City of Sparks
Sparks East
Master
Effluent Management Plan

August 2007

AMEC Infrastructure
9450 Double R Blvd.
Reno, NV 89521
Phone: (775) 786-5873
Fax: (775) 786-6138

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SECTION 1 - INTRODUCTION

1.1 INTRODUCTION

The effluent used to irrigate the several sites included in this effluent management plan (EMP) is discharged from the Truckee Meadows Water Reclamation Facility (TMWRF). TMWRF, operating under NDEP Permit NEV, is permitted to discharge **40** million gallons per day to Steamboat Creek, to Reno Effluent Pipeline or the Sparks Effluent Pipeline. The Sparks Effluent Pipeline serves all of the reuse sites covered in this EMP.

This Effluent Management Plan provides guidance for the land application of effluent on the City of Sparks East sites, which operate under NDEP permit number NEV, a copy of which is included in Appendix A.

This plan outlines the requirements for disposal of a portion of the effluent from TMWRF by effluent irrigation at nine sites. The primary reuse application for these sites will be irrigation of landscaping; however sites may also use effluent for temporary irrigation of revegetation and for dust control during construction.

SECTION 2 - DISCHARGE PERMIT AND EFFLUENT GUIDELINES

2.1 DISCHARGE PERMIT

The complete discharge NDEP permit for the City of Sparks East Sites (NEV**2003513**) is contained in Appendix A. Table 2.1 contains excerpts from the permit indicating important restrictions and compliance requirements.

2.2 EFFLUENT GUIDELINES

Table 2.1- Excerpt from Permit Number NEV

A. Effluent Limitations, Monitoring Requirements and Conditions

1. During the period beginning on the effective date of this permit, and lasting until the permit expires, the permittee is authorized to discharge reclaimed water supplied by the Truckee Meadows Water Reclamation Facility to the nine sites listed.

   Flow monitoring shall be recorded at the subject meter vaults at each site prior to irrigation or other use. Reclaimed water quality shall be in accordance with the limits set forth in discharge permit NEV for the Truckee Meadows Water Reclamation Facility. The discharge shall be limited and monitored by the Permittee as specified below.

Table 2.1

Parameters	Effluent Discharge Limitations		Monitoring Requirements	
	30 Day Average	Daily Max	Measurement Frequency	Sample Type
Flow: (Total) Million Gallons per Month (MGM)			Continuous	Flow Meter
Annual Application Volume (AF)			Cumulative	Flow Meter
Fecal Coliform (CFU, MPN)			Weekly	Discrete

In addition to the discharge limitations and the monitoring requirements outlined in Table 2.1 the permit requires the following (except from NDEP Permit Number

General

1. *The Permittee shall provide documentation to the Division that notification has been made to the local water purveyor and local health agency of the Permittee's use of effluent at these facilities. This document shall describe the plan for compliance with the cross-connection control requirements of the local water purveyor and health agency. This documentation shall be received prior to effluent re-use as detailed in the schedule of compliance.*
2. *There shall be no discharge of substances that would cause a violation of water quality standards of the State of Nevada.*
3. *The permittee shall remit an annual review and services fee in accordance with NAC 445.232 starting July 1, 2006 and every year thereafter until the permit is terminated.*
4. *The Discharge Monitoring Reports (DMRs) must be signed by the City of Sparks designated responsible person in charge. The first DMR submitted under this permit must be include the written designation of the officer as the authorized representative to sign the DMRs. If the officer in responsible charge changes, a new letter designation letter must be submitted.*
5. *The Permittee shall provide a copy of a brief clearly worded document which describes the possible hazards and proper hygiene of working with and around treated wastewater to all ground keepers and other affected personnel at each site. Copies shall be included in the EMP.*
6. *Schedule of Compliance*
    a. *The permittee shall achieve compliance with the effluent flow monitoring requirements, the approved EMP and other conditions of this permit upon issuance of the permit.*
    b. *Prior to effluent reuse, the Permittee shall submit the cross-connection control documentation for the new sites required by part 1.B.10.*
    c. *Permittee shall notify NDEP within 14 days after initiating effluent reuse at each site.*

Effluent Irrigation

7. *The effluent irrigation shall not cause objectionable odors on or off the site.*
8. *The irrigation systems and ancillaries shall be constructed and operated in accordance with plans approved by the Division. All plans must be approved by the Division prior to the start of construction. All changes to the approved plans must be approved by the Division.*
9. *Irrigated areas and all other areas of use shall be posted with conspicuous warning signs clearly stating that reclaimed water is utilized and to avoid contact. Ancillary equipment shall be clearly marked to indicate use with effluent.*
10. *Irrigation of the streetscapes, common areas, parks and school areas shall be performed in such a manner as to reduce standing water to a minimum and to prevent run-off.*
11. *Drinking water fountains where present shall be covered during effluent irrigation.*

In addition to the discharge permit, NPEP has published the WTS - 1A General design criteria for reclaimed wuse. http://ndep.nv.gov/bwpc/wts1a.pdf. A copy of this is included in Appendix B. The WTS - 1B General design criteria for preparing an effluent management plan. http://ndep.nv.gov/bwpc/wts1b.pdf is in appendix C.

2.3 BUFFER ZONES

Since 1994, the effluent from TMWRF is of the quality that no buffer zone is required for the effluent application. The geometric mean in any 30-day period of fecal coliform was below 2.2 c.f.u./100mL throughout 2006. The single maximum value of fecal coliform bacteria did not exceed 23 c.f.u./100mL in 2006. Refer to Figure 2.1: 2006 TMWRF Monthly Geometric Mean Fecal Coliform (MPN/100ml) and Figure 2.2: 2005 TMWRF Fecal Coliform (MPN/100ml). Also enclosed is a copy of the 2006 TMWRF Performance Sheet (Figure 2.3). The following table is an except from NDEP guidelines.

Table 2.2 – Required Buffer Zones

Required Buffer Zone (ft.)	Fecal Coliform MPN (c.f.u./100mL)	
	Geometric mean in any 30 day period	Single maximum value
NONE	2.2	23

2.4 MONITORING WELLS

Monitoring wells can be required to determine if the irrigation is degrading the groundwater quality down-gradient from the re-use site. Monitoring wells are not required for any of the sites covered by this EMP because of the quality of the effluent being used.

2006 TMWRF Monthly Geometric Mean

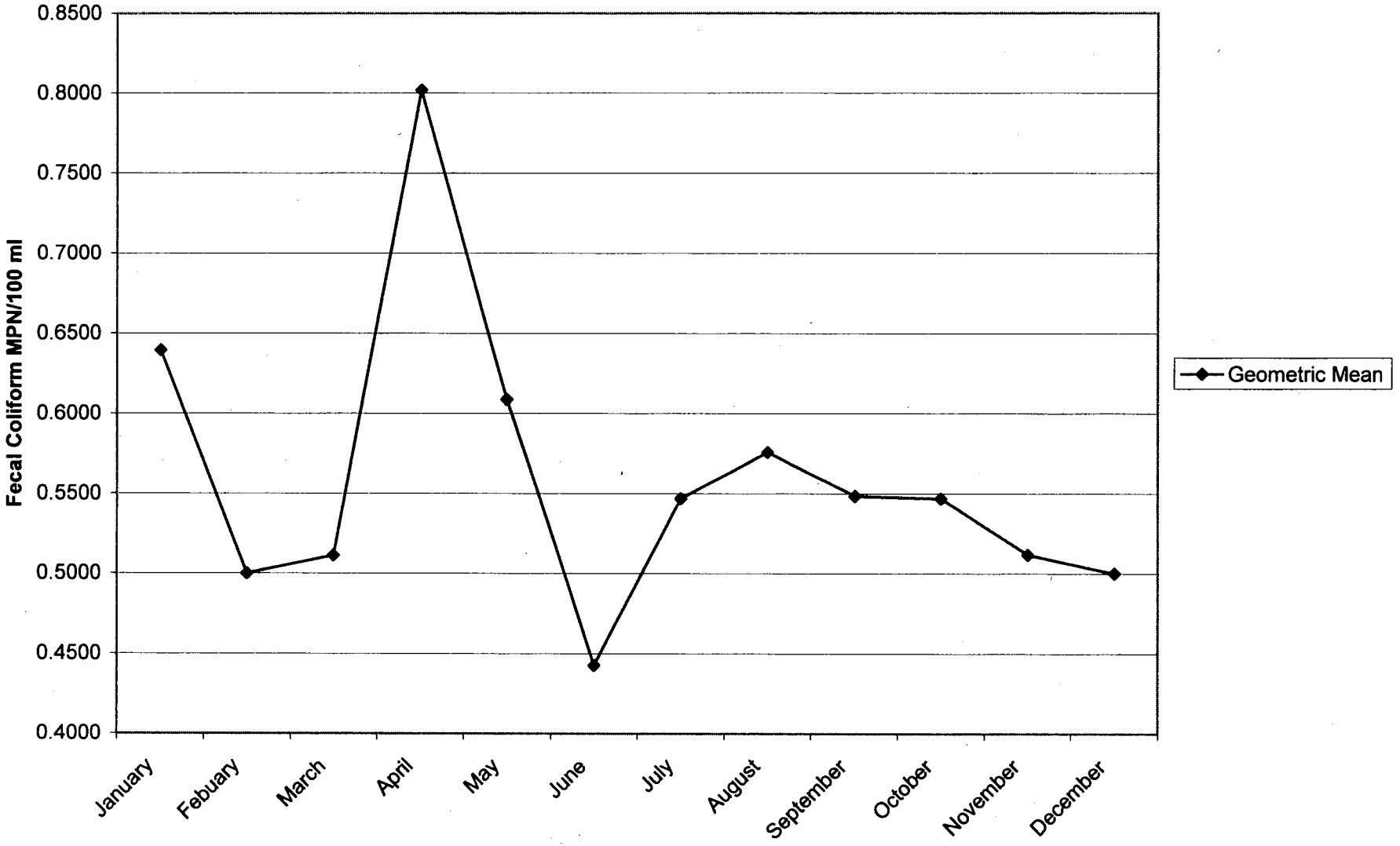


Figure 2.2-2006 TMWRF Fecal Coliform (MPN/100mL)

DAY	January	Febuary	March	April	May	June	July	August	September	October	November	December
1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
2	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	0.5	0.5
3	1	0.5	0.5	0.5	0.5	0.5	0.5	1	0.5	1	0.5	0.5
4	0.5	0.5	0.5	0.5	1	0.1	0.5	0.5	0.5	0.5	0.5	0.5
5	1	0.5	0.5	0.5	1	0.1	0.5	0.5	0.5	0.5	0.5	0.5
6	0.5	0.5	0.5	0.5	276	0.1	0.5	0.5	0.5	0.5	0.5	0.5
7	0.5	0.5	0.5	0.5	0.5	1	0.5	0.5	2	0.5	0.5	0.5
8	0.5	0.5	0.5	1	0.5	0.1	0.5	0.5	0.5	0.5	0.5	0.5
9	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
10	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
11	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
12	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
13	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
14	1	0.5	0.5	0.5	0.1	1	1	0.5	0.5	0.5	0.5	0.5
15	2	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	0.5	0.5	0.5
16	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	0.5	0.5
17	0.5	0.5	0.5	0.5	0.5	1	0.5	0.5	0.5	0.5	0.5	0.5
18	1	0.5	0.5	0.5	0.5	0.5	1	0.5	0.5	0.5	0.5	0.5
19	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
20	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
21	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
22	0.5	0.5	1	29	0.5	0.5	0.5	0.5	1	0.5	0.5	0.5
23	0.5	0.5	0.5	1	0.5	0.5	0.5	0.5	0.5	1	0.5	0.5
24	0.5	0.5	0.5	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
25	0.5	0.5	0.5	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
26	0.5	0.5	0.5	1	0.5	0.5	0.5	1	0.5	0.5	1	0.5
27	0.5	0.5	0.5	1	0.5	1	0.5	0.5	0.5	0.5	0.5	0.5
28	0.5	0.5	0.5	0.5	0.5	0.5	2	0.5	0.5	0.5	0.5	0.5
29	0.5		0.5	96	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
30	0.5		0.5	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
31	0.5		0.5		0.5		0.5	10		0.5		0.5
Geometeric	0.6394	0.5000	0.5113	0.8019	0.6085	0.4425	0.5468	0.5759	0.5484	0.5468	0.5117	0.5000
Average	0.6919	0.5000	0.5160	4.6226	9.1315	0.5110	0.5796	0.8305	0.5822	0.5640	0.5165	0.5000

Figure 2.3-2006 TMWRF Performace Summary Sheet

month	year	Eff_flow	inh_inf	inf_bod	inh_eff	eff_bod	inf_ss	eff_ss	inf_tot_p	eff_tot_p	eff_tds	eff_nh3_n	eff_no3_n	Eff_tot_n	inf_tds
J	2006	34.25	153	178	4	6	161	2	4.87	0.29	471	1.99	0.08	3.09	471
F	2006	31.51	170	197	4	6	169	2	5.92	0.44	439	2.40	0.20	3.88	439
M	2006	31.61	180	218	4	5	169	2	5.81	0.31	465	0.42	0.09	2.05	465.2
A	2006	31.67	166	195	4	5	149	2	5.65	0.25	387	0.21	0.08	2.07	386.6667
M	2006	27.58	167	229	4	5	165	1	5.72	0.32	396	0.21	0.23	1.96	395.5
J	2006	23.5	156	194	4	5	164	2	5.61	0.29	403	0.39	0.11	2.03	402.6
J	2006	23.21	205	235	3	4	159	2	5.54	0.27	424	1.07	0.28	3.12	423.75
A	2006	22.98	189	190	3	4	166	1	5.52	0.28	449	0.06	0.15	1.36	448.5
S	2006	24.46	211	206	3	3	160	1	5.47	0.31	418	0.07	0.27	1.71	418
O	2006	26.86	198	209	3	4	176	1	5.58	0.23	424	0.05	0.12	1.67	423.75
N	2006	29.05	224	246	3	3	177	1	6.05	0.29	383	0.08	0.18	1.72	382.6
D	2006	28.84	236	251	3	4	200	2	6.18	0.38	376	0.17	0.13	1.88	376

2.5 HYGIENE

One of the major concerns with spray irrigation of wastewater effluent is aerosols containing pathogens. The concentration of pathogens in aerosols is directly related to their concentration in the wastewater. Studies show that in the spray irrigation of wastewater, 0.1% to 2.0% of the water is aerosoled. Aerosols are defined as particles ranging from 0.01 to 50μm in diameter that are suspended in the air. In general, pathogens in aerosols remain viable and travel farther with increased wind velocity, increased relative humidity, lower temperature, and darkness (Pettygrove et.al., 1986).

The nightmare irrigation schedules will minimize the risk of public exposure to effluent.

Some of the risks and precautions to be taken while using reclaimed wastewater for irrigation are listed below:

1. Reclaimed wastewater may contain disease-causing organisms and viruses. Skin contact with reclaimed wastewater can result in various skin rashes, and open wounds are especially susceptible to infection. Treat cuts with disinfectant immediately.

2. Workers are to keep their typhoid, hepatitis and tetanus shots current and practice good hygiene. No food or drink should be consumed while working in the reclaimed water irrigation area. Smoking is also prohibited due to the possibility of hand to mouth contamination. Wear boots, gloves, or other protective clothing to minimize direct contact with reclaimed water.

3. Workers should wash thoroughly and, if possible, change their work clothing before leaving the facility. Wash thoroughly with a disinfectant soap before eating or smoking. Drink only water obtained from faucets in the control building or brought from home.

4. Workers should make sure that the area is clear of people that may get sprayed before running the irrigation system.

5. Report any problems to your supervisor that you feel could pose a risk.

2.6 RECLAIMED WATER RUN-OFF CONTROL PLAN

The purpose of the Run-off control plan is to have in written form the exact procedures the site personnel must follow in order to contain runoff and maintain safety in the event of an emergency.

In the case of an emergency the site personnel are to complete the following steps:

1. Shut off the effluent line at the **gate valve** called out on the site plans in each appendix.
2. Call the Maintenance Personnel for the site where the run-off location is occurring and Mike Biselli at 775-353-2271. (See **SECTION 4 – STAFF CONTACTS AND COMMUNICATION PROCEDURES PAGES)**

3. The Permittee shall notify the Division of Environmental Protection within 24 hours of any diversion, bypass, spill, upset, overflow or release of treated or untreated discharge other than that which is authorized by the discharge permit. Using the *Reclaimed Water Run-Off* Reporting Sheet located in Section 6, the site personnel are to report the following information.

    A. The time and date of the discharge.
    B. Exact location and estimated amount of discharge.
    C. Flow path and bodies of water that the discharge reached.
    D. The specific cause of the discharge
    E. The preventive and/or corrective actions taken.

4. It is IMPORTANT to remember that any contact with the effluent could be harmful to your health. YOU MUST REMEMBER:

    A. Reclaimed wastewater may contain disease-causing organisms and viruses. Skin contact with reclaimed wastewater can result in various skin rashes, and open wounds are especially susceptible to infection. Treat cuts with disinfectant immediately.
    B. Workers are to keep their typhoid, hepatitis and tetanus shots current and practice good hygiene. No food or drink should be consumed while working in the reclaimed water irrigation area. Smoking is also prohibited due to the possibility of hand to mouth contamination. Wear boots, gloves, or other protective clothing to minimize direct contact with reclaimed water.
    C. Workers should wash thoroughly and, if possible, change from their work clothing before leaving the facility. Wash thoroughly with a disinfectant soap before eating or smoking. Drink only water obtained from the faucets in the control building or brought from home.
    D. Workers should make sure that the area is clear of people that may get sprayed before running the irrigation system.

E. Report any problem to your supervisor that you feel could pose a risk.

2.7 CROSS CONNECTION CONTROL REQUIREMENT

A. Certification

1. Per NDEP WTS - 1A "General Design Criteria for Reclaimed Water Irrigation Use," (Appendix D) prior to approval of the discharge permit the Permittee must submit their EMP to the water purveyor (TMWA or Washoe Department of Water Resources) for cross connection control certification.
2. The permittee must abide by TMWA's or Washoe County Department of Water Resources' engineering and construction standards, found in Appendix D, for all new construction sites.
3. A copy of the final Effluent Management Plan will be sent to TMWA and Washoe County Department of Water Resources for their files.

B. Testing and Inspection

1. Annual testing and inspection of each site on the discharge permit shall be done to assure that no cross connection had occurred in the interim.
2. Backflow assembly test results will be submitted to TMWA.
3. Testing is not required for sites that do not contain potable water lines.
4. Backflow assembly testing will be performed per procedures defined by AWWA.
5. Site Inspections will be performed per guidelines established by AWWA

2.8 PUBLIC NOTIFICATION

The public shall be notified of the effluent reuse per NAC 445A.275.3 by warning signs stating "Caution Reclaimed Water – Do Not Drink" in the example below. The signs will be posted on the edges of the site identifying the area as a wastewater control facility.

Signs are to be placed at all corners, gates and at 300 ft. intervals around the indicated areas. Other suggestions for the public notification are:

1. Once per year notice in the local newspaper.

SECTION 3 – RECLAIMED WATER IRRIGATION

3.1 SITE LOCATION

The irrigation sites are in the City of Sparks and in unincorporated areas of the Spanish Springs Valley. Refer to Figure 3.1A and Figure 3.1B for an overall vicinity map of the Sparks East Reuse sites. Site-specific information is included in Appendices H through P.

3.2 SOILS

Site-specific soils data is included in Appendices H through P for each reuse site.

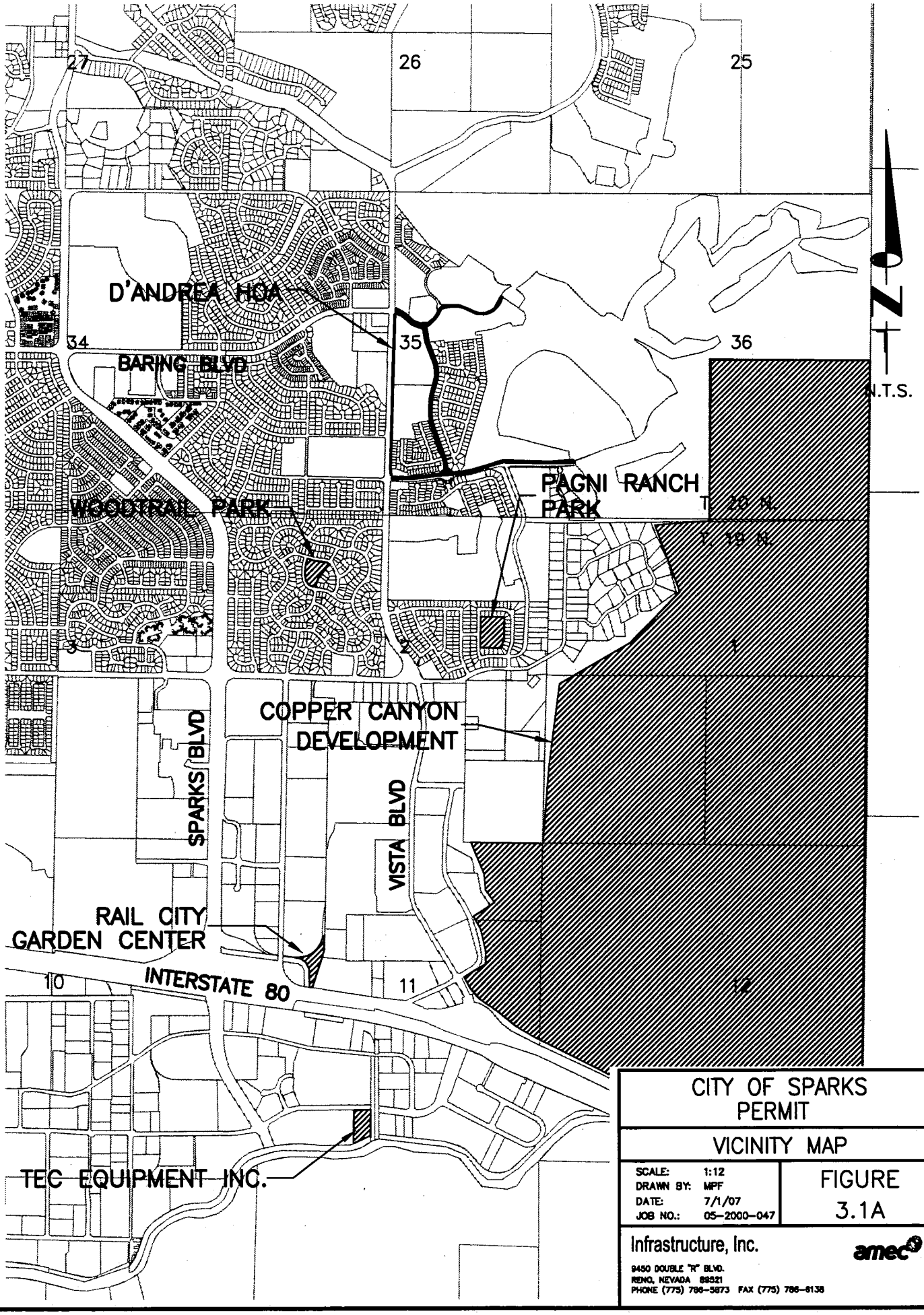
3.3 IRRIGATION PLAN

An irrigation plan for each reuse site is included in the respective appendix. Each site will adopt a plan that minimizes the likelihood of public contact with the effluent and prevents effluent ponding or runoff.

Adjustments will be made to the sprinkler heads as required to prevent ponding and runoff. Potable water lines will be identified and adjustments made to assure proper separation. Any exposed effluent distribution appurtenances will be posted and painted purple to clearly indicate that they are effluent fixtures. If ponding or line breaks should occur they will be quickly identified and repaired.

3.4 IRRIGATION SYSTEM

Each reuse site has a meter to total all effluent delivered to the site. A pressure reducing-pressure sustaining valve is located immediately upstream of the meter at all sites to protect the irrigation system and maintain system pressure. The pressure-sustaining feature is initially set at approximately 60 psi for all sites and will be adjusted as necessary as new users connect to the main pipeline. Refer to the respective appendices for meter vault location and on-site irrigation system plans.

