Net Present Worth Cost	1.90	13.65	11.98	14.22	10.06	9.62	10.92	11.60	12.80	13.25	13.94
Safety & Convenience	5.00	5.00	5.00	5.00	4.67	4.67	4.67	4.67	4.67	4.67	4.67
Wildlife & Environment	4.00	4.00	4.44	5.33	4.44	4.33	5.44	5.44	4.44	5.44	5.44
Growth Inducement	0.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	8.00	8.00	8.00
Public Response	1.33	4.67	5.00	3.33	7.00	7.00	4.00	5.00	7.00	4.00	5.00

Weighted Means

Element	Alternative 0	1	2	3	4	5	6	7	8	9	10
Net Present Worth Cost	36.20	12.70	16.03	11.56	19.89	20.76	18.16	16.81	14.41	13.51	12.12
Safety & Convenience	2.50	2.50	2.50	2.50	2.33	2.33	2.33	2.33	2.33	2.33	2.33
Wildlife & Environment	12.00	12.00	13.33	16.00	13.33	13.00	16.33	16.33	13.33	16.33	16.33
Growth Inducement	0.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	8.00	8.00	8.00
Public Response	2.00	7.00	7.50	5.00	10.50	10.50	6.00	7.50	10.50	6.00	7.50
Weighted Analysis Scores	**52.70**	**40.20**	**45.37**	**41.06**	**52.06**	**52.59**	**48.83**	**48.98**	**48.58**	**46.17**	**46.29**

CHAPTER 8

RECOMMENDED PLAN

Public Involvement

Three public hearings (February 22, 27 and May 14, 1996) were held at Jefferson County Senior Center and Madras City Hall to present the findings and recommendations of the proposed wastewater system improvements and to entertain comments from citizens. There were little comments on the propopsed collection system improvements. Questions were raised at the last hearing as to the logics of constructing a new 1.5 mgd treatmet plant at the south site and upgrading the existing 0.5 mgd plant at the aiport site instead of expanding the existing plant to 2 mgd capacity. The following reasons were presented.

1. FAA strongly opposes the expansion of exisitng treatment plant at the airport because the treatment facillities can attract water fowls creating potential safty to aircraft.

2. The cost of North Plant expansion (22.3 and 21.0 million dollars for Alternatives 2 and 3) is higher than that of constructing a new South Plant and upgrading the North Plant (18.9 and 17.4 million dollars for Alternatives 5 and 7).

3. The north plant expansion will require pumping of wastewater from the "B" Street pump station site to the plant at more than 200 feet of staic head comparing with pumping to the south treatment plant at 30 feet of head. Substatial savings in power cost and operating cost can be realized for implementing the proposed new south treatment plant. In addition, the south plant can serve the southeast growth area by gravity.

After public hearings were conducted and no negative comments were presented by citizens, the wastewater master plan was accepted by the City Council.

Minutes of public hearings are included in Appendix E.

Selection of Wastewater System Improvemwnt Plan

As discussed in Chapter 7, Alternative 5 is the most viable alternative because it has the lowest Present Worth and ranks highest on the Multi-Attribute Analysis. It consists of the following components sized for incremental construction of a total of 2.0 mgd wastewater treatment and collection system capacity in 0.5 mgd increments as dictated by the growth within the study boundary.

Phase I

- Phase I, Alternative B Sewer System Improvements (Fig. 5-2A to Fig. 5-2C)
- "B" Street PS Upgrade to 0.5 mgd Average Flow Capacity
- Upgrade of the Existing NWWTP (Airport) to 0.5 mgd by Aeration
- New SWWTP PS at "B" Street sized for 0.35 mgd average flow
- New 0.5 mgd Sequencing Batch Reactor DEQ Level II Plant at South site
  - Influent Pump Station
  - SBR units
  - Chlorine Disinfection
  - Aerobic Digestion
  - Sludge Drying Beds
- Off-site Level II Effluent Storage
  - Effluent Distribution Pumps
  - 1 mile 6" Effluent FM
  - 0.5 MGD Off-site Storage Lagoon
- Irrigation of privately owned land by others (property owner)

Phase II

- Phase II, Alternative B Sewer System Improvements (Fig. 5-2A to Fig. 5-2C)
- Upgrade SWWTP PS at "B" Street sized for 0.70 mgd average flow
- Added 0.5 mgd Sequencing Batch Reactor DEQ Level II Plant at South site
  - Influent Pump Station Upgrade
  - 0.5 mgd SBR units
  - 0.5 mgd Chlorine Disinfection
  - Additional Aerobic Digestion
  - Additional Sludge Drying Beds
- Off-site Level II Effluent Storage
  - Added Effluent Distribution Pumps
  - Second 1 mile 6" Effluent Forcemain
  - Second 0.5 MGD Off-site Storage Lagoon
- Irrigation of privately owned land by others

Phase III

Phase III, Alternative B Sewer System Improvements (Fig. 5-2A to Fig. 5-2C)
Upgrade SWWTP PS at "B" Street sized for 1.0 mgd average flow
Added 0.5 mgd Sequencing Batch Reactor DEQ Level II Plant at South site
- Influent Pump Station Upgrade
- 0.5 mgd SBR units
- 0.5 mgd Chlorine Disinfection
- Additional Aerobic Digestion
- Additional Sludge Drying Beds

Off-site Level II Effluent Storage
- Added Effluent Distribution Pumps
- Third 1 mile 6" Effluent Forcemain
- Third 0.5 MGD Off-site Storage Lagoon

Irrigation of privately owned land by others

The order-of-magnitude conceptual cost estimates are $8,000,000 for Phase 1, $5,300,000 for Phase 2 and $5,600,000 for Phase 3 with a total of $18,900,000.

Alternative 7 will require building filters to ensure removal of nitrogen and phosphorus to the acceptable limits and constructing wetlands to enhance wildlife habitats for the Willow Creek basin in addition to those three-phase elements as described above for Alternative 5, but without irrigation or winter storage. The order-of-magnitude conceptual cost estimates are $8,100,000 for Phase 1, $4,500,000 for Phase 2 and 4,800,000 for Phase 3 with a total 17,400,000.

Recommendations

Based on the evaluation of Alternatives presented in previous chapters and input from the City of Madras engineering staff, City Council and Administration, ACE Consultants recommends that,

1. Alternative 5 or Alternative 7 be implemented by the City of Madras depending on whether a NPDES permit for discharging into Willow Creek can be obtained from DEQ. Alternative 7 may take substantially longer to implement because of the uncertainty in obtaining the necessary regulatory approval and possible oppositions from environmental groups or others.

2. Further study of constructed wetlands and mixing zones as well as beneficial use of the Willow Creek be conducted and DEQ approval as well as a NPDES permit be obtained before Alternative 7 can be implemented.

3. Additional effluent storage and irrigation sites be identified and arrangement for purchasing, leasing or irrigation contracts be made in order to successfully implement Alternative 5 treatment improvements.

4. Modification of the "B" Street Pump Station and upgrading of the existing north treatment plant to provide 0.5 mgd capacity as part of the Phase 1 improvements be implemented as soon as possible to alleviate the overloading conditions and provide additional capacity while financing is being arranged and the design and construction of the south treatment plant takes place. It is estimated that the Phase 1 improvements including financing, engineering and construction will take over two years to complete.

Appendix A

DEQ Staff Rule Proposal

for

Alternative Mixing Zone Scenarios

Oregon

DEPARTMENT OF ENVIRONMENTAL QUALITY

RECEIVED

JAN 11 1996

CITY OF MADRAS
PUBLIC WORKS

January 9, 1996

Joni Low
League of Oregon Cities
PO Box 928
Salem, OR 97308

Dear Joni:

I have added your name along with Roger Jordan and Gerald Breazeale to the mixing zone rule review mailing list as you requested. I have also enclosed the most recent meeting announcement as well as a copy of the most recent staff rule proposal for alternative mixing zone scenarios.

You also asked that I identify members of the water quality standards policy advisory committee that are participating in mixing zone rule review. Members of this subcommittee and their affiliation are: Nina Bell/Northwest Environmental Advocates, James Ollerenshaw/Association of Clean Water Agencies, Bill Gaffi/ United Sewage Agency, Jim Whitty/Association of Oregon Industries, and Bob Gilbert/ James River. Kevin Downing in DEQ headquarters and Barbara Burton of the DEQ Western Region are also closely involved in this review.

Sincerely,

Dennis Ades
Environmental Specialist
Surface Water Section
Water Quality Division

DA:crw
SW\WC13\WC13888.doc
cc: Roger Jordan, City of Dallas, City Manager
Gerald Breazeale, City of Madras, Public Works Director
Enclosures: 2

To: Wen

From: Jerry B
City of Madras

811 SW Sixth Avenue
Portland, OR 97204-1390
(503) 229-5696
TDD (503) 229-6993

Alternative prescription: A mixing zone may be approved for dischargers that cannot meet the standard mixing zone requirements provided that the discharger can demonstrate to the Department's satisfaction that the discharge creates an overall environmental benefit; or that the discharge is to an artificial water course as defined below; or the discharge is insignificant as described below.

(a) Overall environmental benefit. For the purposes of this rule, the term "practical" shall include environmental impact, availability of alternatives, cost of alternatives, and other relevent factors. In order to be considered for an alternative prescription based on overall environmental benefit, the discharger shall:

(1) Demonstrate that all practical strategies have been or will be implemented to minimize the pollutants or flows or both in the effluent;

(2) Demonstrate that no other practical alternatives to the discharge are available, including but not limited to connection to municipal sanitary sewers, recycling of wastewater, spray irrigation or other reuse of the effluent, and discharge to larger streams where a standard mixing zone may be assigned; and

(3) Demonstrate that, on balance, an environmental benefit would be lost if the wastewater discharge is not allowed to occur, or that the discharger is prepared to undertake other actions that will mitigate the effect of the discharge to result in an overall environmental benefit to the receiving stream. At a minimum, the following two factors must be evaluated and included in the demonstration of overall environmental benefit:

(A) The impact of the discharge on water quality in the entire proposed mixing zone over the entire period of discharge; and
(B) Evaluation of the impact of the increased stream flow resulting from the discharge on passage of native aquatic species.

In addition, the following three factors may be evaluated as part of the overall environmental benefit demonstration:

(C) Whether the increased stream flow resulting from the discharge is essential to support species indigenous to the region or habitat;
(D) Whether the discharge will cause the restoration or aquatic or riparian habitats lost because of human activities, and if so the extent and significance of the additional habitat;
(E) Any mitigation measures that the discharger proposes that would result in an overall benefit, such as the purchase of water rights which would result in increases in stream flows.

(b) Artificial water course: For the purposes of this rule, an artificial water course is one that was constructed for irrigation, or is or should be screened to prevent fish passage, or for the purpose of site drainage, or for the purpose of wastewater conveyance. A mixing zone may be extended through the artificial water course and into a natural water course, provided that the wastewater within the artificial water course does not pose a significant hazard to human health or wildlife.

(c) Insignificant discharges: Insignificant discharges are those either by volume, pollutant characteristic, and/or temporary nature are expected to have little if any impact on beneficial uses in the receiving stream, and for which the extensive evaluations required for discharge to smaller streams are not warranted. For the purposes of this rule, filter backwash discharges and underground storage tank cleanups are the only categories of discharges considered insignificant, and may be permitted a mixing zone that extends the entire width of the receiving stream.

TRIENNIAL WATER QUALITY STANDARDS REVIEW
POLICY ADVISORY COMMITTEE - MIXING ZONE SUBCOMMITTEE

NOTICE OF MEETINGS

<u>Next Meeting</u>

Date:	Tuesday, January 16, 1996
Time:	1:00 p.m. to 5:00 p.m.
Place:	***<u>DEQ NORTHWEST REGION OFFICE</u>*** **2020 SW Fourth Avenue** **Suite 400, Room B** Portland
Agenda:	Review subcommittee recommendations for alternative mixing zone prescriptions.

TO THE PUBLIC: The Department of Environmental Quality appointed the Policy Advisory Committee (PAC) to provide policy advice during the 1992-1994 Triennial Water Quality Standards Review. PAC members have formed an ad hoc subcommittee to provide advice on the review of the mixing zone rule. For further information please call Dennis Ades at 229-5053.

ACCOMMODATION FOR PHYSICAL IMPAIRMENTS: In order to accommodate persons with physical impairments, please notify the Department of any special physical or language accommodations you may need as far in advance of the meeting date as possible. To make these arrangements, contact Dennis Ades at 229-5053 or toll free in Oregon at 1-800-452-4011. For the hearing impaired, the Department's TDD number is 229-6993.

SW\WC13\WC13808.doc

Appendix B

WPCF Permit

Oregon

DEPARTMENT OF
ENVIRONMENTAL
QUALITY

OCT 0 1 1992

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

City of Madras
71 S.E. "D" Street
Madras, OR 97741

Re: Waste Disposal Permit
File # 52520
Jefferson County

We have completed our review of your permit application and comments regarding the preliminary draft permit which was mailed to you on September 4, 1992. The enclosed Water Pollution Control Facilities (WPCF) Permit has been issued.

In reference to comments received about your draft WPCF permit, the following modifications were made as a result:

1) Under Schedule A, the Waste Discharge Limitation headings stated in conditions 1 and 2, were modified to reflect the use of reclaimed water for Levels II and IV. Upon attainment of operational level as required by the permit, land application of reclaimed water is allowed at Levels II and IV as defined in Oregon Administrative Rules (OAR) 340-55-015.

2) The parameters listed for Outfall Number 001, under Schedule B, condition 1.b., are to be monitored and reported for both Level II and Level IV treatment. A note was added regarding the monitoring and reporting minimum frequency of total coliform; the minimum frequency shall be weekly, as required in OAR 340-55-015(12), when land application of the reclaimed water is applied for Level II treatment.

3) Under Schedule D, condition 3 was deleted. Management of the irrigation site shall be addressed in the City's wastewater reuse plan.

811 SW Sixth Avenue
Portland, OR 97204-1390
(503) 229-5696
TDD (503) 229-6993

OAR 340-55 specifies Regulations Pertaining to the Use of Reclaimed Water (Treated Effluent) from Sewage Treatment Plants. Specifically, as stated in Table 1, parks, playgrounds, schoolyards, and golf courses with contiguous residences require that Level IV treatment occur. No modification was made in the permit regarding Level II treatment for irrigation to the golf course.

You are urged to carefully read the permit and take all possible steps to comply with the conditions established.

If you are dissatisfied with the conditions or limitations of this permit, you have 20 days to request a hearing before the Environmental Quality Commission or its authorized representative. Any such request shall be made in writing to the Director and shall clearly state the grounds for the request.

If you have any questions, please contact our Central Region Office at 388-6146.

Sincerely,

Lydia Taylor

Lydia Taylor
Administrator
Water Quality Division

LT:jkj:dh
Enclosure

cc: Central Region, DEQ

WATER POLLUTION CONTROL FACILITIES PERMIT

Department of Environmental Quality
811 S.W. Sixth Avenue, Portland, OR 97204
Telephone: (503) 229-5696

Issued pursuant to ORS 468B.050

ISSUED TO:

City of Madras
71 S.E. "D" Street
Madras, OR 97741

SOURCES COVERED BY THIS PERMIT:

Type of Waste	Method of Disposal
Domestic Sewage	Evaporation and Land Irrigation

PLANT TYPE AND LOCATION:

Stabilization Lagoons
West of Madras airport
Madras, Oregon

RIVER BASIN INFORMATION:

Basin: Deschutes
Sub-Basin: Madras
Hydro Code: 25H-WILL 104.5 N
County: Jefferson

Treatment System Class: II
Collection System Class: II

Nearest surface stream which would receive waste if it were to discharge: Willow Creek

Issued in response to Application No. 998968 received May 31, 1988.

This permit is issued based on land use findings in the permit record.

Lydia R. Taylor
Lydia R. Taylor Administrator

OCT 0 1 1992
Date

PERMITTED ACTIVITIES

Until this permit expires or is modified or revoked, the permittee is authorized to construct, install, modify, or operate a waste water collection, treatment, control and disposal system in conformance with requirements, limitations, and conditions set forth in attached schedules as follows:

All direct discharges to public waters are prohibited.

SCHEDULE A

1. **Waste Discharge Limitations not to be Exceeded After Permit Issuance, and After Attainment of Operational Level as Required by Schedule C, Condition 3.c. of this Permit for Uses Allowed Under OAR 340-55-015 for Level II Treatment.**

   a. Outfall Number 001 (Land Irrigation)

      (1) No discharge to state waters is permitted. All wastewater shall be distributed on land for dissipation by evapotranspiration and controlled seepage by following sound irrigation practices so as to prevent:

         (a) Prolonged ponding of treated wastewater on the ground surface;

         (b) Surface runoff or subsurface drainage through drainage tile;

         (c) The creation of odors, fly and mosquito breeding or other nuisance conditions; and

         (d) The overloading of land with nutrients, organics, or other pollutant parameters.

      (2) Prior to land application of the reclaimed water, it shall receive at least Level II treatment as defined in OAR 340-55 to:

         (a) Reduce Total Coliform to 240 organisms/100 ml in two consecutive samples, and a 7-day median of 23 organisms/100 ml.

      (3) No treated wastewater shall be applied to food crops destined for human consumption or shall otherwise be made available for a use that is inconsistent with the uses provided for in OAR 340-55.

      (4) No wastewater shall be applied within 300 feet of an off-site residence.

      (5) Signs shall be posted around the facility's perimeter and other locations indicating that reclaimed water is used for irrigation and is not safe for drinking and body contact.

      (6) Reclaimed water shall be applied in a manner so that it is not sprayed within 100 feet of areas where food is prepared or served or where drinking fountains are located.

2. **Waste Discharge Limitations not to be Exceeded After Attainment of Operational Level as Required by Schedule C, Condition 3.c. of this Permit for Uses Allowed Under OAR 340-55-015 for Level IV Treatment.**

a. Outfall Number 001 (Land Irrigation)

(1) No discharge to state waters is permitted. All wastewater shall be distributed on land for dissipation by evapotranspiration and controlled seepage by following sound irrigation practices so as to prevent:

(a) Prolonged ponding of treated wastewater (reclaimed water) on the ground surface;

(b) Surface runoff or subsurface drainage through drainage tile;

(c) The creation of odors, fly and mosquito breeding or other nuisance conditions; and

(d) The overloading of land with nutrients, organics, or other pollutant parameters.

(2) Prior to land application of the reclaimed water, it shall receive at least Level IV treatment as defined in OAR 340-55 to:

(a) Reduce Total Coliform to levels not to exceed a 7-day median of 2.2 organisms/100 ml, and no sample to exceed 23 organisms/100 ml.

(b) Reduce wastewater turbidity (NTU) to levels not to exceed a 24-hour mean of 2, and 5 for 5% of time during a 24-hour period.

(3) Public access shall be controlled so that no direct public contact during an irrigation cycle occurs.

(4) Signs shall be posted around the facility's perimeter and other locations indicating that reclaimed water is used for irrigation and is not safe for drinking.

(5) Reclaimed water shall be applied in a manner so that it is not sprayed onto areas where food is prepared or served, or onto drinking fountains.

3. The treatment system has a dry weather design flow of 0.45 MGD.

SCHEDULE B

1. Minimum Monitoring and Reporting Requirements
(unless otherwise approved in writing by the Department)

a. Influent

Item or Parameter	Minimum Frequency	Type of Sample
Total Flow (MGD)	Daily	Reading
Flow Meter Calibration	Annual	Verification
pH	3/week	Grab
BOD_5	Weekly	Composite
TSS	Weekly	Composite
Storage Pond Level	Weekly	Staff Gauge

b. Outfall Number 001 (Land Irrigation) when irrigating

Item or Parameter	Minimum Frequency	Type of Sample
Total Flow (MGD)	Daily	Totalizer
Sprinkler Set Used	Daily	Record/Map
Total Coliform	Daily (See note 1/)	Grab
Quantity Chlorine Used	Daily	Measurement
Chorine Residual	Daily	Grab
Turbidity (NTU)	Daily	Meter
pH	3/week	Grab
Quantity Irrigated (inches/acre)	Monthly	Calculation
TKN	Monthly	Grab
NO_2+NO_3-N	Monthly	Grab

Notes:

1/ The minimum frequency shall be weekly when land application of the reclaimed water is applied for Level II treatment.

2. Reporting Procedures

Monitoring results shall be reported on approved forms. The reporting period is the calendar month. Reports must be submitted to the Department by the 15th day of the following month.

State monitoring reports shall identify the name, certificate classification and grade level of each principal operator designated by the permittee as responsible for supervising the wastewater collection and treatment systems during the reporting period. Monitoring reports shall also identify each system classification as found on page one of this permit.

Monitoring reports (DMRs) shall include a record of the location, quantity and method of use of all sludge removed from the treatment facility and a record of all applicable equipment breakdowns and bypassing.

SCHEDULE C

Compliance Conditions and Schedules

1. By no later than November 1, 1992, the permittee shall submit to the Department for approval a modified Reclaimed Water Use Plan. The management plan shall be in accordance with the Oregon Administrative Rule 340, Division 55, "Regulations Pertaining to the Use of Reclaimed Water (Treated Effluent) from Sewage Treatment Plants". Upon approval of the plan by the Department, the plan shall be implemented by the permittee. No substantial changes shall be made in the approved plan without written approval of the Department.

2. By no later than January 31, 1993, the permittee shall submit a sludge management plan in accordance with Oregon Administrative Rule 340, Division 50, "Disposal of Sewage Treatment Plant Sludge and Sludge Derived Products Including Septage". Upon approval of the plan by the Department, the plan shall be implemented by the permittee.

3. The permittee shall make the necessary improvements and/or upgrade the sewage collection, and disposal facilities in order to achieve compliance with the effluent limitations specified in Schedule A, Condition 2, in accordance with the following:

   a. By no later than November 1, 1992, the permittee shall award construction contracts for completion of necessary improvements. Progress reports are to be submitted to the Department at six (6) month intervals from award of bid.

   b. By no later than August 1, 1993, the permittee shall complete construction of the necessary improvements.

   c. By no later than August 31, 1993, the permittee shall attain operational level of the facilities to meet permit limits.

4. By no later than December 1, 1993, the permittee shall have an individual certified in wastewater treatment system operation at a Grade Level II (or higher) to supervise the operation of the wastewater treatment system. In the interim, the permittee shall have an individual who is certified at a Grade Level I for supervising the operation of the wastewater treatment system.

5. By no later than February 1 of each year following completion and start-up of the reclaimed water use system, the permittee shall submit to the Department an annual report describing the effectiveness of the reclaimed water system to comply with approved reclaimed water use plan, the rules of Division 55, and the limitations and conditions of this permit applicable to reuse of reclaimed water.

6. The permittee is expected to meet the compliance dates which have been established in this schedule. Either prior to or no later than 14 days following any lapsed compliance date, the permittee shall submit to the Department a notice of compliance or noncompliance with the established schedule. The Director may revise a schedule of compliance if he determines good and valid cause resulting from events over which the permittee has little or no control.

SCHEDULE D

Special Conditions

1. All sludge shall be managed in accordance with a current sludge management plan approved by the Department of Environmental Quality. No substantial changes shall be made in sludge management activities which significantly differ from operations specified under the approved plan without the prior written approval of the Department.

2. The permittee shall meet the requirements for use of reclaimed water under Division 55, including the following:

   a. All irrigation shall be managed in accordance with the approved Reclaimed Water Use Plan.

   b. No treated effluent shall be released by the permittee to another person, as defined in Oregon Revised Statute (ORS) 468.005, for use unless there is a valid contract between the permittee and that person that meets the requirements of OAR 340-55-015(9).

   c. The permittee shall notify the Department within 24 hours if it is determined that treated effluent is being used in a manner not in compliance with OAR 340-55. When the Department offices are not open, the permittee shall report the incident of noncompliance to the Oregon Emergency Response System (Telephone Number 1-800-452-0311).

   d. No reclaimed water shall be made available to a person proposing to use reclaimed water unless that person certifies in writing that they have read and understood the provisions in these rules. This written certification shall be kept on file by the sewage treatment system owner and be made available to the Department for inspection by request.

3. The permittee shall comply with Oregon Administrative Rules (OAR), Chapter 340, Division 49, "Regulations Pertaining to Certification of Wastewater System Operator Personnel" and accordingly:

   a. The permittee shall have its wastewater system supervised by one or more operators who are certified in a classification and grade level (equal to or greater) that corresponds with the classification (collection and/or treatment) of the system to be supervised as specified on page one of this permit. The permittee may contract for part-time supervision in accordance with OAR 340-49-015(3) and 340-49-070.

Note: A "supervisor" is defined as the person exercising authority for establishing and executing the specific practice and procedures of operating the system inn accordance with the policies of the permittee and requirements of the waste discharge permit. "Supervise" means responsible for the technical operation of a system, which may affect its performance or the quality of the effluent produced. Supervisors are not required to be on-site at all times.

b. The permittee's wastewater system may not be without supervision (as required by Special Condition 3.a. above) for more than thirty (30) days. During this period, and at any time that the supervisor is not available to respond on-site (i.e. vacation, sick leave or off-call), the permittee must make available another person who is certified in the proper classification <u>and</u> at grade level I or higher.

c. The permittee is responsible for ensuring the wastewater system has a properly certified supervisor available at all times to respond on-site at the request of the permittee and to any other operator.

d. The permittee shall notify the Department of Environmental Quality in writing within thirty (30) days of replacement or redesignation of certified operators responsible for supervising wastewater system operation. The notice shall be filed with the Water Quality Division, Operator Certification Program (see address on page one). This requirement is in addition to the reporting requirements contained under Schedule B of this permit.

WPCF GENERAL CONDITIONS

The permittee shall provide an adequate operating staff which is duly qualified to carry out the operation, maintenance, and testing functions required to insure compliance with the conditions of this permit.

All waste collection, control, treatment, and disposal facilities shall be operated in a manner consistent with the following:

a. At all times all facilities shall be operated as efficiently as possible and in a manner which will prevent discharges, health hazards, and nuisance conditions.

b. All screenings, grit, and sludge shall be disposed of in a manner approved by the Department of Environmental Quality such that it does not reach any of the waters of the state or create a health hazard or nuisance condition.

c. Bypassing of untreated waste is generally prohibited. No bypassing shall occur without prior written permission from the Department except where unavoidable to prevent loss of life or severe property damage.

Whenever a facility expansion, production increase, or process modification is anticipated which will result in a change in the character of pollutants to be discharged or which will result in a new or increased discharge that will exceed the conditions of this permit, a new application must be submitted together with the necessary reports, plans, and specifications for the proposed changes. No change shall be made until plans have been approved and a new permit or permit modification has been issued.

After notice and opportunity for a hearing this permit may be modified, suspended, or revoked in whole or in part during its term for cause including but not limited to the following:

a. Violation of any terms or conditions of this permit or any applicable rule, standard, or order of the Commission;

b. Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts.

The permittee shall, at all reasonable times, allow authorized representatives of the Department of Environmental Quality:

a. To enter upon the permittee's premises where a waste source or disposal system is located or in which any records are required to be kept under the terms and conditions of this permit;

b. To have access to and copy any records required to be kept under the terms and conditions of this permit;

c. To inspect any monitoring equipment or monitoring method required by this permit; or

d. To sample any discharge of pollutants.