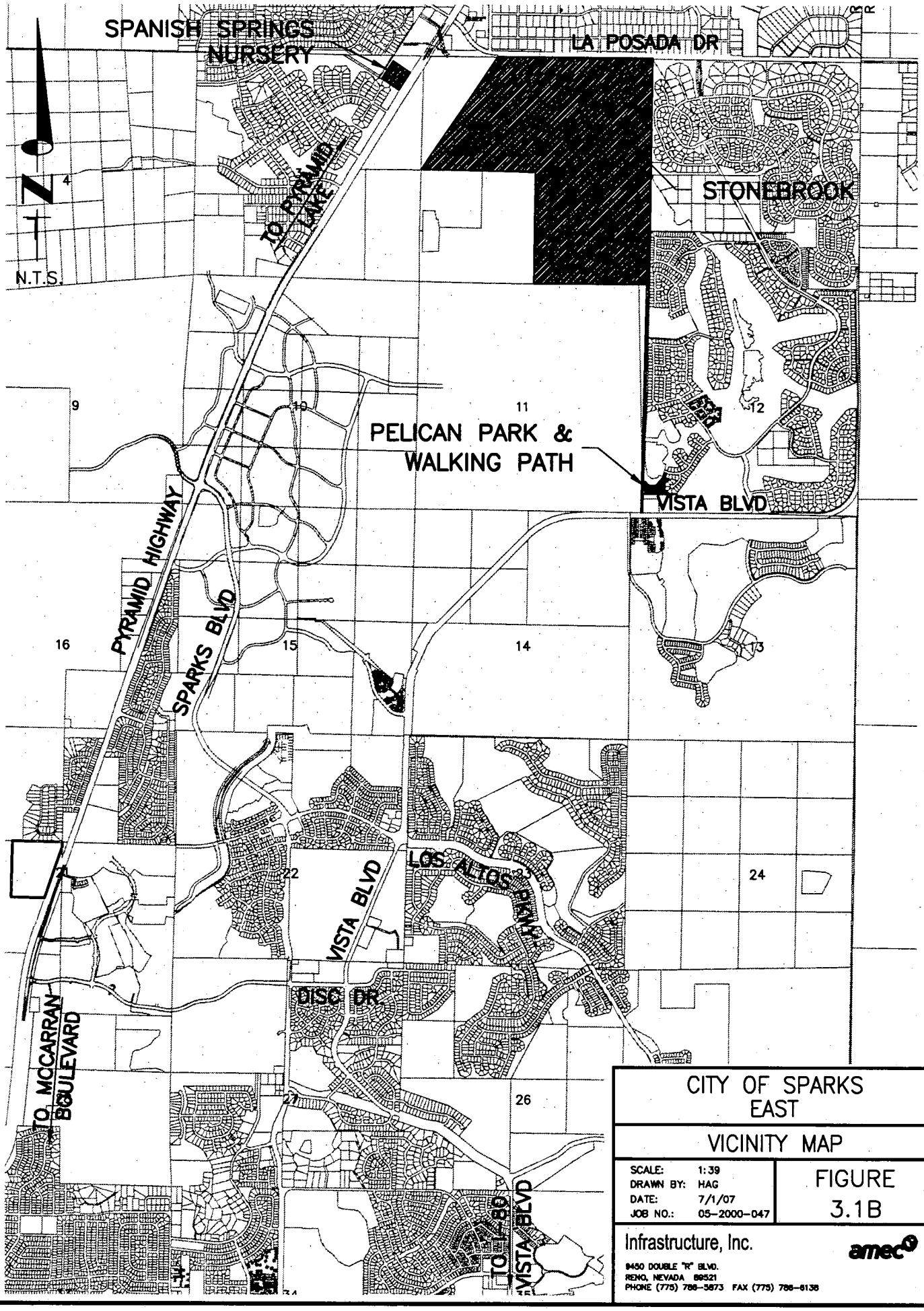


CITY OF SPARKS
PERMIT

VICINITY MAP

SCALE: 1:12	FIGURE
DRAWN BY: MPF	3.1A
DATE: 7/1/07	
JOB NO.: 05-2000-047	

Infrastructure, Inc.
amec
9450 DOUBLE "R" BLVD.
RENO, NEVADA 89521
PHONE (775) 786-5873 FAX (775) 786-6136



CITY OF SPARKS
EAST

VICINITY MAP

SCALE:	1:39
DRAWN BY:	HAG
DATE:	7/1/07
JOB NO.:	05-2000-047

FIGURE
3.1B

Infrastructure, Inc.
amec
9450 DOUBLE "R" BLVD.
RENO, NEVADA 89521
PHONE (775) 786-5873 FAX (775) 786-6138

3.5 IRRIGATION REQUIREMENTS

The expected irrigation requirements for all sites are tabulated in Appendix E and detailed in the respective appendix.

3.6 EFFLUENT STORAGE

No effluent storage will occur at any of the reuse sites covered by this EMP.

3.7 ON-SITE EFFLUENT TREATMENT

No additional effluent treatment will occur at any of the reuse sites covered by this EMP.

3.8 NITROGEN BALANCE

Per NDEP WTS-1B: General Criteria for Preparing an Effluent Management Plan, completion of a nitrogen balance is required if the total nitrogen in the effluent is greater than 10 mg/l total nitrogen. The **TMWRF** effluent, based on 2006 monitoring data, averaged [redacted] mg/L of total nitrogen. The average phosphorous during the year was 0.34 mg/L. Figure 3.2 shows the effluent nitrogen and phosphorous data for 2006. The amount of total nitrogen in the TMWRF effluent is of the level that a nitrogen balance is not required.

Table 3.1 illustrates the nutrients removed by a variety of grasses. For the reuse sites the nitrogen supplied by effluent will not satisfy the tuff grass nitrogen requirement and most fine-grained soils have a high adsorption capability for phosphorous. Phosphorous has not been known to cause adverse effects on crops nor is it known to cause adverse health effects (EPA, 1981). Thus high phosphorous in the soil should not be a problem.

Table 3.1 - Nutrient Uptake Rates (EPA, 1981& Pettygrove et.al., 1986)

	Nitrogen (kg/ha•yr)	Phosphorous (kg/ha•yr)	Potassium (kg/ha•yr)
Bentgrass	170	---	---
Coastal Bermudagrass	400-675	35-45	225
Kentucky bluegrass	200-270	45	200
Ryegrass	200-800	60-85	270-325
Tall Fescue	150-325	30	300
Hybrid Poplar	300-400	---	---
Douglas-fir plantation	150-250	---	---

Note: Multiply by 0.89 to obtain lbs/acre.

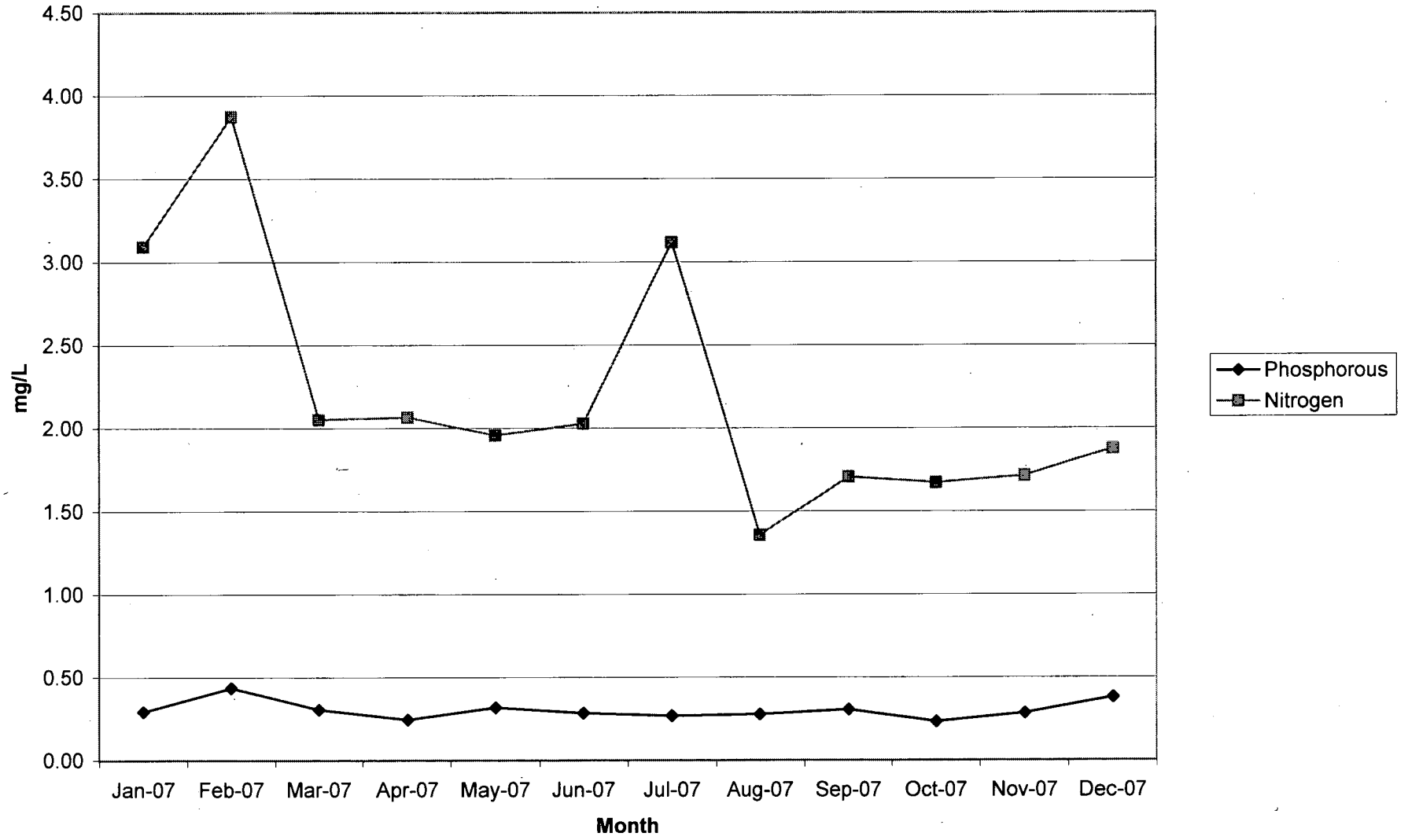
Based on the amount of total nitrogen present in the TMWRF effluent, grass will easily uptake the nitrogen and overloading the soil with nitrogen is unlikely. In fact, additional fertilization will be necessary. Re-use site managers must monitor the amount of fertilizer applied to achieve the proper nitrogen balance. Application rates that allow the transport of nutrients beyond the active root zone will not be allowed.

3.9 WATER BALANCE

As a requirement of the discharge permit, the permittee must calculate the Consumptive Use Balance for each month for each site based upon the parameters listed in Appendix One of WTS-1B. The annual application volume limit and monthly maximum limit shall be determined from this balance. Refer to the completed NDEP Consumptive Use Requirement Worksheet and Water Requirement Design Worksheet in Appendix F. Blank Consumptive Use Requirement worksheets are included in Section 6-Forms.

If the actual annual application volume or monthly maximum volume exceeds the calculated annual application limit or monthly maximum limit, the Permittee shall prepare a report which includes an evaluation of the application rates in the EMP, an explanation of conditions (overseeding, reseeding, extraordinary weather conditions, etc.) which lead to the exceedance, and any planned changes the Permittee deems necessary. This evaluation shall be submitted with the fourth quarter DMR's.

Figure 3.2 TMWRF 2006



SECTION 4 – STAFF CONTACTS AND COMMUNICATION PROCEDURES

4.1 Emergency Phone Numbers & Contacts in the Event of a Spill or Discharge:

TMWRF

Randall Gray
TMWRF Manager
Truckee Meadows Water Reclamation Facility
P.O. Box 857
Sparks, Nevada 89432-0857
8500 Clean Water Way
Reno, Nevada 89502
775-861-4102
rgray@ci.sparks.nv.us

In case of an **emergency**:

1) Refer to the **Reclaimed Water Run-Off Control Plan** on page [illegible].

2) Then grounds personnel are to contact **Mike Biselli and Chris Nicholas** immediately.

NDEP

Weekday:
Front Office
(775) 687-9418

Valerie King, Enforcement Branch Supervisor
(775) 687-9427

Diana Silsby, Enforcement Officer
(775) 687-9438

After Hours
1-888-331-6337

CITY OF SPARKS

Andrew Hummel, P.E.
Civil Engineer II
City of Sparks
910 Roberta Lane
Sparks, NV 89431
(775) 353-2375
ahummel@ci.sparks.nv.us

Mike Biselli
Maintenance Services Manager
City of Sparks
431 Prater Way
Sparks, NV 89432
(775) 353-2271

Chris Nicholas
Maintenance Supervisor
City of Sparks
431 Prater Way
Sparks, NV 89432
(775) 353-2366

4.2 COMMUNICATIONS PROCEDURES

The communication procedures between all parties involved is as follows:

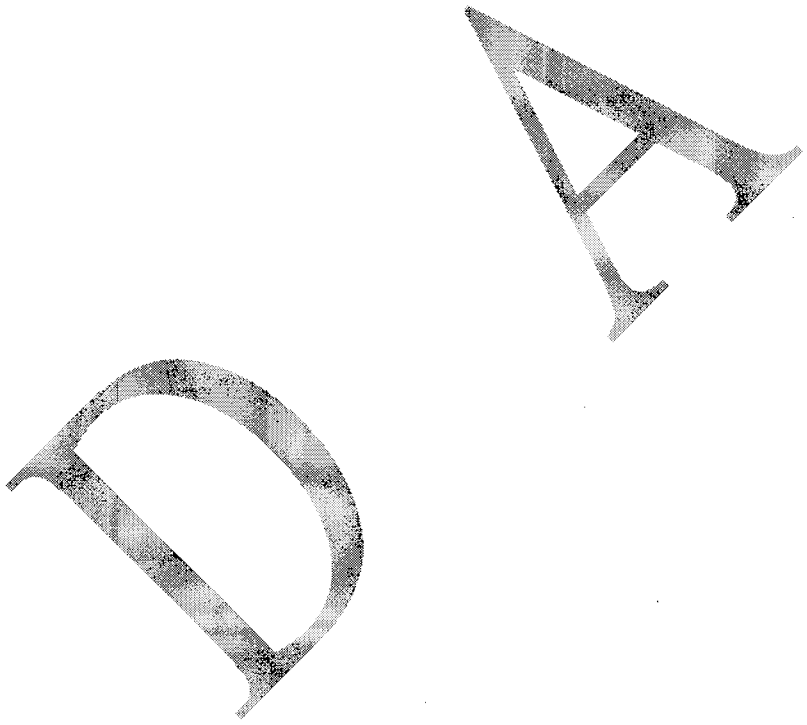
1. The maintenance personnel are to report to their Maintenance Supervisor who is listed in the staff contacts on page

2. The Maintenance Supervisor will then contact Mike Biselli, the Maintenance Services Manager, who is listed in the staff contacts on page .

3. Mike Biselli the Maintenance Service Manager will then contact:

    a. The Water Pollution Control Bureau at the Nevada Department of Environmental Protection who is listed under the staff contacts on page

    Randall Gray the Truckee Meadows Water Reclamation Facility's Manager who is listed in the staff contacts on page



SECTION 5- DISCHARGE MONITORING REPORT (DMR)

5.2 MONITORING REQUIREMENTS

A. Water Inventory
   1. Total effluent reuse flow (continuous monitoring using totalizer readings)
   2. Balance of loss to evaporation and percolation

B. Nutrient Balance
   1. Calculated annual nutrients applied from effluent (TMWRF)
   2. Other nutrients (N & P) from fertilizer
   3. Estimated nutrients removed by crop harvest
   4. Estimated annual nutrient balance in soil or lost to excess irrigation water

C. Effluent Test
   1. Fecal Coliform (weekly from TMWRF data)
   2. Chlorine Residual (weekly from TMWRF data)
   3. Total Nitrogen (TMWRF) (weekly; annual calculation from TMWRF data
   4. Metals*
   5. Calcium Sodium adsorption ratio*

   * These tests are optional

D. Soils Tests *
   1. pH *
   2. Cation exchange capacity and exchangeable cations *
   3. Electrical conductivity *
   4. Metals *

   * These tests are optional

5.2 REPORTING

The Permittee (City of Sparks) shall submit quarterly Discharge Monitoring Reports (DMR) to NDEP. The City of Sparks is also responsible for the effluent quality as it discharges from TMWRF and will coordinate the dissemination of the required data necessary to complete the DMR. This will include TMWRF fecal coliform data, TMWRF nitrogen data, and recorded effluent flow meter data from the re-use site meter vaults. A DMR form is included in Section 6.

The Permittee shall calculate the Consumptive Use Balance for each month each site based upon the parameters listed in Appendix One of WTS-1B (Appendix C and Appendix F). The annual application volume limit shall be submitted with the 4th Quarter DMR. If the actual annual application volume or monthly volume exceeds the calculated annual application limit or monthly maximum limit, the Permittee shall prepare a report which includes an evaluation of the application rates in the EMP, an explanation of conditions (over seeding, reseeding, extraordinary weather conditions, etc.) which lead to the exceedance, and any planned changes the Permittee deems necessary. This evaluation shall be submitted with the fourth quarter DMR.

SECTION 6- COMPLETE SET OF FORMS AN CHARTS FOR REQUIRED INFORMATION

PERMITTEE NAME/ADDRESS *(Include Facility Name/Location if Different)*

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM *(NPDES)*

DISCHARGE MONITORING REPORT *(DMR)*

Form Approved
OMB No. 2040-0004

NAME
ADDRESS

PERMIT NUMBER	**DISCHARGE NUMBER**

FACILITY
LOCATION

	MONITORING PERIOD						
	YEAR	MO	DAY		YEAR	MO	DAY
FROM				TO			

NOTE: Read instructions before

PARAMETER	☒	QUANTITY OR LOADING			QUALITY OR CONCENTRATION				NO. EX	FREQUENCY OF ANALYSIS	SAMPLE TYPE
		AVERAGE	MAXIMUM	UNITS	MINIMUM	AVERAGE	MAXIMUM	UNITS			
	SAMPLE										
	PERMIT REQUIREMENT										
	SAMPLE										
	PERMIT REQUIREMENT										
	SAMPLE										
	PERMIT REQUIREMENT										
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	PERMIT REQUIREMENT										
	SAMPLE										
	PERMIT REQUIREMENT										

NAME/TITLE PRINCIPAL EXECUTIVE OFFICER	I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.		TELEPHONE		DATE		
TYPED OR PRINTED		SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	AREA	NUMBER	YEAR	MO	DAY

COMMENT AND EXPLANATION OF ANY VIOLATIONS *(Reference all attachments here)*

EPA Form 3320-1 (Rev. 03-99) *Previous editions may be used.*

This is a 4-part form

PAGE OF

Paperwork Reduction Act Notice

Public reporting burden for this collection of information is estimated to vary from a range of 10 hours as an average per response for some minor facilities, to 110 hours as an average per response for some major facilities, with a weighted average for major and minor facilities of 18 hours per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including strategies for reducing this burden, to Chief, Information Policy Branch, PM-223, U.S. Environmental Protection Agency, 401 M Street, SW, Washington, DC 20460; and to the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503.

General Instructions

1. If form has been partially completed by preprinting, disregard instructions directed at entry of that information already preprinted.
2. Enter "*Permittee Name/Mailing Address* (and facility name/location, if different)," "Permit Number," and "Discharge Number" where indicated. (A separate form is required for each discharge.)
3. Enter dates beginning and ending "*Monitoring Period*" covered by form where indicated.
4. Enter each "*Parameter*" as specified in monitoring requirements of permit.
5. Enter "*Sample Measurement*" data for each parameter under "*Quantity*" and "*Quality*" in units specified in permit. "*Average*" is normally arithmetic average (geometric average for bacterial parameters) of all sample measurements for each parameter obtained during "*Monitoring Period*"; "*Maximum*" and "*Minimum*" are normally extreme high and low measurements obtained during "*Monitoring Period.*" (Note to municipals with secondary treatment requirement: Enter 30-day average of sample measurements under "*Average*," and enter maximum 7-day average of sample measurements obtained during monitoring period under "*Maximum.*")
6. Enter "*Permit Requirement*" for each parameter under "*Quantity*" and "*Quality*" as specified in permit.
7. Under "*No Ex*" enter number of sample measurements during monitoring period that exceed maximum (and/or minimum or 7-day average as appropriate) permit requirement for each parameter. If none, enter "*0.*"
8. Enter "*Frequency of Analysis*" both as "*Sample Measurement*" (actual frequency of sampling and analysis used during monitoring period) and as "*Permit Requirement*" specified in permit. (e.g., Enter "*Cont,*" for continuous monitoring, "*1/7*" for one day per week, "*1/30*" for one day per month, "*1/90*" for one day per quarter, etc.)
9. Enter "*Sample Type*" both as "*Sample Measurement*" (actual sample type used during monitoring period) and as "*Permit Requirement,*" (e.g., Enter "*Grab*" for individual sample, "*24HC*" for 24-hour composite, "*N/A*" for continuous monitoring, etc.)
10. Where violations of permit requirements are reported, attach a brief explanation to describe cause and corrective actions taken, and reference each violation by date.
11. If "*no discharge*" occurs during monitoring period, enter "No Discharge" across form in place of data entry.
12. Enter "*Name/Title of Principal Executive Officer*" with "*Signature of Principal Officer of Authorized Agent,*" "*Telephone Number,*" and "*Date*" at bottom of form.
13. Mail signed Report to Office(s) by date(s) specified in permit. Retain copy for your records.
14. More detailed instructions for use of this *Discharge Monitoring Report (DMR)* form may be obtained from Office(s) specified in permit.

Legal Notice

This report is required by law (33 U.S.C. 1318; 40 C.F.R. 125.27). Failure to report or failure to report truthfully can result in civil penalties not to exceed $10,000 per day of violation; or in criminal penalties not to exceed $25,000 per day of violation, or by imprisonment for not more than one year, or by both.

WTS-1B: APPENDIX ONE

PLANT CONSUMPTIVE USE WORKSHEET

The consumptive use equation for determining the crop's water requirement takes into account precipitation, evapotranspiration, the efficiency of the irrigation system, and the salt tolerance of the plant species. The salt tolerance of the plant species is used to calculate the leaching requirement (Lr) to remove excess salts from the root zone. Excess salts within the soil cause the plant cells to expend more energy adjusting the salt concentration within the plant tissues, and therefore, less energy is available for vigorous plant growth. The hydraulic loading rate and the TDS to ECw conversion equation included below are derived from Wastewater Engineering: Treatment, Disposal, and Reuse, (Metcalf and Eddy, 1991), the equation for the leaching requirement is from the Nevada Irrigation Guide, (USDA, Soil Conservation Service, 1981).

$$Lw_{(c)} = \frac{(ET-P)}{[E \times (1-Lr)]} \qquad Lr = \frac{ECw}{[(5 \times ECe)-ECw]}$$

where:

- $Lw_{(c)}$ = Allowable Hydraulic Loading Rate Based on Crop Water Needs (in/yr);
- ET = Evapotranspiration Rate (in/yr);
- P = Precipitation Rate (in/yr);
- Lr = Leaching Requirement (%, expressed as a fraction);
- E = Efficiency of Irrigation System (%, expressed as a fraction)
  For example: 75% = 75/100 = 0.75; example efficiencies are included below;
- ECe = Salinity Tolerance of Plant Crop (mmho/cm or dS/m)[1];
- ECw = Salinity of Applied Effluent (mmho/cm); If TDS is supplied by the laboratory, see conversion below; and
- TDS = Average Total Dissolved Solids in Applied Effluent (mg/l).

"ET" - Evapotranspiration

Evapotranspiration is defined as the "loss of water from the soil both by evaporation and by transpiration from the plants growing thereon" (Websters Dictionary, 1990). Since different plants transpire at different rates, a crop coefficient (Kc) can be used to modify the potential ET for a particular area. Values for Kc vary depending upon the geographical location of the crop, and the species grown. If a crop coefficient can be determined, when multiplied by the potential ET rate, the result is a more accurate estimate of ET for an irrigation site. The Division recommends that reusers contact local agriculture representatives identified in Appendix Five for further crop-specific and regional information.

"E" - Irrigation Efficiency
The irrigation system efficiency is related to how effective the method is in delivering the irrigation water equally to all parts of the crop. Example values for efficiency are[4]:

Sprinkler Irrigation Type	Application Efficiency	Surface Irrigation Type	Application Efficiency
Solid Set	0.70 - 0.80	Narrow Graded Border (< 15' wide)	0.65 - 0.85
Portable Hand Move		Wide Graded Border (<100' wide)	0.65 - 0.85
Wheel Roll		Level Border	0.75 - 0.90
Center Pivot or Traveling Lateral		Straight or Graded Contour Furrows	0.70 - 0.85
Traveling Gun		Drip	0.70 - 0.85

"ECe" - Salinity Tolerance of Plant Crop
The plant salt tolerance is crop-specific, and can be obtained from the local Extension Service, literature, or other reputable sources. The low end of the range identifies the ECe value which would result in a 0% reduction of crop yield. The upper end of the range identifies the ECe value which could result in a 25% reduction of crop yield[4].

Example ECe's:

Annual Ryegrass[2] = 3 to 6 mmho/cm or dS/m
Perennial Ryegrass[2,4] = 5.6 to 8.9 mmho/cm or dS/m
Bermudagrass[2,4] = 6.9 to 10.8 mmho/cm or dS/m
Tall Fescue[2,4] = 3.9 to 8.6 mmho/cm or dS/m
Alfalfa[3,4] = 2.0 to 5.4 mmho/cm or dS/m

"ECw" - Salinity of Applied Effluent
Direct measurement of ECw is typically preferred. However, if the laboratory has supplied the reuser with a concentration of TDS, an approximate conversion[4] is ECw ≈ TDS ÷ 640. This conversion is considered accurate within 10%. The value for ECw or TDS is obtained from the treatment plant supplying the effluent. For site design, an average value can be used. For completion of the required annual balance report, the actual analytical results from Discharge Monitoring Reports should be used.

(1) For clairty in this document, the unit for electrical conductivity (EC) is expressed as mmho/cm. However, EC can also be expressed in decisiemens per meter, dS/m.
1 mmho/cm = 1 dS/m
(2) Wastewater Reuse for Golf Course Irrigation, US Golf Association, 1994.
(3) Nevada Irrigation Guide, USDA Soil Conservation Service, 1981.
(4) Wastewater Engineering: Treatment, Disposal, and Reuse, (Metcalf and Eddy, 1991)

Worksheet 1-A

CONSUMPTIVE USE REQUIREMENT WORKSHEET:
Maximum Loading Rate Based on Plant Water Use Requirements

Page _____ of _____ Crop Type = _____

$Lw_{(c)} = \frac{(ET-P)}{[E \times (1-Lr)]}$; $Lr = \frac{ECw}{[(5 \times ECe)-ECw]}$; $ECw \approx TDS \div 640$

(A) Annual Evapotranspiration (ET, in/yr) = _____
(Multiply by Crop Coefficient (Kc) if value is known)

(B) Annual Precipitation (P, in/yr) = _____

(C) (A) - (B) = _____ (in/yr)

(D) Salinity of Applied Effluent (ECw, mmho/cm) or ≈ (TDS, mg/l) ÷ 640 = _____
(Indicate which method was used to determine ECw, Direct Measurement or Approximation by Calculation.)

(E) Salinity Tolerance of Plant Crop (ECe, mmho/cm) = _____

(F) 5 x (E) = _____ (mmho/cm)

(G) (F) - (D) = _____ (mmho/cm)

(H) Leaching Requirement (Lr, %, expressed as a fraction) = (D) ÷ (G) = _____

(I) 1 - (H) = _____

(J) Efficiency of Irrigation System (E, %, expressed as a fraction) = _____

(K) (J) x (I) = _____

(L) (C) ÷ (K) = $Lw_{(c)}$ = _____ (inches/year)

If the water use rate calculated in ("L") above is the lowest application volume calculated between the annual Consumptive Use Limit (This Worksheet) and the Nitrogen Limit (Worksheet 2-A), then fill out Worksheet 1-B to estimate the planned maximum daily flow for the site.

Worksheet 1-B

CONSUMPTIVE USE REQUIREMENT WORKSHEET:
Maximum Loading Rate Based on Plant Water Use Requirements

Page _____ of _____ Crop Type = _____

$Lw_{(c)} = \frac{(ET-P)}{[E \times (1-Lr)]}$; $Lr = \frac{ECw}{[(5 \times ECe)-ECw]}$; $ECw \approx TDS \div 640$

Monthly values for evapotranspiration are dependent on the crop type and regional area of the site, as well as the crop coefficient if known. Monthly precipitation is also regional. The values for ET and P can be obtained from the local extension service, literature, or other reputable source. Please see the explanation in the "WTS-1B: Appendix One" text for futher discussion of crop coefficients.

To calculate the monthly value for $Lw_{(c)}$, perform the calculation for each month as outlined in Worksheet 1-A, and input the result in the table below. Since this form is crop-specific, a value of zero is acceptable when the crop is not in season; however, use of a zero should be explained.

Million Gals/Mo = $Lw_{(c)}$ in/mo x _____ ac ÷ 12 in/ft x 43,560 ft^2/ac x 7.481 gals/ft^3 ÷ 1,000,000
(Enter and use the number of acres for the crop type being irrigated)

MGD (Million gallons/day) = M Gallons/mo ÷ Days/mo

Month	Days/Mo	ET (in/mo)	P (in/mo)	$Lw_{(c)}$ (in/mo)	M Gals/Mo	MGD
Jan	31					
Feb	28					
Mar	31					
Apr	30					
May	31					
Jun	30					
Jul	31					
Aug	31					
Sep	30					
Oct	31					
Nov	30					
Dec	31					
Totals (in/yr):					Note: These totals should approximate the annual values calculated in Worksheet 1-A	

SITE______________________________

IRRIGATION LOG

Month & Year:___/______ Sheet No.___ of ___

DATE & TIME	METER Q (gpm)	Totalizer Reading	Total Gallons

Reclaimed Water Run-Off Reporting Sheet

Date and Time of Discharge: _____/_____/_____ - _____
DD MM YR TIME

Location of Discharge:
Estimated Amount of Discharge:
Flow Path of Discharge:
Bodies of Water Discharge Reached:
Cause of Discharge:
Corrective Actions Taken:
Preventative Actions Taken to Prevent Future Discharge:

REFERENCES

EPA Process Design Manual, 1981. Land Treatment of Municipal Wastewater.

FEMA, 1994. Flood insurance Rate Maps, Washoe County.

Pettygrove, G. Stewart and Asano, Takashi, 1986. Irrigation with Reclaimed Municipal Wastewater.

U.S. Department of Agriculture, Soil Conservation Service, 1983. Soil Survey of Washoe County, Nevada, South Part.

APPENDIX A- TMWRF NDEP DISCHARGE PERMIT
CITY OF SPARKS EAST NDEP DISCHARGE PERMIT:

- **Pagni Ranch Park**
- **Woodtrail Park**
- **D'Andrea HOA**
- **Rail City**
- **TEC Equipment, INC.**
- **Cooper Canyon**
- **Pelican Park**
- **Stonebrook**
- **Spanish Springs Nursery**

APPENDIX B- NDEP WTS-1A: GENERAL DESGIN CRITERIA FOR RECLAIMED WATER IRRIGATION USE

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL PROTECTION
BUREAU OF WATER POLLUTION CONTROL
Carson City Office
901 South Stewart Street, Suite 4001
CARSON CITY, NEVADA 89701
(775) 687-4670

WEB: www.ndep.gov

WTS-1A: GENERAL DESIGN CRITERIA FOR RECLAIMED WATER IRRIGATION USE

GENERAL NOTES:

The Nevada Division of Environmental Protection (NDEP) must be contacted whenever the use of reclaimed water is planned in order to determine the appropriate discharge permit and assist the applicant in preparing the design submittal to the Division.

Also, the Nevada Division of Water Resources (775) 687-4380 must be notified of the plan to use reclaimed water in order to address requirements for secondary water rights. The Nevada State Health Division (775) 687-9521 should be consulted to ensure the use of reclaimed water is consistent with all water supply protection requirements. Finally, please be aware that the local government and water purveyor may have rules on reclaimed water usage and should be consulted.

GUIDANCE INTRODUCTION:

Pursuant to NAC 445A.275, the Nevada Division of Environmental Protection (NDEP) must issue a discharge permit for the use of reclaimed water. Prior to issuing this permit, the Division must conduct a complete review of the plans for the reclaimed water use project. The NDEP requires that the plans be prepared and stamped by a qualified Nevada Registered Professional Engineer. This document was created to assist the applicant in preparing and submitting the required plans.

Content of each individual submittal will vary based on the proposed type of reclaimed water use, so not all items listed in this guidance will apply to a given site. This guidance was organized to cover only existing usages of reclaimed water for irrigation in Nevada. Items that the Division deems a requirement are so marked in the document and items that are simply recommendations are so marked.

Information on any guidance referenced in WTS-1A may be gathered by contacting the Division either by phone or the Internet. This document does not replace best professional judgement in reuse system design and site management. The Division reserves the right to require further supplemental information as needed.

Past guidance documents for reclaimed water use (WTS-1, WTS-9, and the outline format), are now effectively replaced by this guidance and WTS- 1B (General Criteria for Preparing an Effluent Management Plan) This guidance is considered a living document, and revisions may be made in the future as changes in reclaimed water permitting dictate.

TABLE OF CONTENTS WTS-1A

APPENDICES:

KEYWORDS

AIR GAP: Generally, the safest method of back flow prevention control. For this document, it is defined to be an unobstructed vertical distance through the free atmosphere between the lowest openings from any pipe conveying potable water to the flood level rim of any container with treated effluent. The Uniform Plumbing Code details the requirements for Air Gaps and enforcement is the role of the local water purveyor and/or health department.

BUFFER ZONE:
NAC 445A.2742, 2756 defines a buffer zone..

DMR: Discharge Monitoring Report. A table-formatted report where results from permit analytical requirements are recorded for submittal to the NDEP.

FECAL COLIFORM:
Bacteria from the feces of mammals that are used as indicators of pathogenic organisms.

RECLAIMED WATER:
Domestic Wastewater that has been treated to secondary treatment standards and disinfected to levels necessary (per NAC 445a.276) for the chosen method of reuse. Other terms for this water include Treated Effluent, Reuse Water, and Recycled Water.

SAR : Sodium adsorption Ratio, a ratio determined from the concentration (milliequivalents/liter) of sodium, calcium, and magnesium in water. It is used as an indicator of potential soil problems.

$$\text{SAR} = \frac{Na}{[(Ca + Mg)/2]^{1/2}}$$

A modification of this ratio, termed the adjusted SAR, considers the changes in calcium solubility in soil water. The procedure for determining this ratio is listed in Wastewater Engineering Treatment, Disposal and Reuse. 1991.

SOIL LEACHING:
Irrigation practice of applying water to soils in an effort to drive salts beyond the crop root zone. Function of crop salinity tolerance and salt level in irrigation water.

SPRAY IRRIGATION:
Spray irrigation is subdivided into solid set (golf courses, parks, etc.), move-stop (wheel lines), and constant move (center pivot) systems.

SURFACE IRRIGATION:
Surface irrigation is subdivided into flood irrigation and drip irrigation. Additionally, flood irrigation is further subdivided into ridge/furrow systems and graded borders.

SITE CHARACTERIZATION DATA

REQUIREMENTS:

A. Maps for Site(s)

1. General location map for the proposed reclaimed water use area that shows any surrounding water courses, all wells or springs on site and within 250 feet of the site boundary. In addition, show any dwelling units on or within 1000 feet of the site.

2. Topographic site map depicting the boundaries of the reuse site(s). The elevation contour intervals should be at least every five feet. All drainage's within and around the site shall be presented on this map. Also, seismic zone information should be provided, if applicable and available.

3. A 100-year flood zone map of the site.

B. Ground Water Information

The groundwater flow direction, gradient, depth below ground surface, and static water level elevation shall be presented from published data or sampling data for the proposed reuse site. Additionally, water quality data that has been collected from wells at or near the site shall be submitted.

C. Soils Data

Soils data to be included in the submittal include soil classifications, infiltration rates, and general soil chemistry as it relates to plant growth. Soil maps from the NRCS (Natural Resource Conservation Service) are a typical source for this type of information.

D. Plant Survey

Provide a list of current vegetation growing at the site.

RECOMMENDATIONS:

E. Boring Logs

The recommended average is one boring per two acres, with a minimum of two logs, and a maximum of five logs for the site. The depth investigated should range from land surface to the groundwater table, or to a predetermined level based on NDEP consultation. A qualified professional should prepare the logs. The logs should detail, at a minimum, the presence of confining layers, highly pervious stratum, fractured bedrock, and depth to groundwater.

F. Soil Test Pits

Exploratory soil test pit data from surface to a depth of five feet (minimum of two per site). Items to examine include:

1. Soils Texture - NRCS nomenclature
2. Soil Gradation
3. Hardpan, bedrock, or other aquacludes
4. Gravel lenses, soil mottling
5. Soil Chemistry (pH, EC, Cation Exchange Capacity, ESP, SAR, Boron, Sodium, and Nitrogen).

G. Infiltration Tests

Soil infiltration rates determined from field tests. Pilot scale infiltration basin tests are recommended for determining representative values. The EPA Manual "Land Treatment of Municipal Wastewater" provides the procedure for this test. Appendix Six includes the reference citation for the Manual. Standard percolation tests are also acceptable.

PLANT CHARACTERISTICS

REQUIREMENTS:

A. Plant Information to provide for each plant species:*

1. Evapotranspiration Rate (ET);
2. Annual Nitrogen Uptake (pounds per acre per year);
3. Salinity tolerance;
4. Required rooting depth; and
5. Growing season for the region.

* See Appendix Six for references on determining these requirements

RECOMMENDATIONS:

B. Plant information that is recommended for each plant species:

1. Harvesting requirements;
2. Product Demand (economic benefit of crop);
3. Special nutrient needs, sensitivities;
4. Trace Inorganic demands, sensitivities; and
5. Freeze/drought tolerance.

RECLAIMED WATER QUALITY

REQUIREMENTS:

A. Reclaimed Water Quality Data to Provide

1. BOD and TSS.

   Reuse water must meet secondary treatment standards (NAC 445A.275.2). This is 30 mg/l BOD_5 and 30 mg/l TSS, unless specifically exempt for "treatment equivalent to secondary treatment". Please consult the Division for anticipated permit limits.

2. Fecal Coliform or Total Coliform

   Limits on Fecal Coliform and Total Coliform levels are based on the method of irrigation and site buffer zones as described in NAC 445A.275-280. (Refer to Appendix Seven and specific guidance sections for more details).

3. Nitrogen Speciation

   Nitrogen concentrations and nitrogen forms (Ammonia, nitrate, organic) in the reclaimed water.

RECOMMENDATIONS:

B. Reclaimed Water Quality Data that the Division recommends be evaluated

1. Metals

   Examine the concentrations of metals in the reclaimed water that may be present. Certain metals will inhibit plant growth and may also pose a risk to ground water quality if leached.

2. Sodium Adsorption Ratio

   Check the SAR or Adjusted SAR of the reclaimed water.

3. Significant Inorganics

   Electrical Conductivity, pH, Sodium, Chloride, Boron, Phosphorus, TDS, and other pertinent inorganics as related to plant growth should be evaluated.

DETERMINING THE IRRIGATION BUDGETS

REQUIREMENTS:

A. The NDEP requires that the applicant conduct three distinct irrigation balances for the reuse site during the planning phase. The first two balances, for the plant consumptive use needs and the nitrogen loading limit, are prepared to determine the **optimal reclaimed water application rate** for the plant(s) per the chosen method of irrigation and yet still be protective of ground water quality. The third evaluation considers the effect of soil permeability at the site, and is used for design purposes to help ensure that the site is appropriate for reclaimed water irrigation, and ponding and run-off will not occur.

Depending upon site-specific factors, such as the reclaimed water nitrogen content and the crop's nitrogen uptake rate, one of the two balances (nitrogen loading or consumptive use) will govern for groundwater protection. Since these are best design estimates of safe application rates, the Division's reuse discharge permit instructs the user to prepare annual reports detailing the reasons (crop management goals, changes in turf management, seasonal weather differences, etc.) for exceeding the optimal application rate during any given year.

Example worksheets are included in Appendices One through Three. The first worksheet (1-A, 2-A, and 3-A) in each appendix is a general **annual overview** sheet and can be used to estimate the optimal reclaimed water application volume to determine the limiting use rate. The second worksheet in each appendix (1-B, 2-B, and 3-B) is a breakdown of monthly reclaimed water application rates and can be used for initial design, irrigation planning, and annual reporting. Use of these worksheets as an ongoing management tool would allow the applicant to track and compare design and actual usage rates throughout the year.

When preparing the annual balance report, the third worksheet in the nitrogen evaluation section (Worksheet 2-C) incorporates the addition of commercial fertilizer. This promotes additional awareness and provides general guidance to the user on the necessary adjustments in chemical fertilization practices when using reclaimed water containing nitrogen.

If more than one crop type is used at the site, the crop nitrogen uptake rates and salinity tolerances will vary. Therefore, separate worksheets should be completed for each crop area, and the total reclaimed water usage for the site would be the sum of the usage rates for each crop.

A. Flow Rate Recording

Requirement: Method of flow rate measurement for the site(s). If flow meters are used, the meter placement should be such to allow access for reading and servicing. Plans for reclaimed water screening and/or filtering for accurate recording of flow should be evaluated.

B. Storm water Run-on and Run-off Controls

1. **Requirement**: Plans for routing Storm water run-on around, or through, the site shall be provided. Typical run-off controls include conveyance ditches and perimeter berms. The 25-year, 24-hour storm event shall be used in these designs; and

2. **Requirement**: Storage reservoirs must contain, without release, the precipitation that falls within the reservoir boundaries for the 25-year, 24-hour storm event at the site. Also, the reservoir must withstand, without release of reclaimed water (from structural damage of berms, etc.), the run-off generated from the 100-year, 24-hour storm event at the site. If run-on will impact exterior berms, a method of erosion control shall be implemented.

C. Storage Reservoirs

1. **Requirement**: WTS-37 "Guidance Document for Design of Wastewater Detention Basins" shall be used as the general guidance for the design of the reservoir (pond). Water balances shall be developed for each systems specific requirements (winter storage, etc.).

   The NDEP will evaluate the risk to ground water at the site in determining reservoir lining criteria (such as liner thickness and permeability).

2. **Recommendation**: For reclaimed water use sites where this reuse system is the sole discharge method for a community's reclaimed water, a minimum of four days of storage volume should be available in reservoirs for periods when the reuse irrigation system is not operating. Storage time is intended to allow time for system repairs.

3. **Recommendation**: In designing a storage reservoir, special focus should be given to algae control, filtering outake water, and odor control devices.

D. Notification Signage and Public Access Controls

1. **Requirement**: Reuse areas shall have appropriate notification signs that clearly state that treated effluent is in use, and to avoid body contact with spray. (NAC 445A.2752). These signs shall be placed along each side of the reuse area at points of public access (such as gates) and at least every 300 feet along a fence line or border, unless otherwise approved by the Division. See Appendix Five for sign examples. Signs should be bi-lingual, english and spanish (or other applicable language), for areas where workers and the public may not speak english.

2. **Requirement**: All ponds containing effluent must be posted with notification signs stating treated effluent is in storage. Signs should be bi-lingual, english and spanish (or other applicable language), for areas where workers and the public may not speak english.

3. **Recommendation**: A continuous fence around the area of reuse is recommended in sites requiring a buffer zone and control of public access during reuse. Buffer zone requirements are defined in NAC 445A.2756.

4. **Recommendation:** In the case of nighttime irrigation at areas with the potential for public access at night, signs should be illuminated if possible.

E. Subsurface Drainage , if applicable, these are requirements

If the reuse operation requires subsurface drainage, the plans for the drain need to be prepared and submitted to this office. Discharge options for the subsurface drainage will be dependent on its quality and its final disposition. This may require coordination with the reuse permit writer.

F. Reclaimed water disinfection at reuse site; if applicable to meet permit limits, these are requirements

1. Design Drawings of the disinfection system, including system redundancy
2. Design calculations for the dosing, contact time, and other related factors
3. Chemical storage plan
4. Spill containment plan
5. Operation and Maintenance Manual

G. Filtration unit, if applicable to meet permit limits, these are requirements

1. Design Drawings for the filter system, including system redundancy.
2. Design calculations for the filter sizing, pumps, and backwash cycle.
3. Plan for backwash disposal.
4. Chemical storage plan.
5. Spill containment plan.

H. Weather Station at site, if applicable, these are requirements

1. Location for the weather station shall be depicted on the site map.
2. Description of the operational features of the station, including the station wind speed recorder, precipitation, and ET system.

I. Cross-connection Certification

Requirement: Documentation shall be provided that notification has been made to the local water purveyor and the local health agency of the permittee's intent to use reclaimed water. This documentation shall describe the plan for complying with cross-connection control requirements of the local water purveyor.

IRRIGATION SYSTEM DESIGN

Spray Irrigation Design Submittal Items

REQUIREMENTS:

A. Buffer Zones

1. Delineating the Zone(s)

   Delineate the required buffer zones for the reuse site and how the public will be kept from encroaching into these zones. Buffer zones are a function of the reclaimed water quality and public access controls. NAC 445A.2756-2771 defines the size of the zone required. The regulation is included in Appendix Seven.

2. Controlling Aerosol Drift

   For sites with buffer zone requirements, aerosol drift must be controlled to prevent the carryover of aerosols outside of sites buffer zones (NAC 445A.2754). In order to assess the risk of public contact with wind blown aerosol, the prevailing wind direction shall be presented on the site plan. A typical method of controlling aerosol drift involves the use of a weather station with an anemometer which is automated to cease irrigation at target wind speeds.

B. Reuse Water Application Plans

Detailed plans of the irrigation system layout on the reuse site shall be provided. Items to depict are; the location of control valves, drain valves, blow-off valves, air-gaps, flow meters, pumps, and other related items. Detail drawings shall be provided for control valves, pumps, air gaps, flow meters, and other related items.

C. Irrigation Pump System(s)

Design plans for the reclaimed water pump station(s) shall be presented. Relevant items include:

1. Alarm Systems, level sensors, redundancy, spill containment, and back-up power;

2. If potable water is used for seal water, the local water purveyor and/or health authority shall be consulted to examine back flow prevention controls; and

3. Permanent wording stating that reclaimed water is being used should be placed on visible sections of the pump station(s) such as name plates, meters, and valves. This wording should be bi-lingual in areas where the workers do not all speak english. Purple color coding of piping and ancillaries with arrows showing flow direction on the piping.

D. Reclaimed Water Run-off Prevention

In the event of a line break from the irrigation system, surface flow must be *prevented* from discharging off the site. The design for the surface flow containment system must be based on a conservative estimate of the volume of water from a significant system failure. Some acceptable options are containment berms and collection ditches with conveyance to impoundments.

E. Cross connection control and Potable Water Protection

The guidelines for separation between reclaimed water and potable water lines that are required by the governing health department and/or local water purveyor shall be followed. The Division requires that the reuser provide documentation that the governing health authority has approved the plan(s) for cross connection controls and backflow prevention.

RECOMMENDATIONS:

F. American Water Works Association Guidelines

As guidance, the Division recommends the following from the American Water Works Association with regards to irrigation system installation:

1. Purple color for all piping, risers, valve controllers, and valve box covers. In lieu of this, other approved methods or marking, such as purple marking tape over the entire pipe length, could be used. Permanent wording stating that treated effluent is being used should be stenciled on all valve box covers, reclaimed water pipe, and other ancillaries. NOTE: Other identification plans, provided that they meet the objectives of preventing cross connection, misidentification and misunderstanding of piping systems could be used;

2. Prohibiting hose bibs on the treated effluent system;

3. Quick coupler fittings should be such that interconnection cannot be made between potable and reclaimed water systems;

4 At crossings with potable lines, the applicable rules dictated by the governing health authority must be followed.

RECOMMENDATIONS CONTINUED:

G. Drain Valves

Drain valves should be located at low points on the distribution system to allow reuse water line draining for maintenance and seasonal shut-down of the system. Drain water should be infiltrated on-site.

H. Filter Screens

Filter screens or strainers should be installed on the delivery system to prevent sprinkler clogging from algae or other particulates that may be a problem.

I. Piping Protection

Plastic piping should be protected from sunlight. Openings, such as risers, that may allow rodents to nest should be covered.

IRRIGATION SYSTEM DESIGN

Surface (Flood and Drip) Irrigation Design Submittal Items

REQUIREMENTS:

A. Flood Irrigation Design Items

1. Field Grading.

The reuse field should be leveled to allow for smooth and even distribution of water over the field. The slope of the grade is dependent on the type of flood irrigation. Graded border irrigation should be conducted on relatively flat lands. Ridge and furrow irrigation should be sloped, around 2%-5%.

2. Method of reuse water application.

The design plans for reuse water application to the field should be presented. Some common dosing plans include lined ditches with slide gates, slotted pipe, and ridge and furrow systems. The design should focus on even distribution of effluent over the site. Erosion controls at the discharge locations should be incorporated in the design.

3. Tailwater recovery system design.

Design plans for tailwater containment and return systems should be presented. Sizing of the tailwater system must be based on conservative estimates of the volume of tailwater.

B. Drip Irrigation Design Items

1. System Layout

   The design plans for reuse water application to the site should be presented. This includes the layout for the distribution lines, emitter zones, control valves, and design application rates. It is critical that the pressure limits for the distribution system not be exceeded.

RECOMMENDATIONS:

2. Clog Prevention

   Design plans for screening particulate matter, to prevent clogging the emitters, is recommended by the Division.

GROUNDWATER MONITORING

Generally, at least one well located up gradient of the reuse site and two wells located down gradient of the site are required. If the permit requires groundwater monitoring, proposed monitoring well locations are to be presented on the required site map. The proposed well sites and construction design must receive approval from NDEP prior to installation.

NDEP's WTS-4 "Guidance Document for Monitoring Well Siting" shall be used for the well siting and design process. The Nevada Division of Water Resources must be contacted for necessary permits and any additional design requirements.