The permittee shall at all times maintain in good working order and operate as efficiently as possible all treatment or control facilities or systems installed or used by the permittee to achieve compliance with the terms and conditions of this permit.

. The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State, or local laws, or regulations.

. The Department of Environmental Quality, its officers, agents, or employees shall not sustain any liability on account of the issuance of this permit or on account of the construction or maintenance of facilities because of this permit.

. In the event the permittee is unable to comply with all the conditions of this permit because of a breakdown of equipment or facilities, an accident caused by human error or negligence, or any other cause such as an act of nature, the permittee shall:

a. Immediately take action to stop, contain, and clean up the unauthorized discharges and correct the problem.

b. Immediately notify the Department of Environmental Quality so that an investigation can be made to evaluate the impact and the corrective actions taken and determine additional action that must be taken.

c. Submit a detailed written report describing the breakdown, the actual quantity and quality of resulting waste discharges, corrective action taken, steps taken to prevent a recurrence, and any other pertinent information.

Compliance with these requirements does not relieve the permittee from responsibility to maintain continuous compliance with the conditions of this permit or the resulting liability for failure to comply.

10. Definitions of terms and abbreviations used in this permit:

a. BOD_5 means five-day biochemical oxygen demand.

b. TSS means total suspended solids.

c. NH_3-N means Ammonia Nitrogen.

d. NO_3-N means Nitrate Nitrogen.

e. NO_2-N means Nitrite Nitrogen.

f. TKN means Total Kjeldahl Nitrogen.

g. Cl means Chloride.

h. TN means Total Nitrogen.

i. mg/l means milligrams per liter.

j. ug/l means micrograms per liter.

k. kg means kilograms.

l. GPD means gallons per day.

m. MGD means million gallons per day.

n. Averages for BOD, TSS, and Chemical parameters based on arithmetic mean of samples taken.

o. Average Coliform or Fecal Coliform is based on geometric mean of samples taken.

p. Composite sample means a combination of samples collected, generally at equal intervals over a 24-hour period, and apportioned according to the volume of flow at the time of sampling.

q. FC means fecal coliform bacteria.

Appendix C

Golf Course Lease

and

Irrigation Agreement

GOLF COURSE LEASE
AND APPLICATION OF SEWAGE EFFLUENT
IRRIGATION AGREEMENT

This Lease Agreement is entered into in Madras, Oregon as of the 1st day of June, 1992, by and between the CITY OF MADRAS, a Municipal Corporation of the State of Oregon ("City"), and JEFFERSON COUNTY, a County of the State of Oregon ("County"), hereinafter collectively referred to as Lessor, and KEVIN O'MEARA, hereinafter referred to as Lessee.

W I T N E S S E T H :

WHEREAS, Lessor operates a municipal sewage treatment lagoon and plant located at the City of Madras/Jefferson County Airport; and

WHEREAS, pursuant to approved plans by the Department of Environmental Quality, State of Oregon ("DEQ"), the City applies through irrigation the effluent from the sewage treatment ponds on the property contemplated for lease herein; and

WHEREAS, the Lessor is desirous of leasing said property to the Lessee and in furnishing the effluent from the City of Madras sewer lagoons for irrigation purposes.

WHEREAS, the Lessee is currently operating a nine hole golf course which is adjacent to the East of the property leased herein, and is desirous of developing an additional nine holes on a portion of the leased premises.

NOW, THEREFORE, in consideration of the mutual agreements, and promises contained herein, it is hereby agreed between the parties as follows:

1. The Lessee shall lease from the Lessor a parcel of property described and set forth in Exhibit A, attached hereto, which shall consist of 128.72 irrigable acres, more or less, all located in Jefferson County, Township 10 South, Range 13 East of the Willamette Meridian, Section 35.

2.1 Lessor represents and warrants that it has the authority to enter into this Lease, to transfer the leasehold estate and to carry out the conditions and covenants on Lessor's part provided herein.

2.2 A part of the consideration to the Lessor are the agreements of the Lessee in Articles 4 and 5 of this Lease to use treated effluent from the City's Sewerage System.

2.3 Additional consideration shall be the payment by the Lessee to the Lessor of $115,000.00 on June 1, 1997. At Lessee's option, Lessee may pay as follows:

2.3.1 Lessee shall make annual installment payments of not less than $9,918.91 which include interest accrued on the unpaid balance at 7% per annum.

2.3.2 Interest accrual shall commence on June 1, 1997.

2.3.3 The first installment payment is due on or before June 1, 1997 with subsequent installments due on or before June 1 of each year until May 31, 2017 when the entire sum of principal and interest is due.

2.4 Additional consideration to the Lessor is the availability of public golfing within Jefferson County as provided in paragraphs 4.1 and 4.2.

2.5 The consideration to the Lessee is the use of the property for the purposes permitted herein and the use of treated sewage effluent for irrigation of the new and adjoining existing golf course.

3. The term of this Lease shall be for a period of 99 years, commencing on June 1, 1992.

4.1.1 The Lessee will design and build an additional nine hole golf course on approximately 58.4 acres of the leased property. Lessee shall install on that portion of the premises an underground sprinkling system which is capable of applying treated sewage effluent to the additional nine hole golf course. The contouring installation, completion of the water system and the seeding of grass must be completed no later than July 1, 1992. The course must be completed and open for public business no later than October 15, 1992.

4.1.2 During the first twenty-five lease years, the Lessee will not remove or alter any of the golf course facilities or improvements made by the Lessee on the leased premises without the Lessor's prior written approval, which approval shall not be unreasonably withheld.

4.2 During the first twenty-five lease years, Lessee agrees that the golf course will not be a private club and will be open to the public upon payment of reasonable green fees and compliance with reasonable rules of conduct. During the first twenty-five lease years, in the event that the golf course to be constructed on the leased premises, or the adjoining nine hole golf course, is not operated for a period of three consecutive months after the initial opening, subject to the provisions of paragraph 24, Lessor may, as its sole remedy, terminate this Lease upon thirty (30) days written notice to Lessee.

4.3.1 During the first twenty-five lease years, the balance of the property not used for golf course purposes, consisting of approximately 57.22 acres, shall be used for farm purposes by Lessee and shall be irrigated with treated sewer plant effluent. Lessee shall maintain on this portion of the premises crops or pasture which are suitable and qualify for application of sewage effluent pursuant to the rules and requirements of the DEQ.

4.3.2 Lessee shall not have an obligation to maintain crops or pasture if sufficient effluent to sustain such uses is not available pursuant to this Lease. Subject to the preceding limitation, the Lessee shall be required to irrigate this portion of the property with such sewage effluent as may be available.

4.4 During the first twenty-five (25) lease, Lessee agrees to use all of the treated effluent that can be reasonably used on the property that is seasonally made available by the City and that is approved for application pursuant to the rules and regulations of the Department of Environmental Quality. Lessee will comply with all requirements relating to the application of treated effluent that the City must meet to maintain its approval from the DEQ for use of this property for effluent disposal.

4.5 After the first twenty-five years, City may agree to supply treated effluent to Lessee upon mutually acceptable terms. The terms may include but are not limited to, alternative locations of use and charges by City for the effluent. The terms will not alter lease provisions not related to the supply and application of treated effluent generated by City. Prior to entering into an agreement with a third party for supply and application of effluent, City will notify the Lessee of the terms upon which the third party has agreed to accept the effluent and Lessee shall have thirty days to accept or reject an agreeement on the same terms except for the location of effluent application. The right of first refusal shall apply to any proposal by City to supply effluent to a third party during the twenty-sixth through ninety-ninth lease years. After the first twenty-five lease years, Lessee may use the property for any lawful purpose, subject to any obligation to use treated effluent as established by subsequent agreement.

5.1.1 City grants to Lessee the first right to use all of the treated effluent produced from City's sewage treatment plant and suitable for irrigation purposes on the leased premises, and the adjacent nine hole golf course during the term of this Lease. The City of Madras will use its best efforts to cause the effluent to be suitable for the intended uses.

5.1.2 The current design capacity of the effluent irrigation pumps is 500 GPM at a pressure of 72 psi. City will use its best efforts to maintain the effluent pumping system so as to supply the effluent at the design capacity. If the design capacity is subsequently increased, City will use its best efforts to maintain the effluent pumping system so as to supply the effluent at the increased capacity.

5.1.3 City will be responsible for testing the effluent and causing it to satisfy all governmental requirements for the irrigation uses permitted by this Lease.

5.2 Lessee agrees that the effluent provided by City shall first be applied and used on the leased premises, subject to the provisions of paragraph 4.5. The effluent may be used on the adjacent nine hole golf course only after the irrigation needs of the leased premises are met. Lessee agrees to apply the effluent on the adjacent nine hole golf course property in accordance with all DEQ restrictions and requirements. In no event shall Lessee use the water for direct release to surface waters of the State of Oregon.

6. Lessee covenants that all operators running farm machinery on this property shall keep a close lookout for airplanes. Lessee specifically covenants to close all gates during the farming of the premises described herein and not to allow any animals placed on the premises to escape from the premises and to maintain proper fencing and enclosures to prevent animals placed on the property from leaving the property. If animals are placed on the property for grazing purposes, Lessee covenants and agrees to abide by all requirements of the DEQ regarding use of effluent and pasturing animals on the premises. If it is necessary from time to time to remove animals to allow application of effluent to the property by irrigation, then the Lessee shall remove said animals in a timely manner and shall not allow the pasture of animals to interfere with the orderly application of effluent to the premises.

7. Lessor reserves the right to enter the leased premises at any time for the purpose of ascertaining Lessee's compliance with the terms and conditions of this Lease. Lessor will provide reasonable notice except in the event of an emergency and will make reasonable efforts to avoid interfering with Lessee's use and occupancy. Lessee acknowledges that the Lessor will, on a regular basis, inspect the premises to insure that the irrigation is applied within the constraints required by the DEQ.

8.1.1 Lessee shall in all work and cropping under the Lease, pursue the same in a good and farmlike manner and in due and proper season, and in accord with methods prevailing in the

Jefferson County area.

8.1.2 Lessee shall use his best efforts to keep the premises free and clear of noxious weeds, and to keep all irrigation equipment installed by Lessee within the new golf course in good condition during the first twenty-five lease years.

8.1.3 Lessee shall not cause contamination of the property by chemicals or hazardous waste. Lessee shall be responsible for any cleanup of any chemicals or hazardous waste caused by said Lessee that the DEQ may deem to be a hazardous waste disposal. Lessor shall be responsible for the cleanup of any substance as required by governmental authority if the substance is transmitted to the property in the treated sewage effluent.

8.2.1 This Lease and Agreement transfers title of the existing irrigation equipment on the premises from City to Lessee. City shall provide Lessee with a Bill of Sale for the equipment.

8.2.2 Lessee will continue to use the equipment or suitable replacement equipment for the application of effluent unless effluent of suitable quality and quantity for irrigation of the property subject to this Lease and the remainder of the golf course property is unavailable to Lessee for a continuous period of one year, in which case Lessee shall have no further obligation to maintain the equipment on the property. Lessee shall also provide and maintain irrigation equipment necessary to irrigate the golf course with effluent.

8.2.3 Upon assignment of this Lease or termination prior to expiration, Lessee will leave the irrigation equipment necessary to irrigate the golf course on the golf course property and transfer the ownership of said equipment to the assignee of this Lease, if any. Lessee's obligations under this Section 8.2 shall end at the end of the twenty-fifth lease year.

9. Lessee shall provide to Lessor insurance against liability in a policy naming the Lessor as an additional insured and shall provide to the Lessor proof of said insurance. Lessee shall provide insurance to the extent of the Oregon Tort Claims Limit as set forth in ORS 30.270, and Lessee acknowledges that the current limits include:

9.1 $50,000 to any claimant for any number of claims to or destruction of property including consequential damages arising out of a single accident or occurrence;

9.2 $100,000 to any claimant as general and special damages for all other claims arising out of a single accident or occurrence unless those damages exceed $100,000, in which case the claimant may recover an additional special damage, but in no event shall the total award of special damages exceed $100,000; and

9.3 $500,000 for any number of claims arising out of a single accident or occurrence.

10.1.1 City shall be responsible for the sewage treatment system permit.

10.1.2 Lessee shall cooperate with City in the application of this water to the premises to insure continued compliance with the rules related to said sewage treatment permit. This may, from time to time, result in less water being applied on the premises.

10.1.3 Lessee acknowledges that the ultimate use of the property is for the benefit of effluent application from the sewer ponds and shall comply with all requirements that City is required to comply with for City's permit.

10.1.4 Lessee agrees that the sewage treatment system may be required to cease providing the reclaimed water if the DEQ or the City determines that the requirements of the Department are not being met. City shall, however, use City's best efforts always to comply with the use requirements for the reclaimed water also designated as effluent in this Lease.

10.1.5 The Lessee shall have the first right of use of the City's 40 acres of irrigation water, as long as that water is available to the City pursuant to the City's existing agreement with the Bureau of Land Reclamation of the United States Government or any extension of said agreements. In addition, Lessee shall be entitled to an additional 10 acres of water if that water is available and not being used for other, public purposes.

10.2.1 Lessor is restricted from the sale of the lease premises by the terms of its deed from the United States. Lessor will seek approval from the United States to convey the premises to Lessee. If Lessor is initially unsuccessful, it will renew its efforts at any time during this Lease that there is reasonable cause to believe that the United States will remove the restriction. If the restriction is removed, Lessor will immediately convey the property to Lessee or Lessee's assigns by bargain and sale deed.

10.2.2 If any portion of the lease consideration in paragraph 2.3 remains unpaid, Lessee shall give Lessor a promissory note for the remaining balance on the same terms and a deed of trust for the premises to secure the obligation. The bargain and sale deed shall contain covenants setting forth any unperformed obligations of the Lessor and Lessee under the Lease at the time of the conveyance.