The purpose of the monitoring wells are to demonstrate that the use of reclaimed water does not cause the degradation (exceedance of State Drinking Water Standards) of existing or potential underground sources of drinking water. They are recommended where there is a potential for pollutants to be carried into waters of the state by any means. (NRS 445A.490.3., NRS 445A.465.3)

WTS-1A: APPENDIX ONE

PLANT CONSUMPTIVE USE WORKSHEET

The consumptive use equation for determining the crop's water requirement takes into account precipitation, evapotranspiration, the efficiency of the irrigation system, and the salt tolerance of plant species. The salt tolerance of the plant species is used to calculate the leaching requirement (Lr) to remove excess salts from the root zone. Excess salts within the soil cause the plant cells to expend more energy adjusting the salt concentration within the plant tissues, and therefore, less energy is available for vigorous plant growth. The hydraulic loading rate and the TDS to ECw conversion equation included below are derived from Wastewater Engineering: Treatment, Disposal, and Reuse, (Metcalf and Eddy, 1991), the equation for the leaching requirement is from the Nevada Irrigation Guide, (USDA, Soil Conservation Service, 1981).

$$Lw_{(c)} = \frac{(ET-P)}{[E \times (1-Lr)]} \qquad Lr = \frac{ECw}{[(5 \times ECe)-ECw]}$$

where:

- $Lw_{(c)}$ = Allowable Hydraulic Loading Rate Based on Crop Water Needs (in/yr);
- ET = Evapotranspiration Rate (in/yr);
- P = Precipitation Rate (in/yr);
- Lr = Leaching Requirement (%, expressed as a fraction);
- E = Efficiency of Irrigation System (%, expressed as a fraction)
  For example: 75% = 75/100 = 0.75; example efficiencies are included below;
- ECe = Salinity Tolerance of Plant Crop (mmho/cm or dS/m)[1];
- ECw = Salinity of Applied Effluent (mmho/cm); If TDS is supplied by the laboratory, see conversion below; and
- TDS = Average Total Dissolved Solids in Applied Effluent (mg/l).

"ET" - Evapotranspiration

Evapotranspiration is defined as the "loss of water from the soil both by evaporation and by transpiration from the plants growing thereon" (Websters Dictionary, 1990). Since different plants transpire at different rates, a crop coefficient (Kc) can be used to modify the potential ET for a particular area. Values for Kc vary depending upon the geographical location of the crop, and the species grown. If a crop coefficient can be determined, when multiplied by the potential ET rate, the result is a more accurate estimate of ET for an irrigation site. The Division recommends that reusers contact local agriculture representatives identified in Appendix Six for further crop-specific and regional information.

"E" - Irrigation Efficiency

The irrigation system efficiency is related to how effective the method is in delivering the irrigation water equally to all parts of the crop. Example values for efficiency are[4]:

Sprinkler Irrigation Type	Application Efficiency	Surface Irrigation Type	Application Efficiency
Solid Set	0.70 - 0.80	Narrow Graded Border (< 15' wide)	0.65 - 0.85
Portable Hand Move		Wide Graded Border (<100' wide)	0.65 - 0.85
Wheel Roll		Level Border	0.75 - 0.90
Center Pivot or Traveling Lateral		Straight or Graded Contour Furrows	0.70 - 0.85
Traveling Gun		Drip	0.70 - 0.85

"ECe" - Salinity Tolerance of Plant Crop

The plant salt tolerance is crop-specific, and can be obtained from the local Extension Service, literature, or other reputable sources. The low end of the range identifies the ECe value which would result in a 0% reduction of crop yield. The upper end of the range identifies the ECe value which could result in a 25% reduction of crop yield[4].

Example ECe's:

Annual Ryegrass[2] = 3 to 6 mmho/cm or dS/m
Perennial Ryegrass[2,4] = 5.6 to 8.9 mmho/cm or dS/m
Bermudagrass[2,4] = 6.9 to 10.8 mmho/cm or dS/m
Tall Fescue[2,4] = 3.9 to 8.6 mmho/cm or dS/m
Alfalfa[3,4] = 2.0 to 5.4 mmho/cm or dS/m

"ECw" - Salinity of Applied Effluent

Direct measurement of ECw is typically preferred. However, if the laboratory has supplied the reuser with a concentration of TDS, an approximate conversion[4] is ECw ≈ TDS ÷ 640. This conversion is considered accurate within 10%. The value for ECw or TDS is obtained from the treatment plant supplying the effluent. For site design, an average value can be used. For completion of the required annual balance report, the actual analytical results from Discharge Monitoring Reports should be used.

(1) For clarity in this document, the unit for electrical conductivity (EC) is expressed as mmho/cm. However, EC can also be expressed in decisiemens per meter, dS/m.
1 mmho/cm = 1 dS/m

(2) Wastewater Reuse for Golf Course Irrigation, US Golf Association, 1994.

(3) Nevada Irrigation Guide, USDA Soil Conservation Service, 1981.

(4) Wastewater Engineering: Treatment, Disposal, and Reuse, (Metcalf and Eddy, 1991)

Worksheet 1-A

CONSUMPTIVE USE REQUIREMENT WORKSHEET:
Maximum Loading Rate Based on Plant Water Use Requirements
Page _____ of _____ Crop Type = _____

$Lw_{(c)} = \frac{(ET-P)}{[E \times (1-Lr)]}$; $Lr = \frac{ECw}{[(5 \times ECe)-ECw]}$; $ECw \approx TDS \div 640$

(A) Annual Evapotranspiration (ET, in/yr) = _____
(Multiply by Crop Coefficient (Kc) if value is known)

(B) Annual Precipitation (P, in/yr) = _____

(C) (A) - (B) = _____ (in/yr)

(D) Salinity of Applied Effluent (ECw, mmho/cm) or ≈ (TDS, mg/l) ÷ 640 = _____
(Indicate which method was used to determine ECw, Direct Measurement or Approximation by Calculation.)

(E) Salinity Tolerance of Plant Crop (ECe, mmho/cm) = _____

(F) 5 x (E) = _____ (mmho/cm)

(G) (F) - (D) = _____ (mmho/cm)

(H) Leaching Requirement (Lr, %, expressed as a fraction) = (D) ÷ (G) = _____

(I) 1 - (H) = _____

(J) Efficiency of Irrigation System (E, %, expressed as a fraction) = _____

(K) (J) x (I) = _____

(L) (C) ÷ (K) = $Lw_{(c)}$ = _____ (inches/year)

If the Water Use Rate calculated in ("L") above is the lowest application volume calculated for the annual Consumptive Use Limit (This Worksheet), the Nitrogen Limit (Worksheet 2-A) or the Permeability Limit (Worksheet 3-A), then fill out Worksheet 1-B to estimate the planned maximum daily flow for the site.

Worksheet 1-B

CONSUMPTIVE USE REQUIREMENT WORKSHEET:
Maximum Loading Rate Based on Plant Water Use Requirements
Page _____ of _____ Crop Type = _____

$Lw_{(c)} = \frac{(ET-P)}{[E \times (1-Lr)]}$; $Lr = \frac{ECw}{[(5 \times ECe)-ECw]}$; $ECw \approx TDS \div 640$

Monthly values for evapotranspiration are dependent on the crop type and regional area of the site, as well as the crop coefficient if known. Monthly precipitation is also regional. The values for ET and P can be obtained from the local extension service, literature, or other reputable source. Please see the explanation in the "WTS-1A: Appendix One" text for further discussion of crop coefficients.

To calculate the monthly value for $Lw_{(c)}$, perform the calculation for each month as outlined in Worksheet 1-A, and input the result in the table below. Since this form is crop-specific, a value of zero is acceptable when the crop is not in season; however, use of a zero should be explained.

Million Gals/Mo = $Lw_{(c)}$ in/mo x _____ ac ÷ 12 in/ft x 43,560 ft^2/ac x 7.481 gals/ft^3 ÷ 1,000,000
(Enter and use the number of acres for the crop type being irrigated)

MGD (Million gallons/day) = M Gallons/mo ÷ Days/mo

Month	Days/Mo	ET (in/mo)	P (in/mo)	$Lw_{(c)}$ (in/mo)	M Gals/Mo	MGD
Jan	31					
Feb	28					
Mar	31					
Apr	30					
May	31					
Jun	30					
Jul	31					
Aug	31					
Sep	30					
Oct	31					
Nov	30					
Dec	31					
Totals (in/yr):					Note: These totals should approximate the annual values calculated in Worksheet 1-A	

WTS-1A: APPENDIX TWO

NITROGEN LOADING LIMIT WORKSHEET

The nitrogen loading equation takes into account precipitation, evapotranspiration, plant nitrogen uptake, nitrogen content of the applied effluent, and allowable percolate nitrogen concentration. The equation included below is from Wastewater Engineering: Treatment, Disposal, and Reuse, (Metcalf and Eddy, 1991)

$$Lw_{(n)} = \frac{[(Cp, mg/l) \times (P\text{-}ET, in/yr)] + [(U, lb/acre\text{-}yr) \times (4.4)]}{[(1\text{-}f) \times (Cn, mg/l)] - (Cp, mg/l)}$$

where:

$Lw_{(n)}$ = Allowable Hydraulic Loading Rate Based on Nitrogen Loading rate (in/yr);
Cp = Total Nitrogen Concentration in Percolating Water (mg/l);
ET = Evapotranspiration Rate (in/yr);
P = Precipitation Rate (in/yr);
U = Nitrogen Uptake Rate by Crop (lb/acre-yr);
4.4 = Combined Conversion Factor;
Cn = Total Nitrogen Concentration in Applied Wastewater (mg/l); and
f = Fraction of Applied Total Nitrogen Removed by Denitrification and Volatilization.

"Cp" - Nitrogen in Percolating Water
A conservative value for Total N in the water that percolates past the root zone (Cp) is 7 mg/l, which is the first "red flag" value for Nitrate as N in monitoring well samples. Setting the Cp limit at a constant value aids in obtaining an hydraulic nitrogen loading rate ($Lw_{(n)}$) which should be protective of groundwater resources. The drinking water standard for Nitrate as N is 10 mg/l, which would be the maximum allowable value for Cp.

"ET" - Evapotranspiration
Evapotranspiration is defined as the "loss of water from the soil both by evaporation and by transpiration from the plants growing thereon" (Websters Dictionary, 1990). Since different plants transpire at different rates, a crop coefficient (Kc) can be used to modify the potential ET for a particular area. Values for Kc vary depending upon the geographical location of the crop, and the species grown. If a crop coefficient can be determined, when multiplied by the potential ET rate, the result is a more accurate estimate of ET for an irrigation site. The Division recommends that reusers contact local agriculture representatives identified in Appendix Six for further crop-specific and regional information.

"U" - Crop Nitrogen Uptake
Plant nitrogen uptake rates (U) are crop-specific, and can be obtained from the local Extension Service, literature, or other reputable sources. Using the accepted value for U in this equation assumes that the harvested portion of the crop is removed from the site. If plant cuttings are not removed from the area, then the amount of nitrogen removed by uptake should be offset by the amount of nitrogen returned to the soil by decomposing cutting materials. If alfalfa, or another legume, is the site's crop, then similar considerations should be made for atmospheric nitrogen which is fixed into the soil by alfalfa. A discussion with the local agricultural extension service is recommended prior to finalizing a "U" value.

"Cn" - Nitrogen in Applied Wastewater

The total nitrogen in the applied effluent water (Cn) can be obtained from the treatment plant that is supplying the effluent. For site design, an average value can be used. For completion of the required annual balance report, the actual analytical results from Discharge Monitoring Reports shall be used.

"f" - Nitrogen lost to Denitrification and Volatilization

The amount of nitrogen lost to denitrification and volatilization varies depending upon the nitrogen characteristics of the applied wastewater and the microbial activity in the soil. Microbial denitrification, in soils with a sufficient carbon source for the biological activity, may account for as much as 15 to 25 percent of the applied nitrogen during warm, biologically active months. Volatilization of ammonia may be as much as 10 percent, depending upon the ammonia fraction in the total nitrogen applied. (Metcalf & Eddy, 1991) For arid climates, such as Nevada, the value typically used for the "f" term is 0.2.

Nitrogen Addition by Chemical Fertilizers

If the allowable reuse water application volume is limited by plant consumptive use (Worksheet 1-A), nitrogen may need to be added by commercial fertilizer. In the design of a reuse site, this should be estimated to provide the site operator with a guideline for fertilizer application, in addition to the nitrogen being applied via the treated effluent. The application of fertilizer must then be incorporated into the required annual report to demonstrate that the application of commercial nitrogen and effluent nitrogen did not exceed the plant crop's uptake rate.

Worksheet 2-C is designed to be used to provide the Division with the required annual report of effluent and fertilizer usage. Worksheet 2-C can also be utilized as a site management tool to *estimate* the amount of commercial fertilizer which may be required in an upcoming month. However, use of the worksheet in this manner does not preclude the responsible use of good irrigation and nutrient management practices.

Worksheet 2-A

WATER REQUIREMENT DESIGN WORKSHEET:
Maximum Hydraulic Loading Rate Based On Annual Nitrogen Balance Evaluation
Page _____ of _____ Crop Type = _____

$$Lw_{(n)} = \frac{[Cp \times (P-ET)] + (U \times 4.4)}{[(1-f) \times Cn] - Cp}$$

(A) Total Nitrogen in Percolating Water (Cp, mg/l) = _____
(B) Annual Precipitation (P, in/yr) = _____
(C) Annual Evapotranspiration (ET, in/yr) = _____
(Multiply by Crop Coefficient (Kc) if value is known)

(D) (B) - (C) = _____ (in/yr)
(E) (A) x (D) = _____

(F) Crop Nitrogen Uptake (U, lb/ac-yr) = _____
(G) (F) x 4.4 = _____

(H) (E) + (G) = _____

(I) Fraction of Applied Total Nitrogen Lost to Denitrification and Volatilization (f) = _____
(J) 1- (I) = _____
(K) Total Nitrogen in Applied Effluent (Cn, mg/l) = _____
(L) (J) x (K) = _____
(M) (L) - (A) = _____

(N) (H) ÷ (M) = $Lw_{(n)}$ (inches/year) = _____

If the Water Use Rate calculated in ("N") above is the lowest application volume calculated for the annual Consumptive Use Limit (Worksheet 1-A), the Nitrogen Limit (This Worksheet) or the Permeability Limit (Worksheet 3-A), then fill out Worksheet 2-B to estimate the planned maximum daily flow for the site.

Worksheet 2-B

WATER REQUIREMENT DESIGN WORKSHEET:
Maximum Hydraulic Loading Rate Based On Annual Nitrogen Balance Evaluation
Page _____ of _____ Crop Type = _____

$$Lw_{(n)} = \frac{[Cp \times (P-ET)] + (U \times 4.4)}{[(1-f) \times Cn] - Cp}$$

Monthly values for evapotranspiration are dependant on the crop type and regional area of the site, as well as the crop coefficient if known. Monthly precipitation is also regional. The values for ET and P can be obtained from the local extension service, literature, or other reputable source. Please see the explanation in the "WTS-1A: Appendix Two" text for further discussion of crop coefficients.

The monthly value of crop nitrogen uptake (U) can be calculated according to the equation included on the Table. Please see the discussion in the "WTS-1A: Appendix Two" text regarding "U" values for alfalfa crops or sites that do not remove crop cuttings. If a different distribution of monthly "U" is used, due to circumstances such as germination or dormancy periods, then provide documentation explaining the difference.

To calculate the monthly value for $Lw_{(n)}$, perform the calculation for each month as outlined in Worksheet 2-A, using the monthly values for "U", "P", "ET", and "Cn", and input the result in the table below. Since this form is crop-specific, a value of zero is acceptable when the crop is not in season; however, use of a zero should be explained.

Monthly U (lb/ac-mo) = U (lb/ac-yr) x ET(in/mo) ÷ ET (total in/yr)

Million Gallons Per Month = $Lw_{(c)}$ in/mo x _____ # acres (ea. crop type) ÷ 12 in/ft x 43,560 ft^2/ac x 7.481 gallons/ft^3 ÷ 1,000,000

MGD (Million gallons/day) = M Gallons/mo ÷ Days/mo

Month	Days/Mo	P (in/mo)	ET (in/mo)	U (lb/ac-mo)	$Lw_{(n)}$ (in/mo)	M Gals/Mo	MGD of Reclm'd Water
Jan	31						
Feb	28/29						
Mar	31						
Apr	30						
May	31						
Jun	30						
Jul	31						
Aug	31						
Sep	30						
Oct	31						
Nov	30						
Dec	31						
	Totals:					Note: The totals for P, ET and $Lw_{(n)}$ should approximate the annual values used or calculated in Worksheet 2-A	

Worksheet 2-C: *Regardless of the limiting hydraulic loading rate that was defined during the design phase, Worksheet 2-C is designed to be used to provide the Division with the required annual report of effluent and fertilizer usage.*

Effluent N Applied = _____ x _____ (mg/l) x 8.34 x _____ ÷ _____ x
(lb/ac-mo) MGD Applied Effluent N Conc. # days/mo # Acres (1 -"f") (i.e. 0.2.)

Fertilizer N Applied = _____ Monthly Fertilizer used (lbs/mo) x _____ % N in Fertilizer (as a fraction) ÷ _____ acres
(lb/ac-mo)

Crop Name and Nitrogen Uptake Requirement = _____, _____ (lbs/ac-yr)

Month	Days/Mo	Million Gallons Applied (mo)	MGD of Irrigation Water Applied	Effluent N Concentration (mg/l)	Effluent N Applied (lb/ac-mo)	Fertilizer N Applied (lb/ac-mo)	Total N Applied (Effl. N + Fert. N) (lb/ac-mo)
Jan	31						
Feb	28/29						
Mar	31						
Apr	30						
May	31						
Jun	30						
Jul	31						
Aug	31						
Sep	30						
Oct	31						
Nov	30						
Dec	31						
						Total** =	

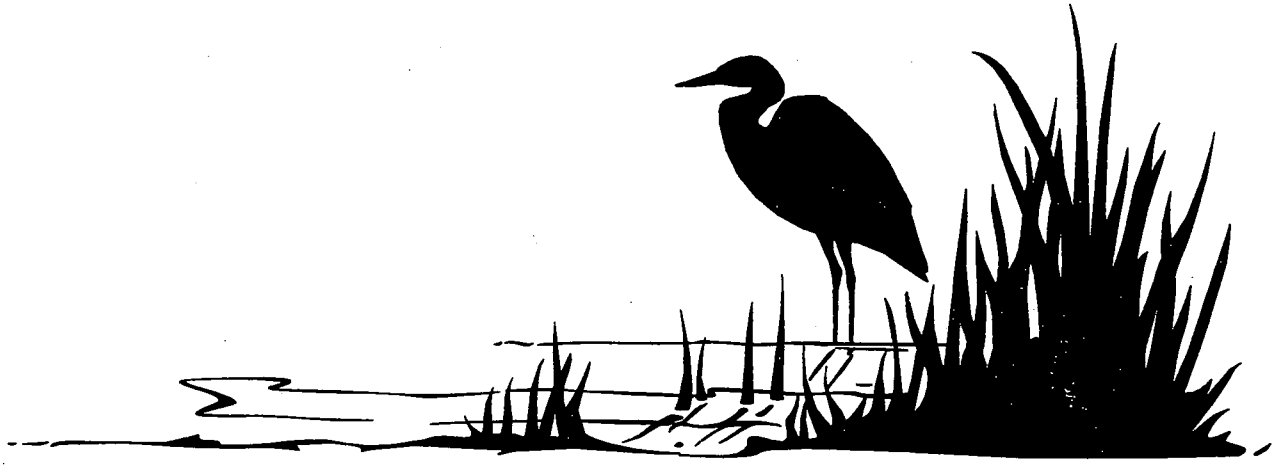
** The Total N Applied to the crop should be less than the crop's Nitrogen Uptake Requirement. Please see your permit for directions if it is not.

APPENDIX THREE

WORKER HYGIENE FACT SHEETS

This project area uses reclaimed wastewater for irrigation. This reclaimed wastewater comes from the sewage treatment plant and meets the standards required for this level of reuse. Potential risks of disease transmission from the use of the reclaimed water is low, however, some general guidelines (listed below), should be followed protect you from becoming ill when working with reclaimed water:

1. Do not drink the reclaimed water or use the reclaimed water for washing.
2. Always wash hands and face with clean water and soap before eating, smoking, or drinking.
3. Wear rubber gloves when working on the irrigation system.
4. Try to keep the irrigation water off your skin and clothes as much as possible.
5. Always treat cuts immediately before continuing with work on the irrigation system.
6. Make sure the area is clear of people that may get sprayed before running the irrigation system.
7. Report any problems to your supervisor that you feel could pose a risk.



APPENDIX FOUR

NOTIFICATION SIGN EXAMPLES

IRRIGATION SIGN

Figure 4.3

IRRIGATION SIGN

Figure 4.4

IRRIGATION SIGN

Figure 4.5

APPENDIX FIVE

REUSE REFERENCE LISTS

LITERATURE REFERENCE LIST FOR RECLAIMED WATER USE MANAGEMENT

1. "Guidelines for Using Disinfected Recycled Water", Awwa California-Nevada Section, 1997 & 1984.

2. "Guidelines for Water Reuse", U S Environmental Protection Agency, 1992, 2004.

3. "Land Treatment of Municipal Wastewater", U S Environmental Protection Agency, 1981.

4. "Nevada Irrigation Guide", US Department of Agriculture, Soil Conservation Service, 1981.

5. Wastewater Reuse For Golf Course Irrigation, US Golf Association, 1994, Lewis Publishers.

6. Water Reuse Manual of Practice, Water Environment Federation 1989.

7. Wastewater Engineering Treatment, Disposal and Reuse, Metcalf & Eddy, 1991, Mcgraw-hill Publishers.

8. Irrigation with Reclaimed Municipal Wastewater- A guidance manual. G.S. Pettygrove and T. Asano, 1985, Lewis Publishers.

Contact List for Technical and Regulatory Guidance

1. **Nevada Division of Environmental Protection, Bureau of Water Pollution Control**
   901 South Stewart Street, Suite 4001, Carson City, NV, 89701 .....(775) 687-4670

2. **Nevada Division of Water Resources**
   901 South Stewart Street, Carson City, NV 89701.....(775) 687-4380

3. **Nevada Division of Health**
   901 South Stewart Street, Carson City, NV 89701.....(775) 687-9521

4. **Desert Research Institute**
   7010 Dandini Boulevard, Reno, NV 89506.....(775) 673-7300

5. **National Resource Conservation Service (NRCS)**
   1528 U.S. Highway 395, Minden, NV 89410.....(775) 883-2623

   5301 Longley Lane, Building F, Room 201, Reno, NV 89511 .....(775) 784-5875

6. **University of Nevada Cooperative Extension**
   2345 Redrock Street, Suite 100, Las Vegas, NV 89146-3160 .....(702) 222-3130

7. **Nevada Department of Agriculture**
   350 Capitol Hill, Reno, NV 89510 .....(775) 688-1180

8. **Center for Urban Water Conservation - UNLV Dept. of Biology**
   Las Vegas, Nevada 89157-4004 .....(702) 895-3853

APPENDIX SIX

NEVADA ADMINISTRATIVE CODE - REUSE REGULATIONS

Use of Treated Effluent

NAC 445A.274 Definitions. (NRS 445A.425) As used in NAC 445A.274 to 445A.280, inclusive, unless the context otherwise requires, the words and terms defined in NAC 445A.2741 to 445A.2748, inclusive, have the meanings ascribed to them in those sections.
(Added to NAC by Environmental Comm'n by R063-04, eff. 10-6-2004)

NAC 445A.2741 "Area of use" defined. (NRS 445A.425) "Area of use" means a site, or an area of land, where treated effluent is in use pursuant to NAC 445A.274 to 445A.280, inclusive.
(Added to NAC by Environmental Comm'n by R063-04, eff. 10-6-2004)

NAC 445A.2742 "Buffer zone" defined. (NRS 445A.425) "Buffer zone" means a bounded area adjacent to, and surrounding, an area of use, that is subject to the provisions of NAC 445A.2756.
(Added to NAC by Environmental Comm'n by R063-04, eff. 10-6-2004)

NAC 445A.2743 "Graywater" defined. (NRS 445A.425) "Graywater" has the meaning ascribed to it in NAC 444.7616.
(Added to NAC by Environmental Comm'n by R063-04, eff. 10-6-2004)

NAC 445A.2744 "Impoundment" defined. (NRS 445A.425) "Impoundment" means a lake, reservoir or lined holding basin.
(Added to NAC by Environmental Comm'n by R063-04, eff. 10-6-2004)

NAC 445A.2745 "Spray irrigation" defined. (NRS 445A.425) "Spray irrigation" means irrigation using sprinklers that are located above the ground surface.
(Added to NAC by Environmental Comm'n by R063-04, eff. 10-6-2004)

NAC 445A.2746 "Subsurface irrigation" defined. (NRS 445A.425) "Subsurface irrigation" means irrigation using an underground distribution system.
(Added to NAC by Environmental Comm'n by R063-04, eff. 10-6-2004)

NAC 445A.2747 "Surface irrigation" defined. (NRS 445A.425) "Surface irrigation" means irrigation using a flood irrigation system or a drip irrigation system. The term does not include spray irrigation.
(Added to NAC by Environmental Comm'n by R063-04, eff. 10-6-2004)

NAC 445A.2748 "Treated effluent" defined. (NRS 445A.425) "Treated effluent" means sewage that has been treated by a physical, biological or chemical process. The term does not include graywater.
(Added to NAC by Environmental Comm'n by R063-04, eff. 10-6-2004)

NAC 445A.2749 Limitation on meaning of "agricultural purposes." (NRS 445A.425) For the purposes of NAC 445A.274 to 445A.280, inclusive, the term "agricultural purposes" does not include the growing of crops for human consumption.
(Added to NAC by Environmental Comm'n by R063-04, eff. 10-6-2004)

NAC 445A.275 General requirements and restrictions. (NRS 445A.425)

1. A person shall not use treated effluent unless:

(a) The person has:

(1) Received the approval of the Division of a plan for the management of effluent; and

(2) Obtained a permit pursuant to NAC 445A.228 to 445A.263, inclusive; and

(b) The treated effluent has received at least secondary treatment.