10.3 Attached hereto and marked as Table 1 is the mandatory requirements specified in the permit with the Lessor. Lessee agrees to abide by those requirements as set forth in Table 1 as if incorporated herein. Lessee shall cooperate with Lessor in providing effluent and other data required by the permit authorizing the use of reclaimed water from the sewage treatment plant and agrees that said report shall be submitted monthly.

10.4 Lessee agrees that there shall be no connection between any potable water supply system and the distribution system carrying reclaimed water unless the connection is through either an unrestricted air gap at least twice as wide as the diameter of the potable water discharge, or a reduced pressure principal backflow preventor which is tested and serviced professionally at least once per year.

10.5 Lessee agrees to abide by all of the Oregon Administrative Rules of the DEQ in the use of this water on the premises and shall abide by OAR 340-55-005 through OAR 340-55-030. Lessee acknowledges that Lessee has received a copy of said Oregon Administrative Rules and has read them, understands them and will abide by them as if they were set forth in this lease agreement.

11.1 The Lessee shall indemnify and hold the Lessor harmless from and against any and all claims, losses, actions or damages made or suffered by any person for death, bodily injury or property damage which results directly or indirectly from any act, default, error or omission arising in connection with or related to the Lessee's farming, operations at the golf course and tenancy of the leased premises.

11.2 In the event any such action or claim is brought against the Lessor, Lessee shall upon notice of the commencement thereof defend the same at its sole cost and expense, promptly satisfy any judgment adverse to the Lessor and operator jointly, and reimburse Lessor for any loss, costs, damage or expense including legal fees suffered or incurred by the Lessor. The foregoing indemnity shall survive the expiration or earlier termination of this agreement.

11.3 The Lessee shall indemnify, defend and hold the Lessor harmless from any and all claims, judgments, damages, penalties, fines, costs, liabilities or losses which arise during or after the term of this Lease because of the contamination of the property by hazardous wastes or hazardous materials as a result of the use or activities of the Lessee, his agents, employees, contractors or invitees. The foregoing indemnity shall not extend to contamination caused by any substance transported to the property in the sewage effluent. The foregoing indemnity shall survive the expiration or earlier termination of this agreement.

12.1 The Lessee shall not assign this agreement, in whole or in part, or any right or obligation hereunder without the Lessor's prior written approval, which approval shall not be unreasonably withheld.

12.2 Lessee shall, however, be allowed to let the premises that are not used for golf course purposes to other parties for the pasturing of said land or for the farming of said land; provided that Lessee must first have entered into a legally enforceable contract with the sublessee wherein the sublessee has assumed and agreed to comply with the requirements of OAR Chapter 340, Division 55 as incorporated into the existing agreement between Lessee and the City for the use and delivery of reclaimed water and such agreement with the sublessee is on file with the City Recorder.

13. The Lessee shall comply with all applicable Federal, State and local laws, rules, ordinances and regulations at all times in the performance of this agreement. The Lessee shall comply with ORS 656.017.

14. This agreement shall be governed by and interpreted in accordance with the laws of the State of Oregon. The parties to this agreement do not intend to infer on any third party and rights under this agreement.

15. All actions relating to this agreement shall be tried before the courts of the State of Oregon to the exclusion of all other courts which may have jurisdiction apart from this provision. Venue and any action shall lie in the Circuit Court of Jefferson County.

16. This agreement supersedes and replaces the prior agreement between the parties dated March 26, 1991 and entitled "Lease Agreement." This agreement supplants and replaces the prior agreement.

17. If any provision of this agreement is found to be illegal or unenforceable, this agreement nevertheless shall remain in full force and effect and the provisions that are declared unenforceable or illegal are to be stricken.

18. This agreement contains the entire agreement between the parties and supersedes any prior written agreements or oral discussions or agreements except for the agreement between Lessee and the City for use and delivery of reclaimed water. The agreement may be modified only in written form with the parties' signatures contained thereon.

19. The parties agree that either party shall not be deemed to have waived any breach of this agreement by the other party, except by an express waiver in writing. An express written waiver as to one breach shall not be deemed a waiver of any further breach not expressly identified even though the other breach be of the same nature as that waived.

20. Lessee, for himself, his heirs, executors and administrators, covenants to and with the Lessor and its assigns:

20.1 To promptly comply with the agreements reserved as hereinbefore specified;

20.2 That all the foregoing terms and conditions, including the reference to farming in due and proper season, are covenants and he will faithfully perform, preserve and keep the same;

20.3 That he will make no unlawful use of the said property;

20.4 That upon the expiration of this lease agreement he will quit and deliver up the premises and all further erections or additions to or upon the same, except as above noted, to the Lessor or those having their estate therein, peaceably, quietly and in as good order and condition (reasonable use and wear thereof, fire and other unavoidable casualties excepted) as the same now are;

20.5 That he will not suffer nor permit any strip or waste of the premises nor make nor suffer to be made any alterations or additions to or upon the same except as permitted by this lease;

20.6 That he will not assign or attempt to assign this lease agreement or permit any other person or persons to occupy the premises or any part thereof, except as permitted in this lease;

20.7 That it shall be lawful for said Lessor or those having their estate in the premises at reasonable times to enter into and upon the same to examine the condition thereof.

21. It is mutually agreed by the parties that in the event any suit or action is brought by the Lessor or Lessee to enforce any term or condition of this lease agreement or to cancel or terminate this lease agreement, that the Court may award the prevailing party in such suit or action such sum in addition to costs and disbursements as may be adjudged reasonable as the prevailing party's attorney fees.

22.1 Provided always, and these presents are upon this condition, that if the said Lessee, his representatives or assigns, shall neglect or fail to do or to perform and observe any or either of the covenants hereinabove contained, which on his part are to be performed, if after thirty (30) days prior written notice to the Lessee by the Lessor said neglect or failure continues, then said Lessor or those having their estate in the premises, lawfully may immediately or at any time thereafter, and while said neglect or failure continues, and without further notice or demand enter into and upon said premises, or any part thereof, in the name of the whole and repossess the same of his former estate and expel Lessee and those claiming under him, remove his effects (forcibly if necessary), and without being taken or deemed guilty in any manner of trespass and without prejudice to any remedies which might otherwise be used for arrears of rent or preceding breach of covenants; provided, however, if said neglect or failure is of a nature that cannot reasonably be cured within the thirty day period, and Lessee has commenced to cure the neglect or failure within the thirty day period and is diligently proceeding with the cure, then Lessee shall not be in default so long as Lessee continues to pursue the cure.

22.2 This Lease shall be binding upon and inure to the benefit of the parties, their respective successors and assigns.

22.3 Notwithstanding the provisions of paragraph 22.1 or any other provision of this Lease to the contrary, after the twenty-fifth lease year and payment by Lessee to Lessor of the lease consideration provided in paragraph 2.3, Lessor may not retake possession of the premises or terminate the Lease and its remedies for Lessee's defaults shall be limited to specific performance of the Lease provisions or recovery of damages or both.

23. Any notice given under this Lease shall be in writing and shall be effective three days after deposit in the U.S. Mail, postage prepaid, addressed to the other party at the following address or at such other address as a party may later provide by notice:

LESSOR:

City Administrator
City of Madras
71 S.E. D Street
Madras, Oregon 97741

Jefferson County
Jefferson County Courthouse
Madras, Oregon 97741

LESSEE:

Kevin O'Meara
1152 N.W. Golf Creek Drive
Madras, Oregon 97741

24. Any prevention, delay or stoppage due to strikes, lockouts, labor disputes, acts of God, inability to obtain labor or materials or reasonable substitutes therefor, enemy or hostile government action, civil commotion, fire or other casualty and any other cause beyond the reasonable control of the party obligated to perform, shall excuse the performance by such party for a period equal to any such prevention, delay or stoppage.

25. Time is of the essence of each provision of this lease.

IN WITNESS WHEREOF, the parties hereto have set their hands and seals the day and year first above written.

LESSOR:

CITY OF MADRAS

Floyd Courtain

Floyd Courtain, Mayor

ATTEST:

Karen J. Coleman

Karen J. Coleman, City Recorder

COUNTY OF JEFFERSON

[signature]

Commissioner

Commissioner

Ron Vincent

Commissioner

ATTEST:

Elaine Henderson, County Clerk

LESSEE:

Kevin O'Meara

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8155.001

EXHIBIT "A"

PROPERTY DESCRIPTION

MADRAS AIRPORT

Golf Course Irrigation Area

A tract of land being a portion of the Southwest one-quarter of Section 35, Township 10 South, Range 13 East, Willamette Meridian, Jefferson County, Oregon, more particularly described as follows.

Beginning at the Southeast corner of the Southwest one-quarter of said Section 35; thence North 00°10'00" East along the North-South centerline of said Section 35 a distance of 2,655.47 feet, more or less, to the Center one-quarter corner of said section; thence South 89°50'40" West along the East-West section line of said Section 35 a distance of 1,322.00 feet to the Northwest corner of the Northeast one-quarter of the Southwest one-quarter of said Section 35; thence parallel with the North-South centerline of said Section 35, South 00°10'00" West 100.00 feet to a point on the outer periphery of an existing center pivot irrigation circle; thence along the arc of said circle on a 920.00 foot radius curve convex left 1084.65 feet through a central angle of 67°33'00", (the chord of which bears South 33°43'30" West 1022.92 feet; thence parallel with the North-South centerline of said section South 00°10'00" West 560.00 feet; thence parallel with the South line of said section South 89°57'00" West 759.88 feet, more or less, to the West line of said Section 35; thence South along said line 1,142.74 feet, more or less, to the Southwest corner of said Section 35; thence North 89°57'00" West along the South line of said Section 35 a distance of 2,644.00 feet, more or less, to the true point of beginning of this description.

LESS AND EXCEPT the South 30 feet thereof, which is the right-of-way of County Road known as Birch Lane.

SUBJECT TO other rights-of-way, easements, and agreements of record.

Contains 128.72 acres, more or less.

REGISTERED PROFESSIONAL LAND SURVEYOR

OREGON
OCTOBER 19, 1950
DONALD J. BRANTON
385

TABLE 1: TREATMENT AND MONITORING REQUIREMENTS FOR USE OF RECLAIMED WATER*

NOTE: This table specifies the allowable beneficial purposes for various levels of quality of reclaimed water. If reclaimed water is to be applied to a specific beneficial purpose, all requirements -- except advisory notices, but including footnotes, listed for that level of reclaimed water and use -- must be met.

CATEGORY	LEVEL I	LEVEL II	LEVEL III	LEVEL IV
Biological Treatment	X	X	X	X
Disinfection		X	X	X
Clarification				X
Coagulation				X
Filtration				X
Total Coliform (organisms/100 ml):				
Two Consecutive Samples	N/L	240	N/L	N/L
7-Day Median	N/L	23	2.2	2.2
Maximum	N/L	N/L	23	23
Sampling Frequency	N/R	1 per week	3 per week	1 per day
Turbidity (NTU):				
24-Hour Mean	N/L	N/L	N/L	2
5% of Time During a 24-Hour Period	N/L	N/L	N/L	5
Sampling Frequency				Hourly
GENERAL				
Public Access	Prevented (fences gates, locks)	Controlled (signs, rural or nonpublic lands)	Controlled (signs, rural or nonpublic lands)	No direct public contact during irrigation cycle

TABLE 1: TREATMENT AND MONITORING REQUIREMENTS FOR USE OF RECLAIMED WATER* *(Continued)*

(Numbers in the Table refer to Footnotes)

CATEGORY	LEVEL I	LEVEL II	LEVEL III	LEVEL IV
Buffers for Irrigation:	Surface: 10 ft. Spray: site specific	Surface 10 ft. Spray: 70 ft.	10 ft.	None required
Agricultural:				
Food Crops	N/A	N/A	N/A	Unrestricted
Processed Food Crops	N/A	1	1	Unrestricted
Orchards and Vineyards	N/A	2	2	Unrestricted
Fodder, Fiber, and Seed Crops not for Human Ingestion	3	1	1	Unrestricted
Pasture for Animals	N/A	4	4	Unrestricted
Sod	N/A	1	1	Unrestricted
Ornamental Nursery Stock	N/A	1	1	Unrestricted
Christmas Trees	N/A	1	1	Unrestricted
Firewood	N/A	1	1	Unrestricted
Commercial Timber	3	1	1	Unrestricted

TABLE 1: TREATMENT AND MONITORING REQUIREMENTS FOR USE OF RECLAIMED WATER* *(Continued)*

(Numbers in the Table refer to Footnotes)

CATEGORY	LEVEL I	LEVEL II	LEVEL III	LEVEL IV
Parks, Playgrounds, Schoolyards, Golf Courses with Contiguous Residences	N/A	N/A	N/A	5,6
Golf Courses without Contiguous Residences	N/A	5,7	5,7	5,6
Cemeteries, Highway Medians, Landscapes without Frequent Public Access	N/A	5,7	5,7	5,6
Industrial or Commercial Use	N/A	9,10,11,12	9,10,11,12	9,10,12
Construction Use	N/A	9,10,11 12,13	9,10,11 12,13	9,10, 12,13
Impoundments:				
Unrestricted	N/A	N/A	N/A	8,10
Restricted	N/A	N/A	8,10,14	8,10
Landscape Impoundments	N/A	8,10,14	8,10,14	8,10

*DEFINITIONS:

Surface: Surface irrigation where application of reclaimed water is by means other than spraying such that contact between the edible portion of any food crop and reclaimed water is prevented.

Spray: Spray irrigation where application of reclaimed water to crops is by spraying it from orifices in piping.

Processed Food Crops: Those which undergo thermoprocessing sufficient to kill spores of *Clostridium botulinum*. Washing, pickling, fermenting, milling or chemical treatments are not sufficient.

TABLE 1: TREATMENT AND MONITORING REQUIREMENTS FOR USE OF RECLAIMED WATER* *(Continued)*

(Numbers in the Table refer to Footnotes)

*DEFINITIONS: *(Continued)*

- N/A: This level of reclaimed water not allowed for this use.
- N/L: No limit.
- X: Required treatment for this treatment level.
- N/R: Not required.

FOOTNOTES:

1 Advisory Notice Only: The Oregon State Health Division recommends that there should be no irrigation of this level of effluent for 3 days prior to harvesting.

2 Surface irrigation where edible portion of crop does not contact the ground, and fruit or nuts shall not be harvested off the ground.

3 The Department may permit spraying if it can be demonstrated that public health and the environment will be adequately protected from aerosols. Advisory Notice Only: The Oregon State Health Division recommends that there should be no irrigation of this level of effluent for 30 days prior to harvesting.

4 Surface or spray irrigation: No animals shall be on the pasture during irrigation.

5 Signs shall be posted around the perimeter of the facility's perimeter and other locations indicating that reclaimed water is used for irrigation and is not safe for drinking, and in the case of effluent quality Levels II and III for body contact (e.g., for Level IV, ATTENTION: RECLAIMED WATER USED FOR IRRIGATION — DO NOT DRINK • ATENCION: RECLAMADO DESPERDICIO DE AGUA USADO PARA LA IRRIGACION. — NO-BEBA EL AGUA; for Levels II and III, ATTENTION: RECLAIMED WATER USED FOR IRRIGATION — AVOID CONTACT — DO NOT DRINK • ATENCION: RECLAMADO DESPERDICIO DE AGUA USADO PARA LA IRRIGACION. — EVITE EL CONTACTO — NO BEBA EL AGUA).

6 Reclaimed water shall be applied in a manner so that it is not sprayed onto areas where food is prepared or served or onto drinking fountains.

7 Reclaimed water shall be applied in a manner so that it is not sprayed within 100 feet from areas where food is prepared or served or where drinking fountains are located.

TABLE 1: TREATMENT AND MONITORING REQUIREMENTS FOR USE OF RECLAIMED WATER* *(Continued)*

(Numbers in the Table refer to Footnotes)

8 Signs shall be posted around the perimeter and other locations indicating that reclaimed water is used and is not safe for drinking, and in the case of effluent quality Levels II and III for body contact (e.g., for Level IV, ATTENTION: RECLAIMED WATER — DO NOT DRINK • ATENCION: RECLAMADO DESPERDICIO DE AGUA — NO BEBA EL AGUA; for Levels II and III, ATTENTION: RECLAIMED WATER — AVOID CONTACT — DO NOT DRINK • ATENCION: RECLAMADO DESPERDICIO DE AGUA — EVITE EL CONTACTO — NO BEBA EL AGUA).

9 The Department may impose more stringent limits on the use of reclaimed water if it believes it is necessary to protect public health and the environment.

10 There shall be no disposal of reclaimed waters into surface or groundwaters without authorization by an NPDES or WPCF permit.

11 Use of reclaimed water in evaporative cooling systems shall be approved only if the user can demonstrate that aerosols will not present a hazard to public health.

12 Members of the public and employed personnel at the site of the use of reclaimed water shall be notified that the water is reclaimed water. Provisions for how this notification will be provided shall be specified in the reclaimed water use plan.

13 Unless decontaminated in a manner approved in writing by the Oregon Health Division, tanker trucks or trailers that transport and/or use reclaimed water shall not be used to transport potable water intended for use as domestic water. A tanker truck or trailer used to transport and/or use reclaimed water shall have the words "NONPOTABLE WATER" written in 6-inch high letters on each side and the rear of the truck. The words "NONPOTABLE WATER" shall not be removed until decontamination as approved by the Health Division has occurred.

14 Aerators or decorative fixtures which may generate aerosols shall not be used unless approved in writing by the Department. Approval will be considered if it can be demonstrated that aerosols will be confined to the area of the impoundment or a restricted area around the impoundment.

TABLE 1: TREATMENT AND MONITORING REQUIREMENTS FOR USE OF RECLAIMED WATER* *(Continued)*

(Numbers in the Table refer to Footnotes)

ADVISORY NOTICE ONLY:

The Oregon State Health Division recommends that persons who must handle irrigation or other equipment for reclaimed wastewater or who are exposed to reclaimed water should be fully advised of any hazards associated with such exposure and should be provided with necessary protective clothing.

MEMORANDUM OF UNDERSTANDING

WHEREAS, the Nine Peaks Golf Course is desirous of receiving reclaimed water from the City of Madras lagoon effluent for irrigation of its landscaping, and

WHEREAS, the City is desirous of securing additional effluent disposal sites and believes that golf course irrigation is a beneficial use of such water.

The parties do hereby agree to the following guidelines, in developing plans for future use by the Golf Course of reclaimed water.

a. The City agrees to supply reclaimed water for golf course irrigation subject to available supply of reclaimed water which can meet the standards set by the Department of Environmental Quality (D.E.Q.) for golf course irrigation. Estimated to be approximately 100 acre feet per year.

b. The reclaimed water will be delivered to a point to be determined by the City at a rate of approximately 500 GPM.

c. Such deliveries to be made only in excess of existing City commitments for supplying reclaimed water.

d. The City reserves the right to divert from delivery any quantity of reclaimed water as may be necessary or desirable to provide for optimum operation of the City's sewerage facilities.

e. The City reserves the right to terminate deliveries to the golf course:

    1. If appropriate water quality standards cannot be met,

    2. If the user fails to meet any condition required by agreement, or

    3. Should equipment failure occur.

f. The City shall be allowed to inspect owners plumbing and storage facilities at any time to assure compliance with any regulation or agreement.

g. The City may meter deliveries to the premises for recording purposes and may, at the expiration of any lease period which may be agreed upon, set charges for the use of such reclaimed water.

h. The Golf Course agrees to install and maintain any necessary equipment and piping from point of delivery to all points of use.

i. The Golf Course agrees to receive and make use of the reclaimed water in such quantities and times, within reasonable limits, as the City is able to deliver.

j. The Golf Course further agrees to handle and use such reclaimed water as may be required by State or Federal regulation.

k. The Golf Course agrees to install appropriate backflow devices on all potable water service lines.

l. The Golf Course will provide the City with as-built drawings of all piping for both domestic and reclaimed water. Installation of all plumbing and equipment for handling reclaimed water shall be approved by the City prior to installation.

m. The Golf Course agrees to maintain all reclaimed water use facilities in a state of good condition.

n. The Golf Course further agrees that should future regulations require a higher level of treatment, of the reclaimed water for golf course irrigation, than may be possible with the existing City treatment facilities, the City may terminate deliveries until such higher standards can be met and may negotiate with the Golf Course to pay all or a portion of the cost associated with the required treatment method prior to re-establishing deliveries.

The provisions of this agreement are for the purpose of creating guidelines whereby the Nine Peaks Golf Course may investigate the feasibility of using reclaimed water from the City of Madras to irrigate the existing facilities and for the use of such reclaimed water in planning any proposed expansion of the facilities. This agreement does not commit the Golf Course to receive reclaimed water, nor does it commit the City to deliver reclaimed water.

CITY OF MADRAS:

Edward E. Sites, Mayor — Date: January 25,1990

JoAnne Holcomb, City Administrator — Date: 1/25/90

NINE PEAKS GOLF COURSE:

Mr. Kevin O'Meara — Date: 1-25-90

Appendix D

Draft FAA Advisory Circular

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U.S. Department
of Transportation

Federal Aviation
Administration

Advisory Circular

Subject: WILDLIFE ATTRACTIONS ON OR NEAR AIRPORTS

Date:
Initiated by: AAS–310

AC No: 150/5200–
Change:

1. PURPOSE. This advisory circular (AC) provides guidance on land uses and activities located on or in the vicinity of airports that are potentially attractive to birds or other wildlife.

2. BACKGROUND. Airports typically include, and are often surrounded by, large tracts of unimproved land. This acreage is desirable for an added margin of safety and for noise mitigation. However, this additional land is not without potential liabilities. Any development in these areas that would result in the creation of a safety hazard to aircraft by attracting or sustaining wildlife is not recommended. Airport operators and land use planners should exercise caution when considering these areas for any development so as not to create a manmade attraction to wildlife.

a. Wildlife may seek refuge on or near an airport for many reasons. As birds and other wildlife may access all areas of an airport, free ranging wildlife can create a potential safety hazard. Aircraft collisions with wildlife have caused accidents that have resulted in fatalities. To the extent practicable, airport operators and land use planners should avoid developments that attract or sustain wildlife in areas that could create a potential hazard to aircraft.

b. As airports are often inherently attractive to wildlife, caution should be exercised not to exacerbate this situation. Certain land uses may provide, by varying degrees, an attraction to birds and other wildlife. This attraction may range from simple curiosity to intense feeding behavior. Scavenging birds, mammals, and even insects may find favorable conditions in or around waste disposal operations. Other manmade attractions, such as retention ponds, mitigated wetlands or agricultural crops may create an attraction to wildlife. If such land uses attract or sustain wildlife near airport operations, the potential for a collision between aircraft and wildlife may be significantly increased. Because of this potential, certain land uses and activities in airport–sensitive areas, as outlined in this AC, are not recommended.

3. DEFINITIONS. For the purposes of this AC the following definitions will apply:

a. **Fly ash.** The fine, sand–like residue resulting from complete incineration of waste. Fly ash usually results from operations, such as coal or waste fired electrical generators.

b. **Piston–use runway.** Any runway used primarily by piston–powered aircraft and not projected for use by turbine–powered aircraft. Infrequent operations of turbine–powered aircraft will not affect this designation.

c. **Potential wildlife hazard.** A wildlife hazard is considered to exist whenever:

(1) There is a potential for birds and other wildlife to be attracted into active airspace or have access to aircraft movement areas;

(2) Any attraction to local wildlife, such as coyotes, rodents, deer etc. could cause conflicts with aircraft or airport operations; and

(3) Other wildlife, although not normally a direct strike hazard, cause serious damage to underground wiring or degrade the integrity of runways, navaids, or safety areas.

d. **Runway edge.** The edge of useable pavement designated for use as a runway.

e. **Turbine–powered aircraft.** Aircraft powered by turbine engines, including turbojets and turboprops.

f. **Turbine-use runway.** Any runway used by turbine-powered aircraft, or a runway with this use projected in a current master plan. This definition presumes that any airport that bases turbine-powered aircraft or offers services to such aircraft will have at least one turbine-use runway. The use of turbine-powered agricultural aircraft, or turbine-powered helicopters on a strip intended for use by smaller piston-powered aircraft does not automatically make a runway a turbine-use runway.

g. Waste disposal site. Landfills, garbage dumps, waste water treatment facilities, underwater waste discharges or other similarly licensed or titled facilities whose operations include processing, burying, storing, or otherwise disposing of putrescible material, trash and refuse. See exceptions outlined in Chapter 3.

LEONARD E. MUDD
Director, Office of Airport Safety and Standards

CHAPTER 1. WILDLIFE ATTRACTIONS

1–1. WASTE DISPOSAL SITES. Waste disposal sites, as defined earlier in this AC, are considered intense attractions to wildlife. Such operations located within the criteria outlined in paragraph 1-4 are normally considered incompatible. Correspondingly, new runway construction or extensions to existing runways should not occur near waste disposal sites as outlined by criteria in paragraph 1-4. Airport construction that does not expand existing operations such as correcting an unsafe condition should not be affected by this guidance.

1–2. WASTE WATER TREATMENT FACILITIES. In the past, waste water treatment facilities were often located on or near airports. However, under certain situations, these facilities can become the only source of open water for a large area. The associated settling ponds may also be used by migratory waterfowl. The attractiveness of waste water treatment plants to wildlife should be considered when siting this type of facility on or in the vicinity of an airport. Construction of new waste water treatment facilities is not recommended within the criteria outlined in paragraph 1-4(a) and (b).

a. Any wildlife problems arising from existing waste water treatment facilities should be managed without delay, using acceptable control practices. Accordingly, expansions of the waste water treatment facility or airport should incorporate measures to minimize wildlife attraction.

b. Some approaches to waste water treatment use vegetation such as cattails as a natural filter. These "artificial marshes" may become very attractive to species of flocking birds, such as blackbirds, for breeding or roosting activities. The establishment of artificial marshes within the criteria specified in paragraph 1-4 should be avoided.

c. Waste Water Discharge and Sludge Disposal. The discharge of waste water or effluent on airport property is not recommended. Regular spraying greatly improves truf quality, thus making it more attractive to grazing animals such as deer. In addition, spraying increases grass growth and requires the airport to mow more often. Mowing operations are attractive to wildlife because they maim insects and small animals. Increased mowing also produces additional straw which may be used for nest construction by birds and rodents. Although not wildlife related, discharging quantities of liquid or spreading sludge on an airport could soften the surface in the disposal area which may impede emergency equipment operations.

d. Underwater Waste Discharges. The underwater discharge of any food waste material, such as fish processing offal, that could become an attraction to scavenging wildlife is not recommended within the criteria specified in paragraph 1-4.