2. As used in this section:

(a) "Five-day inhibited biochemical oxygen demand" means the amount of dissolved oxygen required to stabilize the carbonaceous decomposable organic matter by aerobic bacterial action at 20 degrees centigrade for 5 days.

(b) "Plan for the management of effluent" means:

(1) An effluent management plan; or

(2) A site specific management plan.

(c) "Secondary treatment" means the treatment of sewage until the sewage has, calculated as a 30-day average:

(1) A 5-day inhibited biochemical oxygen demand concentration of 30 milligrams per liter or less;

(2) A total suspended solids concentration of 30 milligrams per liter or less; and

(3) A pH of 6.0 to 9.0 SU.

(Added to NAC by Environmental Comm'n, eff. 9-13-91; A by R063-04, 10-6-2004)

NAC 445A.2752 Signs: Required placement and contents. (NRS 445A.425)

1. A person using treated effluent shall post signs along the outer perimeter of the:

(a) Area of use; and

(b) Buffer zone, if any.

2. The signs must provide reasonable notice to the general public that:

(a) Treated effluent is in use; and

(b) Contact with the effluent should be avoided.

(Added to NAC by Environmental Comm'n by R063-04, eff. 10-6-2004)

NAC 445A.2754 Irrigation: Requirements and restrictions. (NRS 445A.425)

1. A person using treated effluent for irrigation shall not:

(a) Allow the effluent to run off the site being irrigated.

(b) Except as otherwise provided in NAC 445A.2768, use treated effluent to irrigate crops intended for human consumption.

2. A person using treated effluent for spray irrigation shall conduct the irrigation in a manner that inhibits the treated effluent spray from drifting beyond the area of use or the buffer zone, if any.

(Added to NAC by Environmental Comm'n by R063-04, eff. 10-6-2004)

NAC 445A.2756 Buffer zones: Size; boundaries; restriction. (NRS 445A.425)

1. Except as otherwise provided in NAC 445A.2766, 445A.2768 and 445A.2771, the Division will establish the size of a buffer zone.

2. The inner boundary of a buffer zone is determined by measuring a distance equal to the size of the buffer zone from:

(a) A boundary line of the property on which the site is located;

(b) A sign posted pursuant to NAC 445A.2752 informing the public of the presence of treated effluent; or

(c) Any point where the property is open to public access, as determined by the Division.

3. Except as otherwise provided in NAC 445A.2754, a buffer zone must be kept free of treated effluent.

(Added to NAC by Environmental Comm'n by R063-04, eff. 10-6-2004)

NAC 445A.276 Reuse categories: Requirements for bacteriological quality of effluent. (NRS 445A.425)

1. Treated effluent being used for an activity approved for a reuse category must meet the following requirements for bacteriological quality for that category:

	Total Coliform	Fecal Coliform			
	c.f.u. or mpn/100 ml	c.f.u. or mpn/100ml			
Reuse Category	A	B	C	D	E
30-day geometric mean	2.2	2.2	23	200	No Limit
Maximum daily number	23	23	240	400	No Limit

2. As used in this section, "c.f.u. or mpn/100ml" means colony forming units or most probable number per 100 milliliters of the treated effluent.

(Added to NAC by Environmental Comm'n, eff. 9-13-91; A by R063-04, 10-6-2004)

NAC 445A.2762 Reuse category A: Approved uses. (NRS 445A.425) Treated effluent that meets the requirements for bacteriological quality set forth in NAC 445A.276 for reuse category A may be used for:

1. Spray irrigation of land used as a cemetery, commercial lawn, golf course, greenbelt or park even if:
(a) Public access to the area of use is not controlled; and
(b) Human contact with the treated effluent can reasonably be expected to occur.
2. An impoundment in which swimming is prohibited even if:
(a) Public access to the impoundment is not controlled; and
(b) Human contact with the treated effluent can reasonably be expected to occur.
3. Any activity approved for reuse category B, C, D or E.
4. Any other use that is approved by the Division.

(Added to NAC by Environmental Comm'n by R063-04, eff. 10-6-2004)

NAC 445A.2764 Reuse category B: Approved uses. (NRS 445A.425) Treated effluent that meets the requirements for bacteriological quality set forth in NAC 445A.276 for reuse category B may be used for:

1. Spray irrigation of land used as a cemetery, commercial lawn, golf course, greenbelt or park if:
(a) Public access to the area of use is controlled; and
(b) Human contact with the treated effluent cannot reasonably be expected to occur.
2. Subsurface irrigation of land used as a commercial lawn, greenbelt or park.
3. Cooling water in an industrial process.
4. Fire-fighting operations in an urban area if approved by the fire department, fire protection district or other fire-fighting agency in whose district the fire occurs.
5. Any activity approved for reuse category C, D or E.
6. Any other use that is approved by the Division.

(Added to NAC by Environmental Comm'n by R063-04, eff. 10-6-2004)

NAC 445A.2766 Reuse category C: Approved uses. (NRS 445A.425)

1. Treated effluent that meets the requirements for bacteriological quality set forth in NAC 445A.276 for reuse category C may be used for:

(a) Spray irrigation of land used as a cemetery, golf course or greenbelt if:

(1) Public access to the area of use is controlled;

(2) Human contact with the treated effluent does not occur; and

(3) A buffer zone of not less than 100 feet is maintained.

(b) Watering of nursery stock if public access to the area of use is controlled.

(c) Establishment, restoration or maintenance of a wetland if public access to the wetland is controlled.

(d) Washing of gravel used in concrete mixing.

(e) Feed water for a boiler.

(f) An impoundment if:

(1) Public access to the impoundment is controlled; and

(2) Human contact with the treated effluent cannot reasonably be expected to occur.

(g) Fire fighting of forest or other wildland fires if approved by the fire department, fire protection district or other fire-fighting agency in whose district the fire occurs.

(h) Any activity approved for reuse category D or E.

(i) Any other use that is approved by the Division.

2. As used in this section:

(a) "Nursery stock" has the meaning ascribed to it in NRS 555.23562.

(b) "Wetland" has the meaning ascribed to it in NRS 244.388.

(Added to NAC by Environmental Comm'n by R063-04, eff. 10-6-2004)

NAC 445A.2768 Reuse category D: Approved uses. (NRS 445A.425)

1. Treated effluent that meets the requirements for bacteriological quality set forth in NAC 445A.276 for reuse category D may be used for:

(a) Spray irrigation of land used for agricultural purposes if:

(1) Public access to the area of use is prohibited; and

(2) A buffer zone of not less than 400 feet is maintained.

(b) Surface irrigation of land used:

(1) As greenbelt if:

(I) Public access to the area of use is prohibited; and

(II) Human contact with the treated effluent does not occur.

(2) For agricultural purposes; and

(3) For the cultivation of fruit-bearing trees or nut-bearing trees.

(c) Subsurface irrigation of land used for agricultural purposes if public access is controlled.

(d) Dust control.

(e) Soil compaction.

(f) Flushing sewer lines.

(g) An impoundment if:

(1) Public access to the impoundment is prohibited;

(2) All human activities involving contact with the treated effluent are prohibited; and

(3) Human contact with the treated effluent does not occur.

(h) Any activity approved for reuse category E.

(i) Any other use approved by the Division.

2. As used in this section, "dust control" means the program required pursuant to NAC 445B.22037 to prevent controllable particulate matter from becoming airborne.

(Added to NAC by Environmental Comm'n by R063-04, eff. 10-6-2004)

NAC 445A.2771 Reuse category E: Approved uses. (NRS 445A.425) Treated effluent that meets the requirements for bacteriological quality set forth in NAC 445A.276 for reuse category E may be used for:

1. Spray irrigation of land used for agricultural purposes if:
(a) Public access to the area of use is prohibited; and
(b) A buffer zone of not less than 800 feet is maintained.
2. Any other use that is approved by the Division.
(Added to NAC by Environmental Comm'n by R063-04, eff. 10-6-2004)

NAC 445A.279 Determining quality of effluent: Storage reservoirs excluded from treatment process. (NRS 445A.425) For the purpose of determining the quality of effluent, storage reservoirs do not constitute part of the treatment process.
(Added to NAC by Environmental Comm'n, eff. 9-13-91)—(Substituted in revision for NAC 445.178)

NAC 445A.280 Waiver or modification of requirements. (NRS 445A.425) The Director may waive compliance with or modify any requirement of NAC 445A.274 to 445A.280, inclusive, for a specific proposed use of treated effluent upon his determination that because of the size, type or location of the proposed use, the waiver or modification is consistent with the policy set forth in NRS 445A.305.
(Added to NAC by Environmental Comm'n, eff. 9-13-91; A by R063-04, 10-6-2004)

APPENDIX C-NDEP WTS-1B: GENERAL CRITERIA FOR PREPARING AN EFFLUENT MANAGEMENT PLAN

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DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL PROTECTION
BUREAU OF WATER POLLUTION CONTROL
Carson City Office
901 South Stewart Street, Suite 4001
Carson City, Nevada 89701
(775) 687-4670

http://www.ndep.gov

WTS-1B: GENERAL CRITERIA FOR PREPARING AN EFFLUENT MANAGEMENT PLAN

GENERAL NOTES:

The Nevada Division of Environmental Protection (NDEP) must be contacted whenever the use of reclaimed water is planned in order to determine the appropriate regulatory oversight requirements. NDEP shall also be available to assist the applicant in preparing the effluent management plan (EMP).

The Nevada Division of Water Resources (775) 687-4380 must be notified of the plan to use reclaimed water in order to address requirements for secondary water rights. Also, the Nevada State Health Division (775) 687-9521 should be consulted to ensure the use of reclaimed water is consistent all water supply protection requirements. Finally, please be aware that the local government and water purveyor may have rules on reclaimed water usage and should be consulted.

GUIDANCE INTRODUCTION:

Pursuant to NAC 445A.275.1(b), NDEP must issue a discharge permit for the use of reclaimed water. As part of this permitting process, NAC 445A.275.1(a) states that an EMP must be submitted and approved prior to the use of reclaimed water. This guidance was prepared to assist the permittee in preparing a satisfactory EMP. Please be aware that the extent of information and content for each individual EMP will vary for the different types of reclaimed water use, so not all portions of this guidance may apply to your particular EMP.

This guidance was organized to cover only existing usages of reclaimed water in Nevada. Items that the Division deems a requirement are so marked in the document and items that are simply recommendations are so marked. Information on any guidance referenced in WTS-1B may be gathered by contacting this Bureau.

Past guidance documents for reclaimed water use (WTS-1, WTS-9, and the outline format), are now effectively replaced by this guidance and WTS 1A (General Design Criteria for Reclaimed Water Irrigation Use). This Guidance is considered a dynamic document, and revisions may be made in the future as changes in reclaimed water usage regulations dictate.

Thanks is given to the Reuse Nevada Committee for their assistance in helping NDEP prepare this guidance.

The EMP is intended for use by the reuser (golf course superintendent, farmer, park maintenance worker, industrial worker, etc.) so it should be written in a user friendly format. The use of illustrative figures, maps, and tables throughout the EMP is highly recommended. The EMP should be bound in a loose leaf binder to facilitate updates. The date of printing for the EMP and all subsequent revisions must be shown on the title page of the EMP.

This document does not replace best professional judgement in reuse system management and NDEP reserves the right to require further information and review additional factors as needed.

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KEYWORDS

AIR GAP:

Generally, the safest method of back flow prevention control.
For this document, it is defined to be an unobstructed vertical distance through the free atmosphere between the lowest opening from any pipe conveying potable water to the flood level rim of any container with treated effluent. The Uniform Plumbing Code details the requirements for Air Gaps and enforcement is the role of the local water purveyor and/or health authority.

BUFFER ZONE:

NAC 445A.076 defines a buffer zone to be the shortest distance between the boundary of the site being irrigated with reclaimed water and either; **one**, the property line boundary of the site; **two**, a posted public warning sign, or; **three**, any point where the property is open to public access, whichever is least. NAC 445a.276 lists the various buffer zones for spray irrigation sites based on reclaimer water quality and type of site being irrigated.

DMR: Discharge Monitoring Report. A table-formatted report where results from permit sampling and monitoring are recorded for submittal to NDEP.

COLIFORM:

Bacteria from feces of mammals which is used as an indicator of pathogenic organisms.

RECLAIMED WATER:

Domestic Wastewater that has been treated to secondary treatment standards and disinfected to levels necessary (per NAC 445A.276) for the chosen method of reuse. Other terms for this water include Treated Effluent, Reuse Water, and Recycled Water.

SAR : Sodium adsorption Ratio, a ratio determined from the concentration (milliequivalents/liter) of sodium, calcium, and magnesium in water. It is used as an indicator of potential soil problems.

$$SAR = \frac{Na}{[(Ca + Mg)/2]^{1/2}}$$

A modification of this ratio, termed the adjusted SAR, considers the changes in calcium solubility in soil water. The procedure for determining this ratio is listed in Wastewater Engineering Treatment, Disposal and Reuse. 1991.

SOIL LEACHING:

Irrigation practice of applying water to soils in an effort to drive salts beyond the crop root zone. The rate is a function of crop salinity tolerance and salt level in irrigation water.

SPRAY IRRIGATION:

For purposes of this guidance, spray irrigation is categorized into three types; solid set (golf courses), move-stop (wheel lines), and constant move (center pivot) systems.

SURFACE IRRIGATION:

Surface irrigation is categorized as either flood irrigation or drip irrigation. Flood irrigation is further subdivided into ridge/furrow systems and graded borders.

GENERAL ITEMS FOR ALL EMP'S

REQUIREMENTS:

A. Overview of Project

A comprehensive overview of the reclaimed water application for the project. Outline the distribution system, application site, application method, and permit responsibilities. Use figures to illustrate the general system layout.

B. Staff Listing

A listing of supervisors and key responsible staff at the reuse site, including a description of their accompanying responsibilities. This list shall include each person's phone number, cell phone number, mailing address, and e-mail address (if available).

C. Discharge Permit

A complete copy of the active ground water discharge permit issued by this Division shall be inserted into the EMP.

D. Reuse Provider - User Agreement (If Applicable)

A copy (if applicable) of the reuse agreement between the reclaimed water supplier and the user/permit holder. This agreement should include an updatable copy of the reclaimed water quality analysis and special restrictions that may be in place on the reuse.

E. Communication Procedure

The communication procedure(s) between all parties involved in the transfer of reclaimed water, storage of reclaimed water, and use of reclaimed water shall be outlined in the EMP.

F. Hygiene

A brief document describing the proper hygiene of working with reclaimed water. This document should be written in English and any other languages deemed appropriate for the site. (Sample documents are provided in Appendix 4)

G. Reclaimed Water Run-Off Control Plan

1. Identification of areas where a release off the site may occur and how it will be detected (daily rounds, pressure readouts, etc.).

2. Steps that will be taken to control the release.

3. Phone numbers for key personnel involved in the release response plan and persons who are responsible for reporting the release to NDEP.

G. Reclaimed Water Run-Off Control Plan (continued)

4. Description of the permit requirements for reporting a release to NDEP. This includes notification by phone, at (775) 687-4670 as soon as the release is identified and controlled (within 24 hours). Also, a written report on the release (discharge) and the methods used to mitigate the release must be submitted to the NDEP within five days. This report shall list:

   i. the time and date of the discharge;
   ii. exact location and estimated amount of discharge;
   iii. flow path and bodies of water which the discharge reached;
   iv. the specific cause of the discharge; and
   v. the preventive and/or corrective actions taken.

H. Cross Connection and Back Flow Prevention (If applicable)

Summarize the cross connection control plan and back flow prevention plan that has been accepted by the Health Authority and/or water purveyor. Reference all figures that show these controls.

I. Discharge Monitoring Reports (DMR'S)

Outline of the procedure for completing the permit required DMR from field readings and laboratory data sheets. This section shall include a sample DMR to guide the reuser.

RECLAIMED WATER IRRIGATION - GENERAL ITEMS

A. Irrigation Plan

Provide a summary of the irrigation plan for the site(s). This summary shall detail the times of irrigation, the application rates, and flow measuring procedures. Critical focus shall be given to preventing run-off of reclaimed water from the site(s) and reducing reclaimed water ponding. For sites using automated or computer controlled irrigation systems, please include a brief description of how the system operates.

Depending upon the site type and physical location, several items that should be addressed in the irrigation plan are:

1. A plan to avoid irrigation during or just after significant precipitation events.

2. A plan to provide sufficient drying time for soils (after irrigation) before allowing animal grazing. It's recommended that the grazing periods be limited, to the best extent possible, to reduce soil compaction.

3. Plans to harvest crop(s) annually (if applicable).

4. A plan to prevent irrigation on frozen soils or saturated soils.

B. Site Maps

A detailed site map for the irrigation site(s). This map shall delineate the surrounding water courses, storm water controls, buffer zones (if applicable), prevailing wind direction, surrounding dwelling units, and any wells within 250 feet of the reuse site boundary.

C. Irrigation System

Schematic or scaled map of the reuse site that shows the conveyance system and components for the reclaimed water. This includes details on the location of control valves, drain valves, air gaps, flow meters, pumps, and other key components that the reuser will operate and maintain.

D. Ponds

Operation and maintenance plan for the reclaimed water storage ponds (if applicable). Items to address could include water level recording devices and storage volume estimates, algae control, odor control, reclaimed water transfer procedures, free board requirements, berm inspection, weed control, vector control , flow recirculation, notification signage, and mechanical aeration (Note: the generation of aerosols from aeration equipment should be minimized to limit drift).

E. Treatment Systems (if applicable)

The operation and maintenance plans for treatment units that may be required to meet permit limits are to be included in the EMP. This may include such units as sand filters, disinfection systems, or any chemical treatment systems.

F. Crop/Turf Management Plan

It is recommended that management plans addressing maintenance of a healthy crop be summarized in the manual. Items relevant to this pursuit include soil leaching practices, soil amendment applications, soil chemistry monitoring, and other specific procedures for the site's crop. Please contact the local agricultural agency for guidance.

G. Storm Water

Storm water control structure maintenance. This shall include a maintenance program for diversion berms, conveyance ditches, conduits, and pump systems (if applicable).

H. Sampling

Sampling plans required by the permit must be outlined in the EMP. The proper QA/QC for sample preservation, sample holding times, sample containers, and chain of custody

This includes the procedures for collecting a ground water sample from a monitoring well and (if applicable) collecting a reclaimed water samples. Groundwater sampling protocol guidance is available from the Division.

I. Water Balance

Completion of a water balance is required by reuse permits. The procedures for completing the water balance summary for the site(s) must be clearly outlined in the EMP. Completed worksheet "1-B" from Appendix One, or a comparable form, should be included to present the design assumptions and to provide guidance for filling out subsequent reporting forms. Blank worksheets should also be included. Sample forms are attached in Appendix One. Information from these worksheets can be used by the permittee in completing the Annual Report that is typically required to be submitted with the fourth quarter DMR.

J. Nitrogen Balance

Completion of a nitrogen balance is required by reuse permits if the total nitrogen in the effluent is greater than 10 mg/l total nitrogen. The procedures for computing the total amount of nitrogen applied to the site(s) must be clearly outlined in the EMP. This shall include the mass of nitrogen applied from the reclaimed water and fertilizers. Completed Worksheet "2-B" from Appendix Two, or a comparable form, should be included to present the design assumptions and to provide guidance for filling out subsequent reporting forms (Worksheet "2-C" and DMR forms). Blank worksheets should also be included. Sample forms are attached in Appendix Two. Information from these worksheets can be used by the permittee in completing the Annual Report which is typically required to be submitted with the fourth quarter DMR.

K. Signage

Any site using reclaimed water for irrigation or other uses shall post a notice warning the general public to avoid contact with the reclaimed water (NAC 445A.2752). Signage examples are included in Appendix Five for reference. Score cards at golf courses are one option for providing notification to the public that reclaimed water is being used for irrigation.

ADDITIONAL RECLAIMED WATER IRRIGATION ITEMS FOR:

SPRAY IRRIGATION

A. Run-Off Containment Berms

Maintenance plan for containment berms that serve to prevent the surface flow of reclaimed water off the site boundary (NAC 445A.2754) if there is a significant line break or other failure. These berms are site specific requirements and therefore may not apply to your site.

B. Freezing Weather Protection

Depending upon the site location, necessary maintenance items to prevent freezing and damage to the distribution system should be included. Items to address are piping insulation, drains, or valve enclosures.

C. Drinking Water Fountain Protection and Food Serving Areas

Plans to cover or protect drinking water fountains or water stations located on the reuse site prior to the start of irrigation shall be included. Additionally, plans to shield areas where food is handled should be presented.

D. Buffer Zone Controls

Describe the required buffer zones for the quality of reclaimed water used (see table on next page). Also, list procedures for maintaining spray irrigation within these zones. The irrigation plan should control the drifting of aerosols beyond the buffer zones (NAC 445A.2754).

E. Irrigation Scheduling

Spray irrigation under Category B, C, and D criteria (see regulations) should be conducted during the nighttime hours at public areas (parks, golf courses, etc.) and the public shall be restricted from entering the site during the irrigation period.

Treated effluent irrigation for golf courses shall primarily take place during times after the course is closed and shall cease one hour before the course opens for play in the morning. The irrigation system can be operated briefly during daylight hours when golfers are not present or approaching provided the operator ensures that the public are not exposed to effluent spray or wet grass. Daytime irrigation system operation or hand watering shall be supervised at the site of irrigation by course personnel at all times.

Specific areas within the site that are first accessed (example: first few holes on golf course) by the public should be irrigated during the initial stages of the watering cycle to allow drying time before the public is permitted to enter.

F. Agricultural Irrigation

All irrigation shall ensure that the public is not exposed to effluent spray. Appropriate buffers shall be maintained according to Category of effluent used. All sites shall be fenced and posted.

G. Spray Irrigation with Reclaimed Water: Category B, C, D, and E

1. Plans to control public *access* to the irrigation site during times of reclaimed water application are required. Relevant items include fencing, adherence to the required buffer zones (if applicable), and notification of reclaimed water usage. The quality of reclaimed water will dictate the level of access controls (see Table next page) .

2. Plans to control public *contact* with reclaimed water at the site are required. Relevant items include prevention of ponded water, notification signage, irrigation scheduling (ex. night time irrigation), and notification of reclaimed water usage on scorecards, signage or other related documents available to the public. Quality of reclaimed water will dictate level of contact controls required (see Table next page).

Category B	Category C	Category D	Category E
Public Access is Controlled. Human contact with reclaimed water cannot reasonably be expected to occur.	Public Access is Controlled. Human contact with reclaimed water does not occur.	Public Access is prohibited during irrigation periods. No human contact due to site isolation.	Public Access is prohibited during irrigation periods. No human contact due to site isolation.
Areas covered in all categories, plus parks, playgrounds, commercial lawns, and residential lawns.	Golf courses, green belts, cemetery, and other areas	Pasture Lands, other agricultural uses	Pasture Lands, other agricultural uses
No Buffer Zone	**100 ft. Buffer Zone**	**400 ft. Buffer Zone**	**800 ft. Buffer Zone**
30 day Fecal Coliform Geometric Mean equal to or less than: 2.2 mpn (cfu)/100ml. Daily Max: 23 mpn (cfu)/100 ml	**30 day Fecal Coliform Geometric Mean equal to or less than: 23 mpn (cfu)/100ml. Daily Max: 240 mpn (cfu)/100 ml**	**30 day Fecal Coliform Geometric Mean equal to or less than: 200 mpn (cfu)/100ml. Daily Max: 400 mpn (cfu) /100ml**	**No Limit**

ADDITIONAL RECLAIMED WATER IRRIGATION ITEMS FOR:

SURFACE IRRIGATION

A. FLOOD IRRIGATION:

1. Irrigation Methodology

   Operational plan(s) for flow distribution. Relevant items to address include promoting even spreading of reclaimed water over the site(s), reducing soil erosion at the distribution points, and operation of the tailwater recovery system operation (if applicable).

2. Containment Berms and Detention Areas

   A maintenance plan and inspection schedule for containment berms and detention areas (NAC 445A.2754) that are in place to prevent the run-off of the reclaimed water from the site(s) is required.

B. DRIP IRRIGATION

1. Irrigation Methodology

   Operational plan for flow distribution. Relevant items include site inspections (checking for line breaks, etc.) and emitter line maintenance (clogging controls).

C. SUBSURFACE IRRIGATION

The operation of the subsurface irrigation system shall be such that no surfacing or ponding of treated effluent occurs. All piping and control valves shall be properly identified as reclaimed water appurtenances (purple coloring, reclaimed water wording, etc.).

Specific tasks for freezing protection shall be conducted as needed.

CONSTRUCTION USAGE

A. DUST CONTROL

1. Fecal Coliform Levels

The typical minimum fecal coliform limits for this application are 200mpn (cfu)/100 ml for the 30 day geometric mean and 400 mpn (cfu)/100 ml for a daily maximum.