1–3. WETLANDS. Wetlands normally are attractive to many species of wildlife. Airports with existing wetlands on or in the vicinity should be alert to any wildlife use in these areas that could affect safe aircraft operations.

a. When development on or off airport property requires wetland replacement or mitigation, airport operators should oppose any measures to establish wetlands in areas defined in paragraph 1-4 of this AC. This should be done in cooperation with the United States Fish and Wildlife Service, the United States Department of Agriculture, the Environmental Protection Agency, the National Marine Fisheries Service (if the wetland is tidally–influenced), and local agencies that are responsible for wetland protection. To the extent capable, the airport operator should support a mitigation plan that is compatible with safe airport operations. The plan could include financial support for a wetland purchase program that wetland resource agencies recommend. A plan to establish or support wetland areas that are compatible with safe airport operations should be developed.

b. Exceptions may be made if the wetlands to be mitigated provide the habitat for endangered species or ground water recharge. If wetlands are being replaced for ground water recharge, wildlife habitat should not be enhanced beyond what is necessary for hydrological benefits.

c. Dredge Spoil Containment Areas. Dredged spoils from operations such as waterway channel maintenance that require containment should not be deposited such that it functions as a wetland in areas outlined in paragraph 1-4.

1–4. SITING CRITERIA. Wildlife attractions, as described above, are not recommended if located within areas established for the airport through the application of the following criteria:

a. Sites located within 10,000 feet of any edge of a turbine–use runway.

b. Sites located within 5,000 feet of any edge of a piston–use runway.

c. Any site located within five miles of a runway edge, that attracts or sustains hazardous bird movements from feeding, watering or roosting areas into, or across the runways or approach and departure paths of aircraft.

CHAPTER 2. NOTIFICATION

2–1. WASTE DISPOSAL SITE OPERATORS. In accordance with the guidelines specified by the Environmental Protection Agency in 40 CFR 258.10, Location Restrictions, operators of waste disposal sites within the criteria specified in paragraph 1-4(a) and (b), must successfully demonstrate that the operation is not a hazard to aircraft. Additionally, any operator proposing a new or expanded waste disposal site within five miles of a runway edge must notify the airport and appropriate FAA office:

a. Airports are not in a position to approve experimental demonstrations of wildlife control in an active aircraft operations area. To date, a sustained reduction of birds and other wildlife to numbers that normally existed prior to the operation of a putrescible waste facility has not been successfully demonstrated. Thus, in order to successfully demonstrate that a waste disposal site is not an attraction to wildlife and subsequently a potential hazard to aircraft within the criteria specified in paragraph 1-4, it must be proved that the facility will not handle putrescible material other than as outlined in Chapter 3, Exceptions. A copy of an official permit request that does not include the handling of putrescible waste, other than as outlined in Chapter 3, will suffice to demonstrate to the FAA that a facility will not be a hazard to aviation.

b. The 5–mile notification provides the FAA an opportunity to evaluate the impact of a particular site on aviation. The operator or proponent should submit a map of the area identifying the location. A 15 minute quadrangle map is desirable for purposes of detail. The operator should also forward specific details of the operation, such as the type of waste to be handled, how the waste will be processed, and final disposal methods to the FAA for review. A list of FAA Airports offices is provided in AC 150/5000-3, Address List for Regional Airports Divisions and Airports District/Field Offices, current edition.

2–2. FAA. When alerted through the notification process, the FAA will review the map and outline of the proposal or operational plan and decide whether the development presents a potential wildlife hazard by being located in areas sensitive to aircraft operations. Sensitive areas will be identified as those that lie under or next to aircraft traffic patterns. This brief examination should suffice to identify whether further investigation is warranted. If further coordination is needed to identify aircraft traffic patterns, the local Airport Traffic Control Tower manager or Flight Standards District Office may be contacted for additional information.

2–3. AIRPORT OPERATORS. Airport managers and their staff should be alert for any proposal to develop or expand a site near their airport and should notify the appropriate FAA Airports office. Airport planners should consider wildlife attractions and the resulting potential hazard during the environmental assessments required to site new or expand existing airports.

a. Where Federal grants are involved, airport operators should, to the extent practicable, oppose land use proposals that may be considered an attraction to wildlife. Failure to do so could place the operator in noncompliance.

b. When site selections are being proposed, airport operators should become involved in the process as early as possible. Early involvement could save funds that may be lost if they are spent on a site that is later abandoned due to airport safety concerns.

c. If an existing development is incompatible with an airport, as described above, and cannot be immediately terminated, a Notice to Airman (NOTAM) should be issued and steps should be taken to control wildlife and minimize further attraction.

2–4. ADDITIONAL COORDINATION. If after the initial review there remains a question whether a potential wildlife hazard may be created, a professional wildlife control specialist should be contacted. Such suspicions may be triggered by a history of bird strikes at the airport, proximity to a wildlife refuge, body of water, or similar feature.

a. If the services of a wildlife specialist are required, the developer or airport operator may wish to contact the appropriate State Director of the United States Department of Agriculture, Animal Damage Control (USDA) for assistance. Telephone numbers for the respective state office may be obtained by calling USDA's Operational Support Staff Office in Washington, D.C. The USDA will not be responsible for judging the compatibility of the site. The USDA can identify and quantify wildlife common to the area. This information should be used to establish whether the potential for a wildlife hazard exists.

b. If species of wildlife that are a concern to airports are documented in the area to be developed, and the site is within areas which could impact aircraft operations, such sites will be considered a potential wildlife hazard and will not be supported by the FAA.

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CHAPTER 3. EXCEPTIONS

3–1. GENERAL. Provided there is no apparent attraction to wildlife, and that assurances are in place to effectively deal with any that may arise, including permanent cessation of the activity, the operations in the following paragraphs will not be considered potential wildlife hazards.

3–2. ENCLOSED WASTE FACILITIES. Transfer stations or enclosed waste handling facilities that receive garbage indoors, process it via compaction, incineration or similar manner, and remove all residue by enclosed vehicles, should be compatible with safe airport operations provided they are not located on airport property or within the runway protection zone as defined in AC 150/5300–13, Airport Design, current edition. No garbage should be handled or stored outside at any time, for any reason, or in a partially enclosed structure that it is accessible to birds or other wildlife. Such facilities should be maintained in a manner that is neat in appearance and allow the operation to occur without any outward indications that waste disposal operations are underway indoors. Partially enclosed operations that accept putrescible waste are to be considered incompatible and should not be located within areas specified in paragraph 1-4.

3–3. COMPOST OPERATIONS. When possible, avoid locating such facilities on airports. Compost operations should not be located within 1200 feet of any runway or within the runway protection zone for the approach/departure areas.

a. Components of the compost should not include any municipal solid waste at any time. Non–food waste streams such as leaves, lawn clippings, branches and twigs will not be considered an attraction to wildlife within the criteria described above. Sewage sludge, woodchips, etc. may be used as a bulking agent. The finished compost product should not be disposed on the airport.

b. If a compost operation is to be located on airport property, the airport operator should reserve the right to cease operations if the facility ever produces unsafe, undesirable, or incompatible conditions at the airport.

c. Care should be taken to monitor compost mixing operations to assure that steam or thermal rise does not in any way affect air traffic. Discarded leaf disposal bags or other debris must not be allowed to blow onto any active airport area.

3–4. ASH DISPOSAL. Fly ash from resource recovery facilities that are fired by waste, coal, or wood should be mono–filled off airport property, but not within the runway protection zone. Mono filling means that no other waste other than fly ash may be disposed. No other associated or bypass waste should be admitted. Since varying degrees of waste consumption are associated with general incineration, ash disposal other than resource recovery or waste–to–energy fly ash will be classified as regular waste disposal and considered an attraction to wildlife.

3–5. CONSTRUCTION AND DEMOLITION DEBRIS. Disposal of construction and demolition debris is not considered an attraction to wildlife providing the operation is conducted in a sanitary manner and no food waste of any kind is admitted.

3–6. RECYCLING CENTERS. Enclosed recycling centers accepting previously sorted, nonfood items such as glass, newspaper, cardboard or aluminum are not considered attractions to wildlife.

3–7. WATER RETENTION/DETENTION. The movement of storm water away from runway areas is a normal function of most airports. However, large open ponds that permanently retain water on airports are attractive to wildlife and should be avoided whenever possible. These large bodies of water also limit wildlife abatement techniques. Water detention basins of a linear configuration are more desirable from the wildlife control perspective. Detention basins hold water during rainy weather and drain off shortly afterward. If the soil conditions and other requirements allow, underground storm water infiltration systems such as a french drain or buried rock field would provide the least attraction to wildlife.

3–8. AGRICULTURAL CROPS. Relatively few airports are financially self supporting. It is desirable that any airport land that can be "concurrently used" generate revenue for the airport. "Concurrent use" means that the land can fulfill its aviation purpose while at the same time be used for some other purpose that is compatible with aviation operations. The concurrent use should generate a "fair market value" revenue to be used for airport purposes. Agricultural crop production is allowed on airports, in the areas specified below, providing the following guidelines are observed:

a. Adjacent to Runways – AC 150/5300–13 contains object clearing criteria which must be met to ensure safe and efficient operations on an airport. Agricultural operations should not be conducted in areas which must be kept free of objects. These areas are: the Runway Safety Area (RSA), Object Free Area (OFA), and the Obstacle Free Zone (OFZ).

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b. Restricting agricultural operations within the dimensions set forth in the AC 150/5300-13, Table 3-1 and 3-2, will normally provide the minimum object clearance required by FAA airport design standards. However, the presence of visual or electronic navigational aids introduces additional considerations. For example, farming operations should not be permitted within the localizer or glide slope critical areas. Determinations of minimum areas which must be kept free of farming operations must be made on a case-by-case basis because of the large number of variables involved. Therefore, if navigational aids are involved, farm leases on airports must be coordinated with the Airway Facilities Division.

c. Approach Areas – The RSA, the OFA, and the OFZ all extend beyond the end of the runway into the approach area by varying amounts. Of the three, the OFA normally extends the farthest and therefore is the controlling surface. However, for nonprecision operations with 3/4-mile visibility and for precision operations, the width of the OFA is less than the width of the Threshold Siting Surface, (Appendix 2 of AC 150/5300-13) which cannot be penetrated. Therefore, for any runway with visibility minimums less than 1.0 mile, crop restriction lines will need to be adjusted so that crops and farm equipment will not penetrate the slope associated with the Threshold Siting Surface. Threshold Siting standards should not be confused with the Approach Areas described in FAR Part 77.

d. Between Intersecting Runways – Agricultural operations should never be permitted within the Runway Visibility Zone (RVZ) if the resulting crops or farm machinery used to grow and harvest them would block line-of-sight. Furthermore, crops should not block an existing clear line-of-sight between intersecting runways. Specific determinations of what would actually be permissible in these areas requires topographical data. For example, if the terrain within the RVZ is level with the runway ends, farm machinery, trucks, large hay bales, etc., will interfere with line-of-sight while these objects are parked or moving in the area. On the other hand, if the terrain is below the runway elevations, some types of crops may be acceptable.

e. Adjacent to Taxiways & Aprons – Farming operations should not be permitted within the OFA for taxiways. For aprons, since the outer portion of the apron is normally used as a taxilane, restrict farming operations within the OFA for taxilanes.

3-9. WILDLIFE ATTRACTION TO AGRICULTURE. Agricultural operations may attract birds and other wildlife causing a potential hazard to aircraft. If birds or other wildlife become a problem because of agricultural operations on an airport, the airport owner should immediately initiate remedial action.

3-10. REMEDIAL ACTION. If a wildlife problem develops, airport operators should arrange for a site visit by a professional wildlife biologist who specializes in wildlife control. During the site visit, it should be determined whether the agricultural operation is creating an attraction to the species of concern. Possible remedial actions should be discussed during the visit or provided in a letter afterward. Remedial actions may range from changing the specific choice of crop or farming technique to a complete termination of the agricultural operation. Whenever the agricultural operation is stopped, whether due to wildlife hazards or harvest, the farmer tenant should be required to plow under all crop residue and harrow the surface area smooth. These terms should be clearly written into the farm contract and understood by the lessee.

Appendix E

Public Hearing Minutes

CITY OF MADRAS
71 S.E. D STREET MADRAS, OR 97741-1685 503-475-2344 - FAX 475-7061

CITY OF MADRAS
PUBLIC HEARING

This is a summary of the public hearing held on February 22, 1996 at 7:00 p.m. at the Jefferson County Senior Center.

The following were present at the meeting:

Galen Wunsch, Kevin O'Meara, John Curnutt, Mary Krenowicz, Rob Fuller, Chamber of Commerce; City Councilors Rob Osborn, Marjean Whitehouse, Rosie Leal and Jim DeWhitt; Gerald Breazeale, Public Works Director; Patrick Sorensen, City Administrator; Wen Jou, Ace Consultants; and Joe Krenowicz, Mayor.

The public hearing was called to order by Marjean Whitehouse at 7:15 p.m. City Administrator Sorensen explained the background, history and need for updating the current wastewater system. The current plant was constructed in 1976 with a capacity of 450,000 gallons per day. Due to increasing growth, a study conducted by CH2M Hill recommended that the storage capacity be upgraded as well as the level of the treated effluent. According to this study the existing plant would be able to service the area for 20 years at a projected growth rate of 3% per year.

Wen Jou from Ace Consultants is the engineering consultant for the Wastewater System Master Plan currently being finalized by the City of Madras. Mr. Jou gave a presentation regarding his findings. The current study area is 7.4 square miles and there are presently 27 miles of collection lines for the treatment plant. The pump station located on "B" Street is at capacity and the lagoons have exceeded capacity. The study has analyzed several options for remedying the current situation. (These alternatives can be read in the Wastewater System Master Plan). It is the recommendation of Mr. Jou that the City proceed with alternative 5 with the possibility of integrating alternative 7. Both alternatives include upgrading the current system and building a new plant south of town at the McTaggert location acquired by the City several months ago. The difference between the two is the method of disposal for the treated effluent. Alternative 5 is for a spray irrigation process and alternative 7 includes effluent discharge into Willow Creek. The permitting process for discharge to Willow Creek will take a very lengthy amount of time and may not be feasible, spray irrigation can be implemented when built.

Public Works Director Breazeale went on to explain the type and appearance of the plant that is to be built. Several options have been explored regarding the financing of the plant. Systems Development Fees may be raised in order to help finance the new plant. The sewer rates were also compared with Central Oregon towns. In order to get some grant financing from the government the sewer rates will need to be raised. The new system for sewer rates will be based on actual usage as proposed. The City has compiled a spreadsheet regarding actual usage during the winter months. These figures were used in developing the basis for charges. EDU's will be based on 195 gallon per day per dwelling unit.

At this point general discussion followed regarding the new plant, planning process, fees and rates. Councilor Whitehouse asked those in attendance if they were in favor of the proposal. John Curnutt felt that it had to be done in order to obtain sufficient sewer capacity. Rob Fuller liked the idea of the phased development. The general consensus was the project is needed.

The meeting adjourned at 9:00 p.m.

OFFICIAL MINUTES

Common Council, City of Madras

I CALL TO ORDER

The City Council meeting was called to order by Mayor Joe Krenowicz at 7:35 p.m. on Tuesday, February 27, 1996 in the Madras City Hall Council Chambers.

MEMBERS PRESENT WERE:
Mayor Joe Krenowicz; Councilors Robert Osborn, James DeWhitt, and Marjean Whitehouse; City Administrator, Patrick Sorensen; City Attorney, David C. Glenn; Public Works Director, Gerald W. Breazeale; Senior Planner, Paul Dettner; City Treasurer, Brenda Black, and City Recorder, Karen J. Coleman.

ABSENT WERE:
City Police Chief, William Klein, and Councilors Rosie B. Leal, Carl Richardson, and Bob McConnell.

VISITORS PRESENT WERE:
Dave McMechan, Reporter, The Madras Pioneer; Gary Ross, Chairman, City Planning Commission; Wen Jou, Ace Consultants; Ted Viramonte, Central Oregon Intergovernmental Council, and Todd and Dawn McNerney.

II CONSENT AGENDA

Chapter 4, Council; Section 15, Quorum, of the City Charter states as follows:

> A majority of the members of the Council shall constitute a quorum for it to do business. For the purpose of reaching a quorum the Mayor shall be deemed a councilperson.

Due to the absence of three (3) City Council members, the Mayor will, in accordance with the City Charter, be voting on all issues during tonight's meeting.

City Administrator Sorensen requested that the following change be made to the Consent Agenda:

A. The addition of Subsection B, Petroleum Anti-Trust Settlement Grant, to Section VI, "B" Street School Traffic Safety Enhancement Project #1995-10.

A motion was made by Councilor Marjean Whitehouse and seconded by Councilor James DeWhitt to approve the amended Consent Agenda, including payment of checks #5591 through #5649. The motion passed unanimously, 4/0.

Section VII, Committee Reports; Subsection E, Public Works Committee; Item 1), Utility Worker I, was presented at this time; however, the minutes will be prepared to coincide with the meeting agenda.

III COMMENTS FROM CITIZENS AT THE MEETING

Mayor Krenowicz provided those in attendance with the opportunity to present comments at this time.

There were no comments offered.

IV CORRESPONDENCE

City Administrator Sorensen had no correspondence to present at this time.

---------------------------------- RECORDER ---------------------------------- MAYOR

B. <u>Proposed Wastewater System Master Plan</u>

The regular City Council meeting was closed and a Public Hearing opened at 7:47 p.m.

<u>City Administrator Sorensen</u> indicated that a Public Hearing had been held on Thursday, February 22, 1996 at the Jefferson County Senior Center. There had been four (4) or five (5) individuals, in addition to City Council members and staff, in attendance.

Tonight's Public Hearing has been scheduled for the purpose of receiving comments from citizens and to provide Council with the opportunity to formally adopt the Wastewater System Master Plan. By adopting the Wastewater System Master Plan, Council is accepting Ace Consultant's conclusions and recommendations which basically sets in motion the approach the City will be taking.

He mentioned that Council is not approving any fee increases at this time. Discussions have however taken place, during earlier Public Works Committee meetings, pertaining to the need to increase Systems Development Charges in the very near future and to review sewer user fees.

Those in attendance were given the opportunity to hear the entire Wastewater System Master Plan presentation that had been made during the February 22, 1996 Public Hearing.

There were very few citizens in attendance. Comments from the audience indicated that they did not feel that there was a need to hear the presentation as they had been following the process quite closely and had been given sufficient information prior to tonight's City Council meeting.

<u>City Administrator Sorensen</u> mentioned that the City is in hopes of obtaining approximately twenty-five percent (25%) grant and seventy-five percent (75%) loan for the total $7.7 million dollar project.

<u>Mayor Krenowicz</u> indicated that it is very unfortunate that so few individuals have attended the Public Hearings. This issue will be discussed further during future Public Works Committee and City Council meetings. He emphasized the need to get as much information to the public as possible.

<u>Councilor Whitehouse</u> wanted to know what the worse case scenario would be if the City does not receive grant funding and whether the City would be required to present this issue to the voters.

<u>City Administrator Sorensen</u> explained that the City would not be required to present this issue to the voters; however, that it could be an option. He mentioned that the City would simply have to apply for a one-hundred percent (100%) low interest loan. Staff is optimistic that the City will be awarded grant funding.

There were no comments offered in opposition to Council's adoption of the proposed Wastewater System Master Plan.

The Public Hearing was closed and the regular City Council meeting opened at 7:57 p.m.

A motion was made by Councilor James DeWhitt and seconded by Councilor Robert Osborn that Council accept the recommendations as presented in the recently completed Wastewater System Master Plan and proceed accordingly. The motion passed unanimously, 4/0.

OFFICIAL MINUTES

Common Council, City of Madras

I CALL TO ORDER

The City Council meeting was called to order by Mayor Joe Krenowicz at 7:30 p.m. on Tuesday, May 14, 1996 in the Madras City Hall Council Chambers.

MEMBERS PRESENT WERE:
Mayor Joe Krenowicz; Councilors Rosie Leal, Carl Richardson, Robert Osborn, Bob McConnell, Marjean Whitehouse, and James DeWhitt; City Administrator, Patrick Sorensen; City Attorney, David C. Glenn; Senior Planner, Paul Dettner; Public Works Director, Gerald W. Breazeale; City Treasurer, Brenda Black, and City Recorder, Karen J. Coleman.

VISITORS PRESENT WERE:
Wen Jou, Ace Consultants; Walter Summerhalder; Ron Simmelink; Fred and Bonnie Langeliers, Madras Laundry and Dry Cleaning; Alan Durkee; Robert K. Ellis; Keith Johnson; Neva McPherson, Madras Laundry and Dry Cleaning; James Erro, Double E Meat, Inc.; Charlie Campbell, O.K. Barber Shop; Henry and Doris Schledewitz; Jo and William Guiney; John Curnutt, Bosh Properties; Lawrence Hart; Ronald Bergen, First Baptist Church; Angela Shaw; Susan Matheny, The Madras Pioneer; James Beamish, Busy Bee Market; Phil Rice, Original Burger Works; Mike Stewart; Rudy Younger; Richard and Linda McKelvy; Martha Dietz; Wesley Hutson, Wes' Floor Covering; Elizabeth Holquin; George Hawes; Dave McMechan, Reporter, The Madras Pioneer; Bob Thawley, Spiffy Car Wash; Stevens Lawrence Hart; Dallas Stovall, Bright Wood Corporation; Robert Fuller, Executive Director, Madras-Jefferson County Chamber of Commerce; Jefferson County Commissioners, Rick Allen and Jodi Eagan; Helmer Wallan, Economic Development for Jefferson County; Herman Hansen, and Penny Johnson.

II CONSENT AGENDA

City Administrator Sorensen requested that the following change be made to the Consent Agenda:

A. The addition of Section IV-A, Wastewater System Master Plan, between Section IV, Correspondence, and Section V, Public Hearing.

A motion was made by Councilor Carl Richardson and seconded by Councilor Rosie Leal to adopt the Consent Agenda, as amended, including payment of checks #5911 through #6010. The motion passed unanimously, 6/0.

III COMMENTS FROM CITIZENS AT THE MEETING

Mayor Joe Krenowicz provided those in attendance with the opportunity to present comments at this time.

There were no comments offered.

IV CORRESPONDENCE

City Administrator Sorensen had no correspondence to present at this time.

IV-A WASTEWATER SYSTEM MASTER PLAN

City Attorney Glenn entered the meeting at 7:32 p.m.

City Administrator Sorensen explained that the process involving the Wastewater System Master Plan began last year when the City realized that its treatment capacity was beginning to diminish. The City contracted with Ace Consultants, a firm which specializes in wastewater and water systems, in the Spring to develop a Wastewater System Master Plan. Ace Consultants had been instructed to study the City's treatment system to determine what steps would need to be taken.

Ace Consultant's findings and recommendations, following completion of the study, were presented during a series of public meetings and hearings. They had reviewed approximately eleven (11) different scenarios and had narrowed their recommendation to three (3).

Public Works Director Breazeale explained that the City of Madras would be looking at a cost of approximately $19 million over the next twenty (20) year period to develop the full treatment and collection system facilities as outlined in the Wastewater System Master Plan.

Advanced Environmental Services recently submitted a proposal to construct a different type of treatment system, which had not been considered in the Wastewater System Master Plan. In response to their proposal, the City requested Ace Consultants to investigate the opportunity to utilize this new method. The Department of Environmental Quality, Rural Development (formerly Farmers Home Administration), and a user of this particular treatment plant type had been contacted and requested to provide comments. Public Works Director Breazeale asked Wen Jou, an engineer with Ace Consultants, to clarify some of the costs that were illuded to in the local newspaper.

Wen Jou indicated that he would like to be in a position to save the City of Madras $16 million; however, does not feel that this is possible. There are a few points that need to be clarified.

1) The City would be looking at constructing a treatment plant on the North side versus building a new treatment plant to the South.

   This is not possible due to the following reasons:

   - It would cost at least $3.5 million more to construct a treatment plant to the North.
   - The Federal Aviation Administration will not approve another expansion at the Airport site due to air traffic regulations.
   - The pumping costs would increase by approximately $30,000 to pump everything to the North.

2) The Storch Engineering proposal looks at only one (1) element. It does not address effluent storage, sludge, upward pumping, or the collection system. The collection system alone would cost $5.6 million.

3) If the Storch system fails, no provisions have been made for backup.

City Administrator Sorensen explained that the City of Madras is currently growing at a very rapid rate. The City's growth rate has increased by approximately 27% over the last five (5) to six (6) years. The original wastewater treatment plant had been constructed to serve a population of approximately 4,500. It had been anticipated that the original facility would be sufficient through the year 2005 - 2008.

Ace Consultants discovered that the average flow measurements going into the treatment plant averaged between 440,000 and 480,000 gallons per day. The current treatment plant was constructed to handle 450,000 GPD. The treatment plant has basically reached design capacity.

After having the various agencies and engineers review the Storch Engineering proposal it had been concluded that this system had been used in Industrial Site settings; however had never been used in any other municipal system.

The City does not yet require 2 MGD treatment capacity therefore the new treatment and collection system will be constructed in three (3) phases. A new treatment plant will be constructed to the South, which will eventually be used to serve residential and commercial facilities within the City and the existing treatment plant to the North will continue to be utilized by the Industrial Park. Improvements will be based upon the number of Equivalent Dwelling Units (EDU's) in the City. The system currently serves 2,900 EDU's. If growth slows, future improvements to the system will be delayed; however, if growth continues to increase at a rapid rate, the City will need to follow the approved Master Plan. Property has recently been purchased on McTaggart Road, in anticipation of the continuation of the rapid growth rate.

City Administrator Sorensen presented the following information to those in attendance:

SEWER DEBT

(Excluding Southside Sewer Project and Industrial Site Infrastructure Project) as these projects are paid by user fees

Original Sewer Project Cost (1975)		$ 2,783,811
EPA Grant		1,482,969
Annual Debt Service		82,550
	Balance:	$ 1,021,000
Wastewater Treatment Plan - 1990 Expansion		$ 4,046,644
FmHA Grant		1,039,600
Annual Debt Service		156,786
	Balance:	$ 2,639,205
Total Annual Debt Service		$ 239,336
Total Project Balance		$ 3,660,205

The City did not have sewer and was obviously not collecting sewer user fees when the original sewer project was started in 1975, therefore this project was paid for by property taxes. The City managed to obtain a $1.4 million grant from the Environmental Protection Agency to help fund the project. The remaining debt service (with an annual payment of $82,550) will be retired in less than ten (10) years.

The engineering report for the 1990 Wastewater Treatment Expansion Project did not recommend that the City expand treatment capacity or production at the existing wastewater treatment facility. The City had insufficient storage capacity and an inadequate level of treatment at that time. The engineers recommended the addition of a large storage pond for storage of the treated effluent and an upgrade to the existing level of treatment. The City received a grant, in the amount of $1,039,600, from Farmers Home Administration which did not have to be paid back. The annual debt service payment on the loan portion is $156,786 and comes from sewer user fees. The two (2) payments combined total $239,336 per year.

The 1990 Wastewater Treatment Expansion Project did not enlarge the City's treatment capacity. The City is currently proposing to add an additional .5 MGD treatment capacity to the existing treatment plant.

Linda McKelvy wanted to know if the increase in population was due to property annexations into the City.

Councilor Whitehouse indicated that the last annexation was in 1988.

City Administrator Sorensen explained that the Industrial Park is being served with sewer; however, the businesses are paying 2½ times the rate that is paid by City residents.

Linda McKelvy mentioned that she has seen plans for Phase I of the project and requested clarification as to why citizens are being expected to pay for the entire project all at once.