2. Application Items

Plans for controlling the application rate shall address the prevention of ponded reclaimed water. Also, a plan to control the generation of aerosols and the migration of aerosols from the site(s) should be developed. Methods to prevent the application of reclaimed water near water courses (rivers, streams, and lakes) must be presented.

3. Reclaimed Water Dust Control Trucks

Tank trucks and other equipment that hold reclaimed water shall be properly identified with notification signs. **Tank trucks that carry reclaimed water shall not be used to carry potable water.** It is recommended that the tanks be cleaned and disinfected after the project is complete. Please consult the State or local health authority on rules that may be in place for this criteria

INDUSTRIAL USAGE

A. COOLING WATER

1. Fecal Coliform Level

   The typical minimum fecal coliform limits for this application are 2.2 mpn (cfu)/ 100 ml for a 30 day geometric mean and 23 mpn (cfu)/100 ml for a daily maximum. .

2. Application Items

   List operational controls to reduce aerosol drift.

   NDEP recommends that facilities institute operational methods for treatment (lime addition, alum, etc.) to handle scaling, corrosion, fouling, and biological growth throughout the system. This will help reduce line clogging and other system problems. Also, if algae growth is a concern, chlorine can be used to control algae growth provided the water is not discharged to a water course. This should also help reduce the formation of Legionella.

OTHER USES OF RECLAIMED WATER

A. Site specific management plans for the use of reclaimed water will be considered on a case by case basis with appropriate controls and requirements determined by the NDEP.

WTS-1B: APPENDIX ONE

PLANT CONSUMPTIVE USE WORKSHEET

The consumptive use equation for determining the crop's water requirement takes into account precipitation, evapotranspiration, the efficiency of the irrigation system, and the salt tolerance of the plant species. The salt tolerance of the plant species is used to calculate the leaching requirement (Lr) to remove excess salts from the root zone. Excess salts within the soil cause the plant cells to expend more energy adjusting the salt concentration within the plant tissues, and therefore, less energy is available for vigorous plant growth. The hydraulic loading rate and the TDS to ECw conversion equation included below are derived from Wastewater Engineering: Treatment, Disposal, and Reuse, (Metcalf and Eddy, 1991), the equation for the leaching requirement is from the Nevada Irrigation Guide, (USDA, Soil Conservation Service, 1981).

$$Lw_{(c)} = \frac{(ET-P)}{[E \times (1-Lr)]} \qquad Lr = \frac{ECw}{[(5 \times ECe)-ECw]}$$

where:

- $Lw_{(c)}$ = Allowable Hydraulic Loading Rate Based on Crop Water Needs (in/yr);
- ET = Evapotranspiration Rate (in/yr);
- P = Precipitation Rate (in/yr);
- Lr = Leaching Requirement (%, expressed as a fraction);
- E = Efficiency of Irrigation System (%, expressed as a fraction)
  For example: 75% = 75/100 = 0.75; example efficiencies are included below;
- ECe = Salinity Tolerance of Plant Crop (mmho/cm or dS/m)[1];
- ECw = Salinity of Applied Effluent (mmho/cm); If TDS is supplied by the laboratory, see conversion below; and
- TDS = Average Total Dissolved Solids in Applied Effluent (mg/l).

"ET" - Evapotranspiration

Evapotranspiration is defined as the "loss of water from the soil both by evaporation and by transpiration from the plants growing thereon" (Websters Dictionary, 1990). Since different plants transpire at different rates, a crop coefficient (Kc) can be used to modify the potential ET for a particular area. Values for Kc vary depending upon the geographical location of the crop, and the species grown. If a crop coefficient can be determined, when multiplied by the potential ET rate, the result is a more accurate estimate of ET for an irrigation site. The Division recommends that reusers contact local agriculture representatives identified in Appendix Five for further crop-specific and regional information.

"E" - Irrigation Efficiency

The irrigation system efficiency is related to how effective the method is in delivering the irrigation water equally to all parts of the crop. Example values for efficiency are[4]:

Sprinkler Irrigation Type	Application Efficiency	Surface Irrigation Type	Application Efficiency
Solid Set	0.70 - 0.80	Narrow Graded Border (< 15' wide)	0.65 - 0.85
Portable Hand Move		Wide Graded Border (<100' wide)	0.65 - 0.85
Wheel Roll		Level Border	0.75 - 0.90
Center Pivot or Traveling Lateral		Straight or Graded Contour Furrows	0.70 - 0.85
Traveling Gun		Drip	0.70 - 0.85

"ECe" - Salinity Tolerance of Plant Crop

The plant salt tolerance is crop-specific, and can be obtained from the local Extension Service, literature, or other reputable sources. The low end of the range identifies the ECe value which would result in a 0% reduction of crop yield. The upper end of the range identifies the ECe value which could result in a 25% reduction of crop yield[4].

Example ECe's:

Annual Ryegrass[2] = 3 to 6 mmho/cm or dS/m
Perennial Ryegrass[2,4] = 5.6 to 8.9 mmho/cm or dS/m
Bermudagrass[2,4] = 6.9 to 10.8 mmho/cm or dS/m
Tall Fescue[2,4] = 3.9 to 8.6 mmho/cm or dS/m
Alfalfa[3,4] = 2.0 to 5.4 mmho/cm or dS/m

"ECw" - Salinity of Applied Effluent

Direct measurement of ECw is typically preferred. However, if the laboratory has supplied the reuser with a concentration of TDS, an approximate conversion[4] is ECw ≈ TDS ÷ 640. This conversion is considered accurate within 10%. The value for ECw or TDS is obtained from the treatment plant supplying the effluent. For site design, an average value can be used. For completion of the required annual balance report, the actual analytical results from Discharge Monitoring Reports should be used.

(1) For clairty in this document, the unit for electrical conductivity (EC) is expressed as mmho/cm. However, EC can also be expressed in decisiemens per meter, dS/m.
1 mmho/cm = 1 dS/m

(2) Wastewater Reuse for Golf Course Irrigation, US Golf Association, 1994.

(3) Nevada Irrigation Guide, USDA Soil Conservation Service, 1981.

(4) Wastewater Engineering: Treatment, Disposal, and Reuse, (Metcalf and Eddy, 1991)

Worksheet 1-A

CONSUMPTIVE USE REQUIREMENT WORKSHEET:
Maximum Loading Rate Based on Plant Water Use Requirements

Page _____ of _____ Crop Type = _____

$Lw_{(c)} = \frac{(ET-P)}{[E \times (1-Lr)]}$; $Lr = \frac{ECw}{[(5 \times ECe)-ECw]}$; $ECw \approx TDS \div 640$

(A) Annual Evapotranspiration (ET, in/yr) = _____
(Multiply by Crop Coefficient (Kc) if value is known)

(B) Annual Precipitation (P, in/yr) = _____

(C) (A) - (B) = _____ (in/yr)

(D) Salinity of Applied Effluent (ECw, mmho/cm) or ≈ (TDS, mg/l) ÷ 640 = _____
(Indicate which method was used to determine ECw, Direct Measurement or Approximation by Calculation.)

(E) Salinity Tolerance of Plant Crop (ECe, mmho/cm) = _____

(F) 5 x (E) = _____ (mmho/cm)

(G) (F) - (D) = _____ (mmho/cm)

(H) Leaching Requirement (Lr, %, expressed as a fraction) = (D) ÷ (G) = _____

(I) 1 - (H) = _____

(J) Efficiency of Irrigation System (E, %, expressed as a fraction) = _____

(K) (J) x (I) = _____

(L) (C) ÷ (K) = $Lw_{(c)}$ = _____ (inches/year)

If the water use rate calculated in ("L") above is the lowest application volume calculated between the annual Consumptive Use Limit (This Worksheet) and the Nitrogen Limit (Worksheet 2-A), then fill out Worksheet 1-B to estimate the planned maximum daily flow for the site.

Worksheet 1-B

CONSUMPTIVE USE REQUIREMENT WORKSHEET:
Maximum Loading Rate Based on Plant Water Use Requirements

Page _____ of _____ Crop Type = _____

$Lw_{(c)} = \frac{(ET-P)}{[E \times (1-Lr)]}$; $Lr = \frac{ECw}{[(5 \times ECe)-ECw]}$; $ECw \approx TDS \div 640$

Monthly values for evapotranspiration are dependent on the crop type and regional area of the site, as well as the crop coefficient if known. Monthly precipitation is also regional. The values for ET and P can be obtained from the local extension service, literature, or other reputable source. Please see the explanation in the "WTS-1B: Appendix One" text for futher discussion of crop coefficients.

To calculate the monthly value for $Lw_{(c)}$, perform the calculation for each month as outlined in Worksheet 1-A, and input the result in the table below. Since this form is crop-specific, a value of zero is acceptable when the crop is not in season; however, use of a zero should be explained.

Million Gals/Mo = $Lw_{(c)}$ in/mo x _____ ac ÷ 12 in/ft x 43,560 ft^2/ac x 7.481 gals/ft^3 ÷ 1,000,000
(Enter and use the number of acres for the crop type being irrigated)

MGD (Million gallons/day) = M Gallons/mo ÷ Days/mo

Month	Days/Mo	ET (in/mo)	P (in/mo)	$Lw_{(c)}$ (in/mo)	M Gals/Mo	MGD
Jan	31					
Feb	28					
Mar	31					
Apr	30					
May	31					
Jun	30					
Jul	31					
Aug	31					
Sep	30					
Oct	31					
Nov	30					
Dec	31					
Totals (in/yr):					Note: These totals should approximate the annual values calculated in Worksheet 1-A	

WTS-1B: APPENDIX TWO

NITROGEN LOADING LIMIT WORKSHEET

The nitrogen loading equation takes into account precipitation, evapotranspiration, plant nitrogen uptake, nitrogen content of the applied effluent, nitrogen denitrification and volitilization in the soils, and allowable percolate nitrogen concentration. The equation included below is from Wastewater Engineering: Treatment, Disposal, and Reuse, (Metcalf and Eddy, 1991)

$$Lw_{(n)} = \frac{[(Cp, mg/l) \times (P\text{-}ET, in/yr)] + [(U, lb/acre\text{-}yr) \times (4.4)]}{[(1\text{-}f) \times (Cn, mg/l)] - (Cp, mg/l)}$$

where:

$Lw_{(n)}$ = Allowable Hydraulic Loading Rate Based on Nitrogen Loading rate (in/yr);
Cp = Total Nitrogen Concentration in Percolating Water (mg/l);
ET = Evapotranspiration Rate (in/yr);
P = Precipitation Rate (in/yr);
U = Nitrogen Uptake Rate by Crop (lb/acre-yr);
4.4 = Combined Conversion Factor;
Cn = Total Nitrogen Concentration in Applied Wastewater (mg/l); and
f = Fraction of Applied Total Nitrogen Removed by Denitrification and Volatilization.

"Cp" - Nitrogen in Percolating Water

A conservative value for Total N in the water that percolates past the root zone (Cp) is 7 mg/l, which is the first "red flag" value for Nitrate as N in monitoring well samples. Setting the Cp limit at a constant value aids in obtaining an hydraulic nitrogen loading rate ($Lw_{(n)}$) which should be protective of groundwater resources. The drinking water standard for Nitrate as N is 10 mg/l, which would be the maximum allowable value for Cp.

"ET" - Evapotranspiration

Evapotranspiration is defined as the "loss of water from the soil both by evaporation and by transpiration from the plants growing thereon" (Websters Dictionary, 1990). Since different plants transpire at different rates, a crop coefficient (Kc) can be used to modify the potential ET for a particular area. Values for Kc vary depending upon the geographical location of the crop, and the species grown. If a crop coefficient can be determined, when multiplied by the potential ET rate, the result is a more accurate estimate of ET for an irrigation site. The Division recommends that reusers contact local agriculture representatives identified in Appendix Five for further crop-specific and regional information.

"U" - Crop Nitrogen Uptake

Plant nitrogen uptake rates (U) are crop-specific, and can be obtained from the local Extension Service, literature, or other reputable sources. Using the accepted value for U in this equation assumes that the harvested portion of the crop is removed from the site. If plant cuttings are not removed from the area, then the amount of nitrogen removed by uptake should be offset by the amout of nitrogen returned to the soil by decomposing cutting materials. If alfalfa, or another legume, is the site's crop, then similar considerations should be made for atmospheric nitrogen which is fixed into the soil by alfalfa. A discussion with the local agricultural extension service is recommended prior to finalizing a "U" value.

"Cn" - Nitrogen in Applied Wastewater
The total nitrogen in the applied effluent water (Cn) can be obtained from the treatment plant that is supplying the effluent. For site design, an average value can be used. For completion of the required annual balance report, the actual analytical results from Discharge Monitoring Reports shall be used.

"f" - Nitrogen lost to Denitrification and Volatilization
The amount of nitrogen lost to denitrification and volatilization varies depending upon the nitrogen characteristics of the applied wastewater and the microbial activity in the soil. Microbial denitrification, in soils with a sufficient carbon source for the biological activity, may account for as much as 15 to 25 percent of the applied nitrogen during warm, biologically active months. Volatilization of ammonia may be as much as 10 percent, depending upon the ammonia fraction in the total nitrogen applied. (Metcalf & Eddy, 1991) For arid climates, such as Nevada, the value typically used for the "f" term is 0.2.

Nitrogen Addition by Chemical Fertilizers
If the allowable reuse water application volume is limited by plant consumptive use (Worksheet 1-A), nitrogen may need to be added by commercial fertilizer. In the design of a reuse site, and preparation of an EMP, this should be estimated to provide the site operator with a guideline for fertilizer application, in addition to the nitrogen being applied via the treated effluent. **The application of fertilizer must then be incorporated into the required annual report to demonstrate that the application of commercial nitrogen and effluent nitrogen did not exceed the plant crop's uptake rate.**

Worksheet 2-C is designed to be used to provide the Division with the required annual report of effluent and fertilizer usage. Reuse permits require that the annual evaluation of the effluent application include, "the total nitrogen in the applied wastewater, nitrogen from fertilizer applications, nitrogen uptake by plant materials, evapotranspiration rate, precipitation rate, and fraction of applied nitrogen removed by denitrification and volatilization." While Worksheet 2-C does not take precipitation and evapotranspiration into account, the permittee should compare each year's P and ET rates to those that were used during the site design and EMP preparation phases to ensure that the original assumptions remain valid.

Worksheet 2-C can also be utilized as a site management tool to *estimate* the amount of commercial fertilizer which may be required in an upcoming month. However, use of the worksheet in this manner does not preclude the responsible use of good irrigation and nutrient management practices.

Worksheet 2-A

WATER REQUIREMENT DESIGN WORKSHEET:
Maximum Hydraulic Loading Rate Based On Annual Nitrogen Balance Evaluation

Page _____ of _____ Crop Type = _____

$$Lw_{(n)} = \frac{[Cp \times (P-ET)] + (U \times 4.4)}{[(1-f) \times Cn] - Cp}$$

(A) Total Nitrogen in Percolating Water (Cp, mg/l) = _____

(B) Annual Precipitation (P, in/yr) = _____

(C) Annual Evapotranspiration (ET, in/yr) = _____
(Multiply by Crop Coefficient (Kc) if value is known)

(D) (B) - (C) = _____ (in/yr) (Note: In Nevada, P is less that ET; therefore a negative number is correct to use in this worksheet.)

(E) (A) x (D) = _____

(F) Crop Nitrogen Uptake (U, lb/ac-yr) = _____

(G) (F) x 4.4 = _____

(H) (E) + (G) = _____

(I) Fraction of Applied Total Nitrogen Lost to Denitrification and Volatilization (f) = _____

(J) 1- (I) = _____

(K) Total Nitrogen in Applied Effluent (Cn, mg/l) = _____

(L) (J) x (K) = _____

(M) (L) - (A) = _____

(N) (H) ÷ (M) = $Lw_{(n)}$ (inches/year) = _____

If the Water Use Rate calculated in ("N") above is the lowest application volume calculated for the annual Consumptive Use Limit (Worksheet 1-A) or the Nitrogen Limit (This Worksheet), then fill out Worksheet 2-B to estimate the planned maximum daily flow for the site.

Worksheet 2-B

WATER REQUIREMENT DESIGN WORKSHEET:
Maximum Hydraulic Loading Rate Based On Annual Nitrogen Balance Evaluation

Page _____ of _____ Crop Type = _____

$$Lw_{(n)} = \frac{[Cp \times (P-ET)] + (U \times 4.4)}{[(1-f) \times Cn] - Cp}$$

Monthly values for evapotranspiration are dependant on the crop type and regional area of the site, as well as the crop coefficient if known. Monthly precipitation is also regional. The values for ET and P can be obtained from the local extension service, literature, or other reputable sources. Please see the explanation in the "WTS-1B: Appendix Two" text for futher discussion of crop coefficients.

The monthly value of the crop nitrogen uptake (U) can be calculated according to the equation included on the Table. Please see the discussion in the "WTS-1B: Appendix Two" text regarding "U" values for alfalfa crops or sites that do not remove crop cuttings. If a different distribution of monthly "U" is used, due to circumstances such as germination or dormancy periods, then provide documentation explaining the difference.

To calculate the monthly value for $Lw_{(n)}$, perform the calculation for each month as outlined in Worksheet 2-A, using the monthly values for "U", "P", "ET", and "Cn", and input the result in the table below. Since this form is crop-specific, a value of zero is acceptable when the crop is not in season; however, use of a zero should be explained.

Monthly U (lb/ac-mo) = U (lb/ac-yr) x ET(in/mo) ÷ ET (total in/yr)

Million Gallons Per Month = $Lw_{(c)}$ in/mo x _____ (ea. crop type) # acres ÷ 12 in/ft x 43,560 ft^2/ac x 7.481 gallons/ft^3 ÷ 1,000,000

MGD (Million gallons/day) = M Gallons/mo ÷ Days/mo

Month	Days/Mo	P (in/mo)	ET (in/mo)	U (lb/ac-mo)	$Lw_{(n)}$ (in/mo)	M Gals/Mo	MGD of Reclm'd Water
Jan	31						
Feb	28/29						
Mar	31						
Apr	30						
May	31						
Jun	30						
Jul	31						
Aug	31						
Sep	30						
Oct	31						
Nov	30						
Dec	31						
	Totals:					Note: The totals for P, ET and $Lw_{(n)}$ should approximate the annual values used or calculated in Worksheet 2-A	

Worksheet 2-C: *Regardless of the limiting hydraulic loading rate that was defined during the design phase, Worksheet 2-C is designed to be used to provide the Division with the required annual report of effluent and fertilizer usage.*

Effluent N Applied = _____ x _____ (mg/l) x 8.34 x _____ ÷ _____ x
(lb/ac-mo) MGD Applied Effluent N Conc. # days/mo # Acres (1 -"f") (i.e. 0.2.)

Fertilizer N Applied = _____ Monthly Fertilizer used (lbs/mo) x _____ % N in Fertilizer (as a fraction) ÷ _____ acres
(lb/ac-mo)

Crop Name and Nitrogen Uptake Requirement = _____ (lbs/ac-yr)

Month	Days/Mo	Million Gallons Applied (mo)	MGD of Irrigation Water Applied	Effluent N Concentration (mg/l)	Effluent N Applied (lb/ac-mo)	Fertilizer N Applied (lb/ac-mo)	Total N Applied (Effl. N + Fert. N) (lb/ac-mo)
Jan	31						
Feb	28/29						
Mar	31						
Apr	30						
May	31						
Jun	30						
Jul	31						
Aug	31						
Sep	30						
Oct	31						
Nov	30						
Dec	31						
						Total** =	

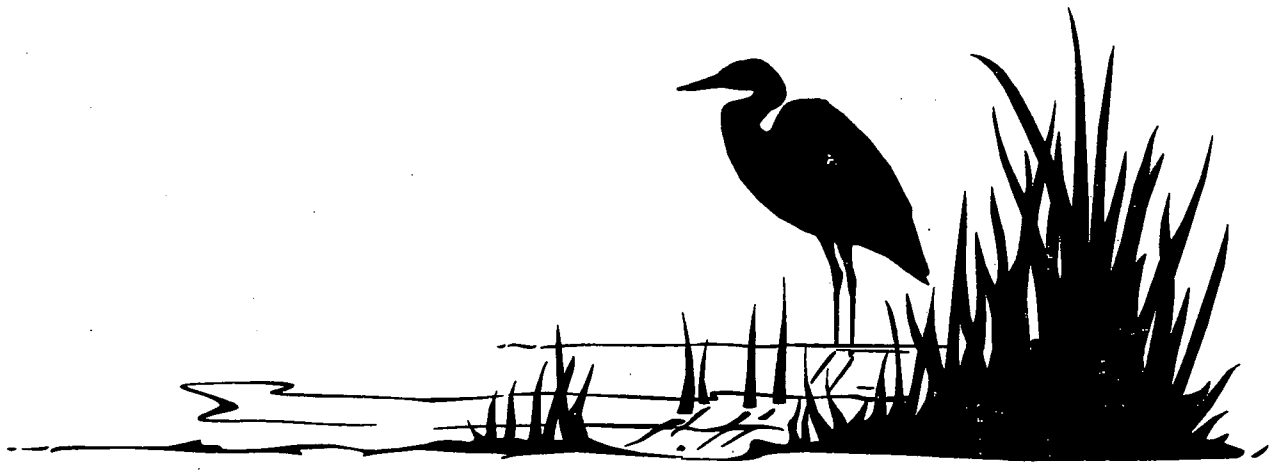
** The Total N Applied to the crop should be less than the crop's Nitrogen Uptake Requirement. Please see your permit for directions if it is not.

APPENDIX THREE

WORKER HYGIENE FACT SHEETS

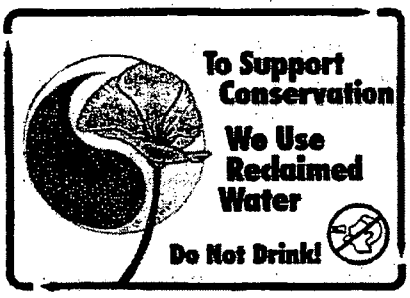
This project area uses reclaimed wastewater for irrigation. This reclaimed wastewater comes from the sewage treatment plant and meets the standards required for this level of reuse. Potential risks of disease transmission from the use of the reclaimed water is low, however, some general guidelines (listed below), should be followed protect you from becoming ill when working with reclaimed water:

1. Do not drink the reclaimed water or use the reclaimed water for washing.
2. Always wash hands and face with clean water and soap before eating, smoking, or drinking.
3. Wear rubber gloves when working on the irrigation system.
4. Try to keep the irrigation water off your skin and clothes as much as possible.
5. Always treat cuts immediately before continuing with work on the irrigation system.
6. Make sure the area is clear of people that may get sprayed before running the irrigation system.
7. Report any problems to your supervisor that you feel could pose a risk.



APPENDIX FOUR

PUBLIC NOTIFICATION SIGN EXAMPLES



IRRIGATION SIGN

Figure 4.3

IRRIGATION SIGN

Figure 4.4

IRRIGATION SIGN

Figure 4.5

APPENDIX FIVE

REUSE REFERENCE LISTS

Literature References For Reclaimed Water Use Management

1. "Guidelines for Using Disinfected Recycled Water", Awwa California-Nevada Section, 1997 & 1984.

2. "Guidelines for Water Reuse", U S Environmental Protection Agency, 1992 and 2004.

3. "Land Treatment of Municipal Wastewater", U S Environmental Protection Agency, 1981.

4. "Nevada Irrigation Guide", US Department of Agriculture, Soil Conservation Service, 1981.

5. Wastewater Reuse For Golf Course Irrigation, US Golf Association, 1994, Lewis Publishers.

6. Water Reuse Manual of Practice, Water Environment Federation 1989.

7. Wastewater Engineering Treatment, Disposal and Reuse, Metcalf & Eddy, 1991, Mcgraw-hill Publishers.

8. Irrigation with Reclaimed Municipal Wastewater- A guidance manual. G.S. Pettygrove and T. Asano, 1985, Lewis Publishers.