Public Works Director Breazeale explained that the City is not planning to do the entire project at this time. This is a three (3) phase project that will take the City, at a projected growth rate of 4½%, through the next twenty (20) years. At the present time, the City is experiencing a 10% annual growth rate inside the City limits without annexation. If this growth rate continues the proposed system will not last the anticipated twenty (20) years. A new Master Plan would need to be developed to look beyond this twenty (20) year period.

The City is currently looking at an initial expansion of $1.6 million which will provide needed improvements to the pump station on 1st and "B" and will enlarge the existing plant's treatment capacity to .5 MGD. This will provide another 50,000 gallon per day capacity.

The second phase of the expansion will include the construction of a treatment plant at the South end of town, as well as the installation of another pump station, pressure lines, and gravity collection system. The total cost for Phase I-A and Phase I-B is $7.7 million.

Mike Stewart wanted to know if the gravity collection system is being planned to serve future property annexations.

Public Works Director Breazeale presented a map which contained the proposed collection and pressure system. The Master Plan was designed to serve the areas inside and around the City limits. If an area that has already reached urban density and is experiencing septic system failures wants to join the City, the plan will be in place to allow that to happen.

City Administrator Sorensen assured those in attendance that the City has no immediate plans to annex the Bel Air area. The City will take into consideration those areas where new subdivisions are proposed; however will not annex vacant land simply for the sake of annexing.

Public Works Director Breazeale explained that the Master Plan had recommended the use of gravity as much as possible to save on pumping costs, related labor, and problems resulting from the pump stations located throughout the City. The Master Plan suggests that the City serve the East part of town with gravity lines running two (2) different directions. The gravity line that is being proposed for Loucks Road had been included in the Wastewater System Master Plan before the subdivision had been proposed in that area.

The life of the Master Plan would allow all of the existing urbanized areas to connect to the City system. At the 2 MGD the City would be in a position to serve a population of 16,000 to 18,000.

Linda McKelvy had questions about the gravity flow process.

Public Works Director Breazeale indicated that a portion of the flow currently being pumped through the pump station at 1st and "B" Street (where the City currently pumps over 200 feet in elevation to the North Treatment Plant) will be converted to the South Treatment Plant (60 feet in elevation), thus reducing the pumping costs by approximately $30,000 per year.

Mike Stewart requested clarification that there were 3,000 buildings on the City sewer system at this time.

Public Works Director Breazeale explained that there were currently 2,990 EDU's (Equivalent Dwelling Units).

Mike Stewart asked if the EDUs were a minimum of $16 per month.

Public Works Director Breazeale answered "yes".

Mike Stewart wanted to know if the user fees that are currently being collected total approximately $649,000 per year.

Stevens Hart indicated that it would be approximately $576,000 per year.

OFFICIAL MINUTES

Common Council, City of Madras

Mike Stewart requested clarification that the City is collecting $640,000 and is only paying out approximately $320,000.

City Administrator Sorensen explained that this is Capital retirement, not operational costs.

Mike Stewart noted that the City had a sewer reserve fund that was loaned to the individuals that participated in the Southside Sewer Extension Project. He wanted to know where these funds came from.

Public Works Director Breazeale advised Mr. Stewart that the City had accumulated approximately $800,000 in Systems Development Charges.

Mike Stewart wanted to know who had provided the funding that had been utilized for bancrofting.

Public Works Director Breazeale explained that Farmers Home Administration had awarded the City a grant/loan for the bancrofting of this project.

Jim Erro, Double E Meats, mentioned that he feels he is being penalized for locating his business in the Industrial Park as he is being required to pay 2½ times the rate paid by City residents.

City Administrator Sorensen advised those in attendance that all businesses in the Industrial Park are required to pay 2½ times the rate that is paid within the City.

Jim Erro indicated that the City is proposing to increase his sewer fees by 350%. He requested an explanation as to how he can pass on a 350% increase to the people he does business with.

Public Works Director Breazeale suggested that Mr. Erro might like to refrain from making comments until Council opens the Public Hearing.

Jim Erro wanted to know why the Industrial Site owners have to work with the City.

City Administrator Sorensen advised Mr. Erro that the County does not have a municipal sewer system.

Mayor Krenowicz indicated that it appears that the group is getting into issues that should be discussed during the Public Hearing.

Larry Hart wanted to know why the City does not explore the possibility of placing a large pipe in Willow Creek, running the sewer through this pipe, and constructing a plant at the base to accommodate the flow since Willow Creek runs downhill.

City Administrator Sorensen mentioned the fact that the City is currently exploring the viability of discharging the treated effluent into Willow Creek.

Larry Hart advised City Administrator Sorensen that he is not saying that the City should discharge the effluent into Willow Creek.

Wen Jou, Ace Consultants, indicated that the City would run into a number of environmental issues if they were to extend the sewer along the canyon.

Mike Stewart wanted to know what would happen if the City were to have another flood, like the flood in 1964.

Public Works Director Breazeale advised Mr. Stewart that he would have to let the engineer address this issue after the meeting.

Steve Hart requested clarification that the City currently has 3,000 EDUs, and wanted to know how many EDU's the City had in 1988.

RECORDER MAYOR

OFFICIAL MINUTES

Common Council, City of Madras

Public Works Director Breazeale mentioned that the City's current population is 4,675 and is charging for 2,990 EDU's. The City had a population of 2,700 in 1990.

He indicated that the first phase of a two (2) phase project will cost the City $7.7 million. The debt retirement on a 100% loan at five percent (5%) interest is $448,756 per year. There would be additional costs for operation and maintenance of $275,613. The total increased debt service cost plus operation and maintenance would total $724,369. If the system is not expanded, the City will have no alternative but to deny future development.

When the original system was built in 1975 it was constructed to serve beyond its actual need. It had been anticipated that this plant would last thirty (30) years. It is necessary to construct the system in advance of actual need. If you take the annual cost of $724,369 and divide it by twelve (12) it comes out to $60,364 per month. If the City were to take the $60,364 and divide it by the existing 2,990 EDU's it would be necessary to increase the sewer user rates by $20.18 per month making a total cost of $36.18 per EDU. In his opinion this would be a steep cost for the users.

The City has been investigating opportunities for grants to finance the needed improvements. The most realistic scenario would be receipt of a 25% grant. Rural Development (formerly known as Farmers Home Administration) has indicated that the City of Madras would qualify for a 50% grant based on its current population and income levels; however, they do not have sufficient grant funds available to fund at that level. They do have loan funding available. The City will need to increase the sewer user fees by $15.13 per EDU assuming 25% grant funding is received from Rural Development. The user fees would therefore be $31.14 per EDU. Rural Development has confirmed that a City the size of Madras, at the current income level, should be able to afford $31 to $32 per EDU per month. Rural Development wants to assure that the City is providing sufficient capital to finance the project without grant funding. They will refuse to grant additional funding that would drop the user fees below this level.

It has been determined that a typical household in the City of Madras produces 195 gallons per day of wastewater. EDU's are used to calculate industry and commercial businesses as well.

Penny Johnson wanted to know if the total EDUs (2,990), that had been mentioned earlier in the meeting, included industry and commercial businesses.

Public Works Director Breazeale answered "yes".

Single residential housing units are currently charged one (1) EDU. A five (5) unit apartment complex would be charged five (5) EDU's, a ten (10) unit apartment complex, ten (10) EDUs, etc. Formulas have also been developed to determine EDUs for car wash businesses and laundromats. When examining the equity of determining sewer user fees subject to EDU charges the City had looked at what the actual usage had been for various households and businesses. Discrepancies had been found to exist between similar businesses and the amount of water they were using. Individuals and businesses that are not using much water are actually subsidizing those that are using more.

The City looked at the development of a flow base rate which is a combination of the existing EDU method and Winter meter readings assuming that during the months of October through March people are not generally watering their yards. Every account was adjusted using meter readings that were averaged during this six (6) month period. With the proposed flow base rate, those individuals and businesses that are using more of the system are paying more for use of the system. This method of billing would definitely encourage water conservation and could possibly delay the need to construct new facilities in the future. It was discovered that this new method would impact more businesses rather than residents and would generate approximately $15,297 in additional revenue per month or $183,564 per year.

The disadvantages of this new method are as follows:

1) Water accounts would have to be reviewed each year to select the reader meetings for the six (6) month period.

2) There will be a period of adjustment where people may come in to advise the City that there is a problem with the reading. The account would then have to be reviewed, and if found to be in error, adjusted.

3) Income would not be as reliable because users could reduce their user fee by conserving on water.

4) This new method will place a considerable impact on those users that have been utilizing large quantities of water.

5) The proposed flow base rate method also requires Deschutes Valley Water District cooperation. (They have been very cooperative to this point.)

He presented the following sewer rate comparisons:

Sunriver	$22.00	Redmond	$16.60
Juniper Utilities	$20.00	Madras	$16.00
Bend	$17.06	Metolius	$10.50
Prineville	$17.00	Culver	$ 9.00

He mentioned the fact that most of these systems will need to look at expansion in the very near future and will more than likely need to increase their fees to a comparable rate. Oregon law allows the imposition of Systems Development Charges on new development to pay for the facilities that are needed to service that development. The City of Madras recently increased its Sewer Systems Development Charges from $800 per EDU to $2,000 per EDU. This is a very significant increase; however, this increase had been based on the need to raise approximately $18,924,000 over the life of the Wastewater System Master Plan. The recommended improvements will give the City a treatment capacity of 2 MGD. This would serve 10,256 EDUs. If the City were to take the $18,924,000 and divide it by the 7,266 EDUs that would benefit from this increase, the City would have the ability to legally charge $2,604 per EDU for Sewer Systems Development Charges. This increase will provide a significant source of revenue to finance Phases II and III of the proposed treatment plant expansion and should alleviate the need to double the sewer user rates in the future.

George Hawes indicated that if the City continues to grow, additional EDUs should come online and be paying into the system.

Public Works Director Breazeale agreed that as the City continues to grow additional EDUs would be paying into the system for the debt service.

Mike Stewart wanted to know how much the increased Systems Development Charges will detour development.

City Administrator Sorensen explained that Jefferson County is one of the fastest growing counties in the State. The Systems Development Charges in Madras are lower than those currently being charged in Bend and Redmond.

Bill Guiney indicated that it is his understanding that as the City expands and additional subdivisions are developed, there will be more people paying EDUs. He wanted to know if this would reduce the cost per EDU.

Public Works Director Breazeale advised Mr. Guiney that it would eventually; however one of the things that must be considered is the level of inflation as there is always an increase in cost year after year to operate the system. The bond payments would remain the same. The City may be in a position to pay down the existing debt at a faster rate and get the system in a very healthy financial condition. This may deflect future rate increases or actually place the City in a position to buy them down.

Bob Ellis mentioned the fact that he had seen nothing in the history that had been presented earlier which pertained to the costs for bookkeeping and paperwork to keep this straight.

City Administrator Sorensen explained that there is built-in operational costs. Obviously as the City grows these costs will increase. The City currently has a good operational accounting system in place.

Public Works Director Breazeale indicated that the City currently has 1,178 sewer accounts. These accounts were reviewed individually. Of the 1,178 accounts, 185 (approximately 16%) have shown an increase in EDUs. Letters were forwarded to these individuals advising them of the increase. It had been determined that twenty-two (22) accounts would actually experience a decrease in their monthly user fees.

V PUBLIC HEARING

The regular City Council meeting was closed and a Public Hearing opened at 8:41 p.m.

A. Sewer Fee Rate Structure and Proposed Increase

Mayor Krenowicz advised those in attendance that this process had taken over one (1) year to get to this point. The City has held numerous informational meetings and Public Hearings to discuss this issue. The Public Works Committee directed the City Administrator, Public Works Director, and Ace Consultants to develop a plan that would have a minimum impact on single resident occupied homes for the cost of this upgrade. The City is leaning more toward an actual usage fee based service. Individual's using very little water should not have to subsidize those individuals and businesses that do.

He indicated that speakers would be given four (4) to five (5) minutes to offer their comments and requested that they refrain from reiterating comments made by other individuals.

Walt Summerhalder, 715 S.E. Turner Street, advised Council that he had been paying the City $16 per month for sewer. He recently received a letter indicating that he could be paying as much as $62 per month. This would increase his user fees from $192 per year to $744 per year. His pension cannot withstand this type of increase. He mentioned the fact that the Deschutes Valley Water District does not read meters during the Winter months. When a reading was finally take the usage went from 700 cu. ft. to 4,200 cu. ft.

Public Works Director Breazeale asked Mr. Summerhalder whether he would be in favor of the flow base method if it should be determined that his actual usage has been miscalculated. He volunteered to work with Mr. Summerhalder to assure that the calculations are correct.

Walt Summerhalder had no objections to the City placing a meter on the sewer line to determine actual usage.

Public Works Director Breazeale explained that the City does not want people paying for water that is not actually going into the sewer system.

Penny Johnson wanted to know if there were two (2) separate rates being charged, one for residential and one for commercial.

Public Works Director Breazeale answered "no".

Penny Johnson mentioned that there are a number of people in town that are doing business in their homes. She wanted to know if these individuals would be charged commercial rates even though they are actually designated as residential.

City Administrator Sorensen answered "no". He explained that individuals working out of their homes will be charged based on their average Winter usage.

REFERENCES

CH2M Hill: Madras Area Wastewater Facilities Plan and Environmental Assessment, , 1978

CH2M Hill: City of Madras Effluent Reuse Plan, 1993

CH2M Hill: City of Madras Wastewater Treatment Facilities Modifications, 1990

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Hammer, Donald A: Constructed Wetlands for Wastewater Treatment, 1990

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State of Oregon: Oregon Administrative Rules, Chapter 340, 1991

Vernick, Arnold S. & Walker, Elwood C.: Handbook of Wastewater Treatment Processes, 1981