Contacts for Technical and Regulatory Guidance

1. **Nevada Division of Environmental Protection, Bureau of Water Pollution Control**
   901 South Stewart Street, Suite 4001, Carson City, NV, 89701 .....(775) 687-4670

2. **Nevada Divsion of Water Resources**
   901 South Stewart Street, Carson City, NV 89701.....(775) 687-4380

3. **Nevada Division of Health**
   901 South Stewart Street, Carson City, NV 89701 .....(775) 687-9521

4. **Desert Research Institute**
   7010 Dandini Boulevard, Reno, NV 89506.....(775) 673-7300

5. **Natural Resource Conservation Service (NRCS)**
   1528 U.S. Highway 395, Minden, NV 89410.....(775) 883-2623

   5301 Longley Lane, Building F, Room 201, Reno, NV 89511 .....(775) 784-5875

6. **University of Nevada Cooperative Extension**
   2345 Redrock Street, Suite 100, Las Vegas, NV 89146-3160 .....(702) 222-3130

7. **U.S. Agriculture Department**
   920 Valley Road, Reno, NV 89512 .....(775) 784-6057

8. **Center for Urban Water Conservation - UNLV Dept. of Biology**
   Las Vegas, Nevada 89157-4004 .....(702) 895-3853

APPENDIX SIX

NEVADA ADMINISTRATIVE CODE - REUSE REGULATIONS

Use of Treated Effluent for Irrigation

Use of Treated Effluent

NAC 445A.274 Definitions. (NRS 445A.425) As used in NAC 445A.274 to 445A.280, inclusive, unless the context otherwise requires, the words and terms defined in NAC 445A.2741 to 445A.2748, inclusive, have the meanings ascribed to them in those sections.
(Added to NAC by Environmental Comm'n by R063-04, eff. 10-6-2004)

NAC 445A.2741 "Area of use" defined. (NRS 445A.425) "Area of use" means a site, or an area of land, where treated effluent is in use pursuant to NAC 445A.274 to 445A.280, inclusive.
(Added to NAC by Environmental Comm'n by R063-04, eff. 10-6-2004)

NAC 445A.2742 "Buffer zone" defined. (NRS 445A.425) "Buffer zone" means a bounded area adjacent to, and surrounding, an area of use, that is subject to the provisions of NAC 445A.2756.
(Added to NAC by Environmental Comm'n by R063-04, eff. 10-6-2004)

NAC 445A.2743 "Graywater" defined. (NRS 445A.425) "Graywater" has the meaning ascribed to it in NAC 444.7616.
(Added to NAC by Environmental Comm'n by R063-04, eff. 10-6-2004)

NAC 445A.2744 "Impoundment" defined. (NRS 445A.425) "Impoundment" means a lake, reservoir or lined holding basin.
(Added to NAC by Environmental Comm'n by R063-04, eff. 10-6-2004)

NAC 445A.2745 "Spray irrigation" defined. (NRS 445A.425) "Spray irrigation" means irrigation using sprinklers that are located above the ground surface.
(Added to NAC by Environmental Comm'n by R063-04, eff. 10-6-2004)

NAC 445A.2746 "Subsurface irrigation" defined. (NRS 445A.425) "Subsurface irrigation" means irrigation using an underground distribution system.
(Added to NAC by Environmental Comm'n by R063-04, eff. 10-6-2004)

NAC 445A.2747 "Surface irrigation" defined. (NRS 445A.425) "Surface irrigation" means irrigation using a flood irrigation system or a drip irrigation system. The term does not include spray irrigation.
(Added to NAC by Environmental Comm'n by R063-04, eff. 10-6-2004)

NAC 445A.2748 "Treated effluent" defined. (NRS 445A.425) "Treated effluent" means sewage that has been treated by a physical, biological or chemical process. The term does not include graywater.
(Added to NAC by Environmental Comm'n by R063-04, eff. 10-6-2004)

NAC 445A.2749 Limitation on meaning of "agricultural purposes." (NRS 445A.425) For the purposes of NAC 445A.274 to 445A.280, inclusive, the term "agricultural purposes" does not include the growing of crops for human consumption.
(Added to NAC by Environmental Comm'n by R063-04, eff. 10-6-2004)

NAC 445A.275 General requirements and restrictions. (NRS 445A.425)

1. A person shall not use treated effluent unless:

(a) The person has:

(1) Received the approval of the Division of a plan for the management of effluent; and

(2) Obtained a permit pursuant to NAC 445A.228 to 445A.263, inclusive; and

(b) The treated effluent has received at least secondary treatment.

2. As used in this section:

(a) "Five-day inhibited biochemical oxygen demand" means the amount of dissolved oxygen required to stabilize the carbonaceous decomposable organic matter by aerobic bacterial action at 20 degrees centigrade for 5 days.

(b) "Plan for the management of effluent" means:

(1) An effluent management plan; or

(2) A site specific management plan.

(c) "Secondary treatment" means the treatment of sewage until the sewage has, calculated as a 30-day average:

(1) A 5-day inhibited biochemical oxygen demand concentration of 30 milligrams per liter or less;

(2) A total suspended solids concentration of 30 milligrams per liter or less; and

(3) A pH of 6.0 to 9.0 SU.

(Added to NAC by Environmental Comm'n, eff. 9-13-91; A by R063-04, 10-6-2004)

NAC 445A.2752 Signs: Required placement and contents. (NRS 445A.425)

1. A person using treated effluent shall post signs along the outer perimeter of the:

(a) Area of use; and

(b) Buffer zone, if any.

2. The signs must provide reasonable notice to the general public that:

(a) Treated effluent is in use; and

(b) Contact with the effluent should be avoided.

(Added to NAC by Environmental Comm'n by R063-04, eff. 10-6-2004)

NAC 445A.2754 Irrigation: Requirements and restrictions. (NRS 445A.425)

1. A person using treated effluent for irrigation shall not:

(a) Allow the effluent to run off the site being irrigated.

(b) Except as otherwise provided in NAC 445A.2768, use treated effluent to irrigate crops intended for human consumption.

2. A person using treated effluent for spray irrigation shall conduct the irrigation in a manner that inhibits the treated effluent spray from drifting beyond the area of use or the buffer zone, if any.

(Added to NAC by Environmental Comm'n by R063-04, eff. 10-6-2004)

NAC 445A.2756 Buffer zones: Size; boundaries; restriction. (NRS 445A.425)

1. Except as otherwise provided in NAC 445A.2766, 445A.2768 and 445A.2771, the Division will establish the size of a buffer zone.

2. The inner boundary of a buffer zone is determined by measuring a distance equal to the size of the buffer zone from:

(a) A boundary line of the property on which the site is located;

(b) A sign posted pursuant to NAC 445A.2752 informing the public of the presence of treated effluent; or

(c) Any point where the property is open to public access, as determined by the Division.

3. Except as otherwise provided in NAC 445A.2754, a buffer zone must be kept free of treated effluent.

(Added to NAC by Environmental Comm'n by R063-04, eff. 10-6-2004)

NAC 445A.276 Reuse categories: Requirements for bacteriological quality of effluent. (NRS 445A.425)

1. Treated effluent being used for an activity approved for a reuse category must meet the following requirements for bacteriological quality for that category:

	Total Coliform	Fecal Coliform			
	c.f.u. or mpn/100 ml	c.f.u. or mpn/100ml			
Reuse Category	A	B	C	D	E
30-day geometric mean	2.2	2.2	23	200	No Limit
Maximum daily number	23	23	240	400	No Limit

2. As used in this section, "c.f.u. or mpn/100ml" means colony forming units or most probable number per 100 milliliters of the treated effluent.

(Added to NAC by Environmental Comm'n, eff. 9-13-91; A by R063-04, 10-6-2004)

NAC 445A.2762 Reuse category A: Approved uses. (NRS 445A.425) Treated effluent that meets the requirements for bacteriological quality set forth in NAC 445A.276 for reuse category A may be used for:

1. Spray irrigation of land used as a cemetery, commercial lawn, golf course, greenbelt or park even if:
(a) Public access to the area of use is not controlled; and
(b) Human contact with the treated effluent can reasonably be expected to occur.
2. An impoundment in which swimming is prohibited even if:
(a) Public access to the impoundment is not controlled; and
(b) Human contact with the treated effluent can reasonably be expected to occur.
3. Any activity approved for reuse category B, C, D or E.
4. Any other use that is approved by the Division.

(Added to NAC by Environmental Comm'n by R063-04, eff. 10-6-2004)

NAC 445A.2764 Reuse category B: Approved uses. (NRS 445A.425) Treated effluent that meets the requirements for bacteriological quality set forth in NAC 445A.276 for reuse category B may be used for:

1. Spray irrigation of land used as a cemetery, commercial lawn, golf course, greenbelt or park if:
(a) Public access to the area of use is controlled; and
(b) Human contact with the treated effluent cannot reasonably be expected to occur.
2. Subsurface irrigation of land used as a commercial lawn, greenbelt or park.
3. Cooling water in an industrial process.
4. Fire-fighting operations in an urban area if approved by the fire department, fire protection district or other fire-fighting agency in whose district the fire occurs.
5. Any activity approved for reuse category C, D or E.
6. Any other use that is approved by the Division.

(Added to NAC by Environmental Comm'n by R063-04, eff. 10-6-2004)

NAC 445A.2766 Reuse category C: Approved uses. (NRS 445A.425)

1. Treated effluent that meets the requirements for bacteriological quality set forth in NAC 445A.276 for reuse category C may be used for:

(a) Spray irrigation of land used as a cemetery, golf course or greenbelt if:

(1) Public access to the area of use is controlled;

(2) Human contact with the treated effluent does not occur; and

(3) A buffer zone of not less than 100 feet is maintained.

(b) Watering of nursery stock if public access to the area of use is controlled.

(c) Establishment, restoration or maintenance of a wetland if public access to the wetland is controlled.

(d) Washing of gravel used in concrete mixing.

(e) Feed water for a boiler.

(f) An impoundment if:

(1) Public access to the impoundment is controlled; and

(2) Human contact with the treated effluent cannot reasonably be expected to occur.

(g) Fire fighting of forest or other wildland fires if approved by the fire department, fire protection district or other fire-fighting agency in whose district the fire occurs.

(h) Any activity approved for reuse category D or E.

(i) Any other use that is approved by the Division.

2. As used in this section:

(a) "Nursery stock" has the meaning ascribed to it in NRS 555.23562.

(b) "Wetland" has the meaning ascribed to it in NRS 244.388.

(Added to NAC by Environmental Comm'n by R063-04, eff. 10-6-2004)

NAC 445A.2768 Reuse category D: Approved uses. (NRS 445A.425)

1. Treated effluent that meets the requirements for bacteriological quality set forth in NAC 445A.276 for reuse category D may be used for:

(a) Spray irrigation of land used for agricultural purposes if:

(1) Public access to the area of use is prohibited; and

(2) A buffer zone of not less than 400 feet is maintained.

(b) Surface irrigation of land used:

(1) As greenbelt if:

(I) Public access to the area of use is prohibited; and

(II) Human contact with the treated effluent does not occur.

(2) For agricultural purposes; and

(3) For the cultivation of fruit-bearing trees or nut-bearing trees.

(c) Subsurface irrigation of land used for agricultural purposes if public access is controlled.

(d) Dust control.

(e) Soil compaction.

(f) Flushing sewer lines.

(g) An impoundment if:

(1) Public access to the impoundment is prohibited;

(2) All human activities involving contact with the treated effluent are prohibited; and

(3) Human contact with the treated effluent does not occur.

(h) Any activity approved for reuse category E.

(i) Any other use approved by the Division.

2. As used in this section, "dust control" means the program required pursuant to NAC 445B.22037 to prevent controllable particulate matter from becoming airborne.

(Added to NAC by Environmental Comm'n by R063-04, eff. 10-6-2004)

NAC 445A.2771 Reuse category E: Approved uses. (NRS 445A.425) Treated effluent that meets the requirements for bacteriological quality set forth in NAC 445A.276 for reuse category E may be used for:

1. Spray irrigation of land used for agricultural purposes if:

(a) Public access to the area of use is prohibited; and

(b) A buffer zone of not less than 800 feet is maintained.

2. Any other use that is approved by the Division.

(Added to NAC by Environmental Comm'n by R063-04, eff. 10-6-2004)

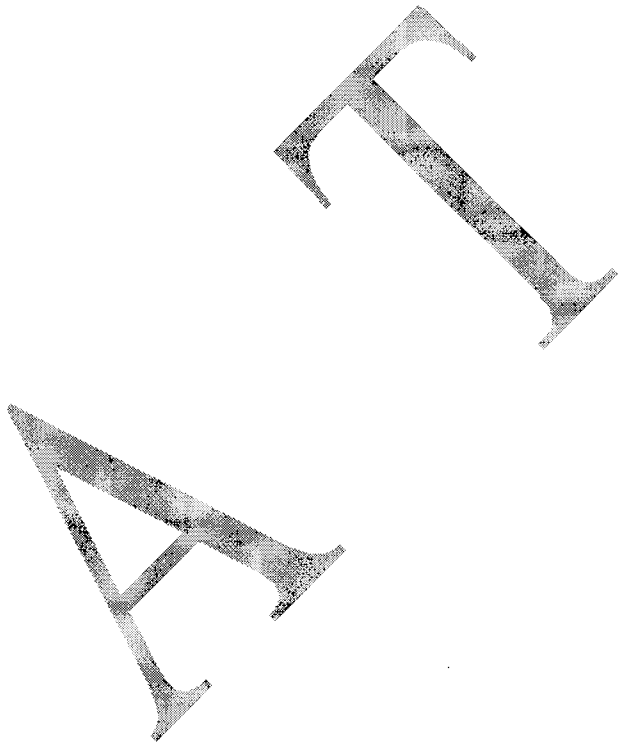
NAC 445A.279 Determining quality of effluent: Storage reservoirs excluded from treatment process. (NRS 445A.425) For the purpose of determining the quality of effluent, storage reservoirs do not constitute part of the treatment process.

(Added to NAC by Environmental Comm'n, eff. 9-13-91)—(Substituted in revision for NAC 445.178)

NAC 445A.280 Waiver or modification of requirements. (NRS 445A.425) The Director may waive compliance with or modify any requirement of NAC 445A.274 to 445A.280, inclusive, for a specific proposed use of treated effluent upon his determination that because of the size, type or location of the proposed use, the waiver or modification is consistent with the policy set forth in NRS 445A.305.

(Added to NAC by Environmental Comm'n, eff. 9-13-91; A by R063-04, 10-6-2004)

APPENDIX D-TMWA'S 8A "RESENTIAL POTABLE AND NON-POTABLE WATER SEPERATION," TMWAS'S "BACKFLOW PREVENTION AND CROSS-CONNECTION CONTROL PROGRAM" AND WASHOE COUNTY STANDARDS FOR RECLAIMED WATER



BACKFLOW PREVENTION AND CROSS-CONNECTION CONTROL PROGRAM

FOR

TRUCKEE MEADOWS WATER AUTHORITY

Amended April 2003

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SECTION 1 PURPOSE, LEGAL AUTHORITY, RESPONSIBILITY

PURPOSE

The purpose of TMWA's backflow prevention program is:

1. To protect TMWA's potable distribution system against the possibility of actual or potential contaminants or pollutants entering TMWA's potable water system by containing that contamination or pollution within that water customer's private internal water system.
2. To develop and implement an effective, ongoing, consistent backflow prevention program which will comply with Nevada Administrative Codes (NAC) 445A.67185 through NAC 445A.67255, Public Water Systems.
3. To assist in the education of water customers about health (contamination) and non health (pollution) hazards of water use. This, in turn, will promote the elimination of actual and potential cross connections.

LEGAL AUTHORITY

Under Nevada Administrative Code 445A.67185, Public Water Systems, the water purveyor has the primary responsibility for preventing water from unapproved water supplies, or any other substances, from entering the potable public water system. Per NAC 445A.67185, the water purveyor shall

1. Ensure that there are no unprotected connections between the supplies of water, systems for the pumping, storage and treatment of water, and distribution system of the public water system and any source of pollution or contamination pursuant to which any unsafe water or other degrading material can be discharged or drawn into the public water system as a result of backsiphonage or backpressure.
2. Develop and carry out a program for the control of cross-connections that is approved by the health authority.

RESPONSIBILITY

Clear responsibilities exist in the development, implementation and maintenance of an effective backflow prevention and cross-connection control program. TMWA believes that an effective backflow prevention program includes both service protection and internal protection conscientiously followed by all water customers.

TMWA RESPONSIBILITY

TMWA's responsibilities as a purveyor of drinking water include the following:

1. Performing water treatment to ensure all drinking water standards set forth at the State and Federal level are met,
2. Ensuring that drinking water standards are maintained within its distribution system through programs such as flushing and water quality testing

3. Developing, implementing and maintaining a backflow prevention program consisting of service protection at the point where customer services connect to the distribution system.

    a. TMWA's Backflow Prevention Group will review all new service connection requests and all existing service connections to determine when a service connection presents an actual or potential hazard to TMWA's water distribution system.

    b. For the purposes of providing service protection for new or existing water services, TMWA will designate the required type of backflow prevention to comply with NAC 445A and TMWA's policy.

    c. TMWA will designate the installation location for backflow prevention installation.

    d. TMWA will provide Backflow Prevention Installation Requirements and Standards to the water customer or his/her representative.

    e. TMWA will require the water customer to install the designated backflow prevention, by and at the customer's expense, within a length of time determined by TMWA, as a requirement for water service.

    f. TMWA will not authorize water service turn on until backflow prevention has been satisfactorily installed, inspected by a member of the TMWA Backflow Prevention Group and has been tested by a certified tester.

    g. TMWA will terminate an existing water service if, after a reasonable attempt, a satisfactory conclusion to a retrofit of existing services is not achieved. A satisfactory conclusion includes installation which has been inspected and approved by a member of the TMWA Backflow Prevention Group and has been tested by a certified tester.

    h. TMWA will notify water customers of tests due.

    i. TMWA will maintain records and monitor that backflow prevention is properly installed, maintained and tested.

    j. TMWA will periodically reevaluate service connections to assess the degree of hazard posed by the water customer's premise. This will be done by TMWA Backflow Prevention Group whenever there is a change in the customer at a premise or per a schedule acceptable to TMWA.

    k. TMWA will define enforcement actions for any customers that fail to comply with the Backflow Prevention Program.

    l. TMWA is not responsible for detecting, eliminating or controlling cross connections within a customer's water system.

WATER CUSTOMER RESPONSIBILITY

Customers have very clear responsibilities for backflow prevention and cross-connection control. The following measures ensure the quality of the community's water supply as well as ensuring water quality within internal plumbing.

1. Water customers claim ownership, or custody, of potable water once it passes the water meter or point of connection to TMWA's distribution system. Furthermore, customers have the prime responsibility to maintain their internal water piping to ensure that "used water" shall not reverse back into TMWA's distribution system.
2. All costs associated with backflow prevention assemblies shall be borne by the water customer.
3. It is the water customer's responsibility to design the backflow prevention installation to meet all of TMWA's requirements, and to conform with other applicable codes, such as the Uniform Plumbing Code (UPC), the National Fire Protection Association (NFPA) and all city or building codes.
4. The customer shall design his water system (either a new water service or the retrofit of an existing water service) to accommodate pressure losses attributed to the installation of backflow prevention assemblies. This may include installing pumps or renovating existing private water systems.
5. Upon notification from TMWA, the customer shall install, repair, replace or test the backflow prevention assembly within a length of time determined by TMWA.
6. If the backflow prevention assembly is not installed immediately after the meter or point of connection, the water customer shall provide annually in writing to TMWA a declaration that no connections exist, or will be made, between the meter or point of connection and the backflow prevention assembly.
7. The customer shall make all installations and repairs such that the assembly remains in factory working condition.
8. Customers have a responsibility to design, build and maintain their internal private water system per City Building and UPC codes.
9. The water customer shall have the assembly tested per the requirements in this policy.
10. The customer is responsible for any loss or damage resulting from the installation, repair, maintenance, operation, malfunction or vandalism of a backflow prevention assembly.
11. Customers are responsible to notify TMWA of any possible hazards, pollutants or contaminants which may have entered TMWA's distribution system from the customer's internal system.
12. If service protection does not exist or has been installed internal to a customer's internal system, the customer's system shall be available at all reasonable times for inspection or testing by TMWA to determine the existence of unprotected cross connections.
13. Customers have the responsibility to notify TMWA Backflow Prevention Group of the intent to use non potable water on the same premise where TMWA water is being delivered.
14. If non potable water is being used on the customer premises, the customer's water system shall be available at reasonable time for a shut down inspection and test by TMWA to determine the existence of cross connections.

REFERENCES TO OTHER SECTIONS OF THIS POLICY

Enforcement Action

SECTION 2 DEFINITIONS

The following terms are relevant to TMWA's backflow prevention and cross-connection control program. Any term not specifically defined in this section shall revert to the meaning as defined by the Nevada Administrative Code (NAC) 445A – Public Water Systems – and subsequent revisions thereof.

AIR GAP SEPARATION: The term air-gap separation means a physical break between the free flowing end of the supply pipe and the overflow rim of a receiving vessel. The air-gap shall be at least double the diameter of the supply pipe measured vertically above the top rim of the vessel, in no case less than one inch. In certain proximity to walls, the air gap shall be three times the diameter of the supply pipe.

APPROVED BACKFLOW PREVENTION ASSEMBLY: The term "approved backflow prevention assembly" means an assembly which has passed laboratory and field evaluation tests performed by the University of Southern California (USC) Foundation for Cross-Connection Control and Hydraulic Research.

APPROVED WATER SUPPLY: Approved water supply in the context of this policy statement means the treated water supplied by TMWA, the water quality of which is regulated by the State Health Division and the District Health Department.

ATMOSPHERIC VACUUM BREAKER (AVB): An atmospheric vacuum breaker means a vacuum breaker that contains an air inlet valve, a check seat and one or more air inlet ports, in which: 1) The flow of water causes the air inlet valve to close the air inlet ports ; and 2) When the flow of water stops: (a) the air inlet valve falls and forms a check valve against backsiphonage; and (b) the air inlet ports open to allow air to enter and satisfy the vacuum.

AUXILIARY WATER SUPPLY: The term "auxiliary supply" means any water supply on or available to the premises other than the approved water supply.

AWWA STANDARD: The term "AWWA Standard" means an official standard developed by the American Water Works Association (AWWA).

AWWA TEST: The term "AWWA test" is synonymous with the term "test".

BACKFLOW: The term "backflow" shall mean an undesirable flow condition, caused by a differential in pressure that causes the flow of water or other liquids, gases, mixtures or substances into the distribution system of a potable supply of water from any source or sources other than an approved water supply source. Backsiphonage is one cause of backflow. Backpressure is the other cause.

BACKFLOW PREVENTION GROUP: The term "backflow prevention group" means the personnel charged with administration of TMWA's backflow prevention program.

CERTIFIED SPECIALIST: The term "certified specialist" shall mean an individual who is certified to perform cross-connection control and backflow prevention surveys. Certification shall be obtained through the California Nevada Section of the American Water Works Association or through the USC Foundation for Cross-Connection Control and Hydraulic Research. TMWA maintains a list of certified specialists who are eligible to perform surveys for TMWA water customers. Cross-Connection Control Specialist is synonymous with Certified Specialist.

CERTIFIED TESTER: The term "certified tester" shall mean an individual who is certified by the California-Nevada Section of the American Water Works Association, to perform tests on backflow prevention assemblies. In Washoe County, the District Health Department maintains a current list of certified testers.

COMMUNITY'S DRINKING WATER OR COMMUNITY'S WATER DISTRIBUTION SYSTEM: This term means the potable water in TMWA Water Distribution System.

CONSTRUCTION WATER: The term "construction water" shall mean any water, potable or otherwise, which may be used for any construction activity i.e. dust control and grading purposes, mixing concrete etc. Potable water supplied by TMWA for construction purposes shall be protected with backflow prevention as determined by TMWA's backflow prevention group.

CONTAMINATION: The term "contamination" shall mean a degradation of the quality of water by any foreign substance which creates a hazard to the public health, or which may impair the usefulness or quality of the water.

CROSS-CONNECTION: The term "cross-connection" as used in this program means any unprotected actual or potential connection between a potable water system and any source or system containing water or a substance that is not or cannot be approved as safe, wholesome, and potable. By-pass arrangements, jumper connections, removable sections, swivel or changeover assemblies, or other assemblies through which backflow could occur, shall be considered to be cross-connections.

CUSTOMER'S PRIVATE WATER SYSTEM: The term refers to the water customer's private plumbing system within the customer's premises.

DISTRIBUTION SYSTEM: The term shall mean the potable TMWA Water Distribution System.

DISTRICT HEALTH DEPARTMENT: This term refers to the Washoe County Health Department.

DOUBLE CHECK VALVE ASSEMBLY (DC): The term "double check valve assembly" or DC" means an assembly of two internally loaded , independently acting check valves, including tightly closing resilient seated shut-off valves on each end of the assembly and 4 properly located resilient seated test cocks.

DOUBLE CHECK DETECTOR ASSEMBLY: This is a Double Check Valve with a

smaller sized approved bypass containing a specific water meter and an approved double check valve assembly.

FREEZE PROTECTION: The term "freeze protection" as it pertains to this program means an above or below ground enclosure designed with sufficient insulation and heat to prevent the water in a backflow prevention assembly from freezing. Such enclosure shall also allow ready access for maintenance and testing purposes and provide clearances as defined by TMWA Installation Standards.

HEALTH AGENCY: The term "health agency" as it pertains to this program means the Nevada State Health Division.

HEALTH HAZARD: The term "health hazard" shall mean actual or potential threat of contamination to the approved water supply.

INSTALLATION INSPECTION: The term "installation inspection" as it pertains to this program means an inspection by a member of TMWA's Backflow Prevention Group of a newly installed backflow prevention assembly providing service protection.

INSTALLATION STANDARDS: The term "installation standards" as it pertains to TMWA's backflow prevention and cross-connection control program means the Backflow Prevention Installation Requirements and Standards and this policy as developed by TMWA. These standards are consistent with the Nevada Administrative Code and other recognized experts in the backflow prevention field, such as the USC Foundation for Cross-Connection Control and Hydraulic Research.

INTERNAL BACKFLOW PREVENTION OR INTERNAL BACKFLOW PROTECTION: The terms "internal backflow prevention" or "internal backflow protection" refer to backflow prevention used for the purpose of isolation on a piece of equipment or use of water within a water customer's private plumbing system.

INTERNAL WATER SYSTEM: The term "internal water system" refers to the private piping of water on a water customer's premises.

LOCAL HEALTH AGENCY: The term " local health agency" means the Washoe County District Health Department.

NON HEALTH HAZARD: The term "non health hazard" shall mean actual or potential threat of pollution to the approved water supply.

NON POTABLE WATER: The term "non potable water" shall mean a water supply which has not been approved for human consumption by the health agency having jurisdiction.

POINT OF CONNECTION (POC): The Point of Connection is synonymous with Service Connection. The P.O.C. is the back of curb for all streets with planter strips. The P.O.C. is the back of sidewalk for streets with sidewalk contiguous with the curb and gutter. Where the P.O.C. is unclear, the location will be designated by a TMWA

Backflow Prevention Group member. If a meter exists, that shall be considered the P.O.C.

POLICY: The term "policy" or TMWA "policy" shall refer to the document titled Backflow Prevention and Cross Connection Control Policy for TMWA Power Company and its contents.

POLLUTION: The term "pollution" shall mean a degradation of the quality of water by any foreign substance which would not constitute a health hazard to the public health, but which would adversely and unreasonably affect the aesthetic qualities of water for domestic uses.

PRIVATE WATER SYSTEM: The term refers to the water customer's private plumbing system within the customer's premises.

PREMISES: The term "premises" means any and all areas on a water customer's property which are served or have the potential to be served by TMWA's potable water system.

RECLAIMED WATER: The term "reclaimed water" means effluent derived from wastewater treatment system, which as a result of treatment, is suitable for uses other than potable use.

REDUCED PRESSURE PRINCIPLE ASSEMBLY (RP): The term "reduced pressure principle assembly" or "RP" means an assembly incorporating two internally loaded, independently operating check valves and an automatically operating differential pressure relief valve located between the two checks, with resilient seated shut-off valves on each end of the assembly, and equipped with 4 properly located resilient seated test cocks.

REDUCED PRESSURE PRINCIPLE DETECTOR ASSEMBLY: This is a Reduced Pressure Principle assembly with a smaller sized approved bypass containing a specific water meter and an approved reduced pressure principle assembly.

RETROFIT: The term retrofit refers to installation of backflow prevention assemblies, for the purpose of providing service protection, on existing water services.

SERVICE CONNECTION: The term "service connection" refers to the point of connection of a customer's (or water user's) piping to TMWA's main or water meter.

SERVICE PROTECTION: The term "service protection" as it pertains to this program means the installation of backflow prevention on the water service connection, just downstream of the water meter or point of connection, the purpose of which is to protect TMWA's distribution system from cross-connections or potential cross-connections within the customer's piping system. A synonym is containment. NAC 445A defines the service connection as the point at which the water purveyor loses its authority and control over water.

TMWA POWER COMPANY: TMWA is synonymous with TMWA Power Company

TEST: The term "test" as it pertains to this program means a functional test of a USC approved backflow prevention assembly. This test shall be conducted by a CA-NV AWWA Certified Backflow Prevention Tester, per procedures adopted by AWWA.

THERMAL EXPANSION: The term "thermal expansion" means the increase in water pressure within a customer's water system due to thermal affects. Thermal expansion is a potential problem within a customer's system which has been equipped with a backflow prevention assembly and appropriate measures shall be taken by the customer, i.e. properly designed and sized thermal expansion tanks.

USED WATER: The term "used water" means water which has passed the point of service connection and therefore has left the control of the water purveyor.

UTILITY: The term "utility" means TMWA Power Company who is responsible for the operation of the water distribution system.

WATER CUSTOMER: The term "water customer" means any person (or that person's representative) or agency (or that agency's representative) obtaining or using water from TMWA's water potable water supply system.

WATER DISTRIBUTION SYSTEM: Means TMWA's water distribution system.

WATER USER SUPERVISOR: When requested by the water purveyor, the water customer shall appoint a water user supervisor who shall be responsible for conformance with all applicable laws, rules and regulations pertaining to backflow prevention; for the installation, operation and use of all water piping systems, backflow prevention assemblies and water using equipment on the premises; and for the avoidance of unprotected cross connections. The Water User Supervisor will be responsible for the customer's private water system and be responsive to backflow prevention requirements set forth by the water purveyor and NAC 445A.

WATER SUPPLIER: The term "water supplier" means the person who owns or operates the approved water supply system. The water supplier in this program is TMWA Power Company.

SECTION 3 GENERAL BACKFLOW PREVENTION REQUIREMENTS

CURRENT INSTALLATION REQUIREMENTS

Backflow prevention assemblies are required by TMWA (on domestic, fire and irrigation water services) to provide service protection for TMWA's distribution system. This backflow prevention shall be installed per TMWA Backflow Prevention Installation Requirements and Standards and this policy as a condition for new water service or continuation of existing service. Any proposed deviation from these requirements and standards will require approval from a member of TMWA's Backflow Prevention Group.

Backflow prevention requirements and installation standards may change over time. It is the responsibility of the water customer to ensure the current version of TMWA's Backflow Prevention Installation Requirements and Standards and this policy is complied with. These requirements refer to both new and existing water services, and for domestic, irrigation and fire services, unless specified otherwise by TMWA Backflow Prevention Group.

Retrofits of existing services may present some special circumstances that will be dealt with on a case by case basis. For additional information on Retrofits of existing services, please refer to those sections of this policy.

Refer to the TMWA Backflow Prevention Installation Requirements and Standards in the Appendix for detailed installation, inspection, testing and design requirements.

DESIGN CONSIDERATIONS

The installation of backflow prevention requires a number of considerations be reviewed prior to installation. Of particular importance in the design of a system incorporating a backflow prevention assembly are provisions:

- for thermal expansion of downstream water or fluids
- for drainage systems to handle full port discharges from the relief valves of reduced pressure principle backflow prevention assemblies
- to prevent freezing of the backflow prevention assembly and the water service
- to prevent submergence of internally or externally installed backflow prevention assemblies

APPROVED ASSEMBLIES

Pursuant to NAC 445A, any backflow prevention assembly installed for service protection on TMWA water services shall be on the current University of Southern California (USC) List of Approved Backflow Prevention Assemblies. TMWA maintains a current USC list of the approved assemblies and will, upon request, provide the most current list to a water customer.

Backflow prevention assemblies are approved by USC as an integral unit beginning with the #1 shut off valve, through the assembly body and through the #2 shut off valve. Any modification, including use of spare parts other than those of the original manufacturer or using a non-USC-approved shut off valve, invalidates the USC approval, and therefore the approval of TMWA as an acceptable assembly.

TYPES AND METHODS OF BACKFLOW PREVENTION

Types and methods of backflow prevention that are acceptable to TMWA for providing service protection include the following:

- Pressure Vacuum Breaker or Spill Prevention Pressure Vacuum Breaker
- Double Check Valve Assembly and Double Check Valve Detector Assembly
- Reduced Pressure Principle Assembly and Reduced Pressure Principle Detector Assembly
- Air Gap

A member of TMWA's Backflow Prevention Group shall specify the required type of protection based on NAC 445A and TMWA's policies, and to be commensurate with the assessed degree of hazard on the customer's premise. In situations that are not covered in NAC 445A, TMWA shall evaluate each situation on a case by case basis and will determine the required type of backflow prevention. The water customer may at his/her discretion choose a higher level of protection than the minimum required by TMWA.

Per NAC 445A.6721, TMWA reserves the right to require more stringent requirements than that set forth in NAC 445A.

DOMESTIC, IRRIGATION

DC, RP or Air Gap, to be determined by TMWA Backflow Prevention Group.

FIRE

- Dry systems also require double check valve assemblies due to the potential of contamination when non potable water is introduced through the fire pumper connection.
- NFPA Class 1, 2 and 3 systems require the installation of an approved double check valve assembly.
- NFPA Class 4, 5 or 6 systems require the installation of an approved reduced pressure principal assembly.
- At its discretion TMWA may require detector check assemblies.

SPECIAL CIRCUMSTANCES

The normal types of backflow prevention required for a water service are listed above. However a retrofit situation or any special circumstances listed below (or not listed) may cause an exception to the norm.

- Where access to a premise is denied by the water customer to TMWA Backflow Prevention Group, TMWA's distribution system shall be protected with an Air Gap.
- Where there is one contaminant (health) hazard, TMWA's distribution system shall be protected with a Reduced Pressure Principle Assembly, to be determined by TMWA Backflow Prevention Group.
- If it is impossible or impractical to make a cross connection survey, TMWA's distribution system shall be protected with an Air Gap or a Reduced Pressure Principle Assembly, to be determined by TMWA Backflow Prevention Group.

ATMOSPHERIC VACUUM BREAKER (AVB)

The use of atmospheric vacuum breakers for service protection on new service connections is prohibited.

INSPECTIONS

All inspections shall be performed by the Backflow Prevention Group unless otherwise assigned by mutual agreement to another department of TMWA. Any backflow prevention installed for service protection for a new service connection or existing service connection shall be inspected by a TMWA Backflow Prevention Group member as a condition for new water service or continuation of existing service.

If any inspection is not requested, TMWA may require the service trench be excavated and/or the backflow prevention assembly moved to the meter or the point of connection.

BACKFLOW PREVENTION ASSEMBLY TESTS

The water customer shall have each assembly, which was installed for service protection, tested by a certified tester as a condition for new water service or continuation of existing service. Upon conclusion of the test, it is the water customer's responsibility to submit a copy of this written test report to TMWA. Assembly tests are required:

1. After installation of a new assembly
2. After repair, replacement, relocation of an assembly
3. After a backflow incident
4. Annually; or more frequently as required by TMWA for the purpose of monitoring cross connection hazards; or more frequently for the purpose of reviewing assemblies that repeatedly fail the tests.

Water service will be terminated if tests are not performed as required by TMWA.

Refer to the portion of this section titled Repair and Replacement regarding when a test

is not successfully completed.

INITIAL TESTS

Each newly installed backflow prevention assembly, or any backflow prevention assembly which has been repaired, replaced or relocated, shall be tested and the successful test results shall be received by TMWA within seven (7) working days of the water meter turn on or repair of the assembly. If the test is not received in this period the procedure to terminate water service, based on the section Enforcement Action, item 3 of Water Service Termination (Refusal or unapproved delay to test a backflow prevention assembly), will be instituted.

ANNUAL TESTS

TMWA will notify customers by mail when the periodic (usually annual) testing of the assembly providing service protection is required. TMWA may require certain assemblies be tested more frequently and will notify the customer of this requirement. The following communication process will be used:

1. TMWA will notify the water customer of the required backflow prevention test at the beginning of the month in which the test is due. The customer will be given a thirty (30) day time frame to comply and have the test provided to TMWA.
2. A second notice will be sent to the water customer who does not take action on the first notification. The second notice will allow a five (5) work day time frame to comply.
3. The third notice will notify the customer of a Disconnect Notice to be carried out within 48 hours and to remain in effect until the test is completed.
4. A delayed test in the current year will not change the next year's test date to the later date when the test was actually done. For example, a test is due in August 1998, but is not performed until October 1998. The next test will be due in August 1999, not in October 1999.

REPAIR OR REPLACEMENT OF ASSEMBLIES

An assembly may be removed by the customer for repair provided the water is not used until the repair is completed. A retest of the repaired assembly will be required after the repair is complete.

An assembly may be removed by the customer for replacement provided the water is not used until the replacement assembly is installed. All assemblies used as replacements shall be installed per TMWA Backflow Prevention Installation Requirements and Standards and this policy and shall be tested by a certified tester after installation. The manufacturer, serial number, and size of the old assembly shall be noted on the test form and shall be noted as being replaced.

TMWA may notify the customer of required repairs to a backflow prevention assembly or replacement of a backflow prevention assembly. TMWA will notify customers by mail regarding repair or replacement requirements.

REMOVAL OR RELOCATION OF ASSEMBLIES

Approval shall be obtained from TMWA Backflow Prevention Group before a backflow prevention assembly, which was installed for service protection, can be removed or relocated. Relocation, inspections and tests of the relocated assembly shall be completed as noted in the TMWA Backflow Prevention Installation Requirements and Standards and this policy.

INSTALLATION LOCATION

The location of backflow prevention for service protection shall be designated by the TMWA Backflow Prevention Group. The normal installation locations are listed below, however a retrofit situation or any special circumstances listed below (or not listed) may cause an exception to the norm.

TMWA shall require of any water customer with backflow prevention designated as service protection, that is not installed immediately after the meter, or point of connection:

a. An annual certification stating that no connections or taps have been made between the meter, or point of connection, and the backflow prevention.

SPECIAL CIRCUMSTANCES

The backflow prevention assembly for all water services to a premise shall be installed at the meter or point of connection to TMWA's main if any of the following apply:

- If an auxiliary water supply or non potable water supply (recycled, ditch, well, surface, etc.) is on the premises.
- If entry to any portion of the premises is not available for inspection by TMWA.
- If any customer cannot or will not allow an on-premises inspection of his private internal water system.
- If all conditions for an internal installation as noted in the TMWA Backflow Prevention Installation Requirements and Standards or this policy are not met, including approval by TMWA Backflow Prevention Group for an internal installation.

DOMESTIC, IRRIGATION

- Domestic Service: immediately downstream of the meter effective 9/1/98.
- Irrigation Service: immediately downstream of the meter.

FIRE SYSTEM DEFINITIONS

The following definition system is used by TMWA for determining the appropriate installation location for backflow prevention on a private fire protection system for new or existing services. It is not to be confused with the NFPA fire system classification system.

1. Type A System-Single Fire Service follows all of the following characteristics:
    a. A single fire service line (one point of connection to TMWA's main) serves one fire suppression system in one building with one riser and
    b. The fire suppression system is not directly or indirectly connected to any other fire suppression system and
    c. this is not a looped system and
    d. there are no fire hydrants on this fire service line and
    e. the length (of the fire service line) between the point of service connection on TMWA's main and the riser and backflow prevention installation location in the building is less than 150 feet and
    f. TMWA Backflow Prevention Group has approved an internal installation and
    g. All requirements for internal installations are met.
2. Type B system-defined as any configuration of fire service not designated as Type A system. Type B systems may include, but are not limited to, the following characteristics:
    a. multiple points of connection to TMWA's main.
    b. looped systems with one point of connection.
    c. one fire service line provides water suppression to more than one building.
    d. the fire service line is greater than 150 feet from point of connection to the backflow prevention.
    e. fire hydrants are on the fire service line.

LOCATION REQUIREMENTS

The location for the backflow prevention shall be determined by TMWA for each project.

For all backflow prevention assemblies that are required by TMWA for service protection, the preferred location of the backflow prevention assembly shall be immediately inside the property being served. The rationale for this requirement is that TMWA loses control of water quality once water passes into the customer's system. On the other hand, TMWA is aware that locating the backflow prevention assembly at the fire system riser provides easier accessibility for testing and maintenance purposes, and may provide some freeze protection benefits. For these reasons the following standards shall be used in the location of backflow prevention assemblies:

TYPE A SYSTEMS

Internal installations will be accepted for the fire suppression systems defined by TMWA Backflow Prevention Group as a Type A system. All requirements for internal installation as described in the TMWA Backflow Prevention Installation Requirements and Standards and this policy shall be met. If, in the opinion of TMWA, these requirements for internal installations have not been met, TMWA will require corrections to the installation or may require the backflow prevention assembly be moved to an exterior location just inside the property line.

TYPE B, C & D SYSTEMS

The backflow prevention assembly is required at the point of connection (immediately inside the customer's property line) for these systems. All requirements for installation as described in the TMWA Backflow Prevention Installation Requirements and Standards and this policy shall be met.

1. DC's may be installed above ground in a freeze proof enclosure, or in an underground vault properly designed for drainage.
2. RP's shall be installed above ground in a freeze proof enclosure properly designed for drainage.
3. On request from the water customer, rather than an RP at the property line, TMWA will consider allowing a double check valve assembly at property line accompanied by RP's inside the facility at the glycol loops. The RP installations shall meet all requirements for an internal installation.

SECTION 4 RETROFIT PROCEDURE FOR EXISTING SERVICE CONNECTIONS

As directed by the District Health Department, TMWA shall review all existing water service connections to assess the degree of hazard within a premise to designate the required backflow prevention. All existing domestic, irrigation and fire service connections will be reviewed. The retrofit program will be carried out:

- through mailings to specific water customers,
- during remodels, tenant improvements, expansions, or construction projects or
- through other methods deemed necessary by TMWA.

REMODELS, TENANT IMPROVEMENTS, OTHER CONSTRUCTION

Retrofits which are initiated in conjunction with a building permit for remodels, tenant improvements, building additions, etc. may not require the detailed survey discussed below. TMWA Backflow Prevention Group will review the construction project and water use and will determine the appropriate type of backflow assembly and location. These retrofits shall be completed during the course of the construction project and are required for continuing water service. Water services that are not required to be upgraded with backflow prevention as a result of this construction will be retrofitted at a later time.

NON CONSTRUCTION RELATED RETROFITS

TMWA will contact other customers for retrofit of their domestic, irrigation and fire water services without the stimulus of a construction project. Upon being contacted by Sierra, a water customer of an existing service connection may have two options (and will be notified of the available options):

1. The water customer shall install the required backflow prevention in conformance with NAC 445A and TMWA policy, and per TMWA Backflow Prevention Installation Requirements and Standards. Backflow prevention, commensurate with the degree of hazard per NAC 445A, shall be installed for service protection if one of more of the following characteristics exist:
    - Premise with complex plumbing arrangements which make it impractical to assess whether cross connection hazards exist,
    - Premise with a repeated history of cross connections being established or reestablished,
    - Premise where cross connections are unavoidable, or not corrected, or where there is a high potential for change in the plumbing system.
2. If the customer wishes to install backflow protection internal to his plumbing system, or if petition is being made with TMWA to lower the level of backflow prevention for service protection, the customer shall contract with a Cross Connection Specialist to perform a detailed survey of the premise. TMWA strongly encourages customers to conduct cross-connection control surveys to provide internal protection.

a. The survey will list the hazards associated with the water use on the premise and will recommend the proper level of backflow prevention for these hazards for internal protection. The survey will also list backflow prevention requirements for service protection.

b. A copy of the survey will be forwarded by the specialist to TMWA Backflow Prevention Group.

c. TMWA will evaluate this survey; review, approve or change requirements and locations for internal protection; and may make additional requirements for internal protection.

d. Having a survey performed will not eliminate, and may not reduce the service protection requirement designated by NAC 445A or TMWA Policy.

e. The retrofit will be carried out as noted in this section under Retrofit Steps.

RETROFIT STEPS

After it has been determined which step above will be followed, the following is a brief description of the next steps in the retrofit.

1. The type of backflow prevention for service protection and its location will be determined by a member of TMWA's Backflow Prevention Group. The level of protection listed in NAC 445A will be the requirement for service protection. Any water use not listed in this detail will be reviewed on a case by case basis for service protection requirements.
   - If TMWA assess that no hazard exists with the current water use and no service protection is required:
     a. A periodic review will be made of this premise to reevaluate level of hazards
     b. TMWA will document the reasons for not requiring service protection.
2. TMWA recognizes the hardships that may be imposed on a customer through this retrofit program. Therefore, the schedule for implementation of the backflow prevention improvements may be flexible, provided TMWA, after any necessary consultation with the District Health Department, determines there is no immediate risk. TMWA and the customer will jointly agree on a completion date. General timeframes for completion of installation follow:
   a. Where TMWA identifies a contaminant (health) hazard, service protection shall:
      - be completed within 90 days or
      - In accordance with an alternate schedule acceptable to TMWA.
   b. Where TMWA identifies a pollutant (non health) hazard, service protection shall be completed In accordance with a schedule acceptable to TMWA.
2. After the final determination is made, an agreement letter will be made between TMWA and the water customer describing in detail the improvements to be made and a schedule by which the improvements shall be completed.

3. If the retrofit is not completed at the agreed upon time, the water service may be terminated after the notification steps listed in Enforcement Action, Water Service Termination, unless the customer receives an approval from TMWA Backflow Prevention Group for an extension.

SECTION 5 REQUIREMENTS FOR RETROFITS

GENERAL BACKFLOW PREVENTION REQUIREMENTS

As a general rule, retrofit installations shall be per the requirements in this policy and the TMWA Backflow Prevention Installation Requirements and Standards. This section shall contain only items which may be exceptions only for retrofits to the installation requirements described in Section 3, General Backflow Prevention Requirements, and to the TMWA Backflow Prevention Installation Requirements and Standards.

If, in the original utility plans for the project, a backflow prevention assembly was called for but not installed, the backflow prevention assembly as called for on the utility plans shall be installed.

APPROVED ASSEMBLIES

Regarding any presently existing backflow prevention assembly which was a USC approved assembly at the time of installation, but is not currently on a USC Approved Assemblies list: As long as the assembly passes the annual AWWA functional test, has been maintained and/or repaired to meet original factory working conditions, and is commensurate with TMWA's assessed degree of hazard, the assembly will be accepted as an approved assembly for service protection. It shall be replaced with an approved assembly at the point when it is either moved or can no longer meet the specifications listed above.

REDUCED LEVEL OF SERVICE PROTECTION

This section is applicable to domestic and fire water services. TMWA recognizes that, on occasion during a retrofit, the installation of the proper backflow prevention assembly may be difficult due to space, drainage constraints or the physical configuration of the water customer's premise. In these situations, at the water customer's request, TMWA may consider, in consultation with the District Health Department, a reduced level of protection. As a requirement for a reduced level of service protection the water customer shall commit in writing to the following:

1. In the event a water customer request a reduced level of service protection, the owner accepts liability for installing the pollutant (non health) hazard level type of assembly to protect against a contaminant (health) hazard.
2. The water customer shall have a Cross Control Connection Specialist perform a detailed cross-connection survey of the premise as noted in the section titled Procedure for Retrofit of Existing Services.
3. The customer shall complete installation of internal protection improvements as outlined in the survey and approved by TMWA to provide a level of protection commensurate with the assessed degree of hazard.
4. TMWA will require the water customer to maintain an aggressive, on going internal backflow prevention program.

5. The backflow prevention for internal protection shall be installed per TMWA Backflow Prevention Installation Requirements and Standards and this policy, inspected by TMWA Backflow Prevention Group, maintained or repaired to original factory working condition, and tested by a certified tester at an interval to be determined by TMWA.
6. An increased frequency of testing of service protection assemblies as determined by TMWA may be required.
7. For reduced service protection on a domestic service some additional requirements are noted in the Domestic Service, Backflow Prevention Options, noted below.
8. For reduced service protection on a fire system some additional requirements are noted in the Fire Service, Backflow Prevention Options, noted below.
9. Records detailing the internal protection, the repair and maintenance, and tests shall be maintained by the water customer and will be submitted to TMWA on an annual basis.
10. Each year, a written re-certification shall be required of the owner or property manager containing details regarding the following items. After receipt and review of the certification, TMWA's Backflow Prevention Group shall then determine if the reduced service protection is still adequate. Should the level of service protection not be adequate for the level of hazard, the water customer shall be required to upgrade the service protection backflow prevention assembly to the proper type as a requirement for continued water service. The following will be included in the re-certification:
    - Changes in tenancy,
    - Changes in water use,
    - Plumbing changes
    - Use of non potable water
11. TMWA shall require reasonable access to the premise to conduct an initial cursory survey and periodic re-evaluations to determine if the internal protection is adequate to protect TMWA distribution system.
12. TMWA may also require the customer have additional detailed surveys performed by a Cross Connection Specialist.

INSTALLATION LOCATION

SPECIAL CIRCUMSTANCES

The backflow prevention assembly for all water services to a premise shall be installed at the meter or point of connection to TMWA's main if any of the following apply:

- If a water customer's premises has internal cross connections that cannot be permanently corrected or controlled
- If a water customer's premises has intricate internal plumbing and piping
- If the water service laterals between the point of connection and the water use

cannot be located or defined to the satisfaction of TMWA

- If any conditions listed in the section General Backflow Prevention Requirements, Installation Location Requirements, Special Considerations apply.

DOMESTIC SERVICES

Backflow prevention shall be as close as possible to the meter.

TMWA may consider allowing the backflow prevention assembly to be located internally at the water riser if physical space is limited for an exterior installation, if proof is provided that no lateral taps exist prior to the proposed installation location inside the building, and if all requirements are met for an internal installation including sufficient access to the assembly for testing and maintenance purposes

IRRIGATION SERVICES

Backflow prevention shall be immediately downstream of the meter. Installations shall be per the TMWA Backflow Prevention Installation Requirements and Standards and this policy.

FIRE SERVICES

Backflow prevention shall be as close as possible to the service connection. The fire hydrants, number of fire risers and the fire department pumper connection will be a consideration during placement of the backflow prevention assembly.

TMWA may consider allowing the backflow prevention assembly to be located internally at the fire system riser if physical space is limited for an exterior installation, if proof is provided that no lateral taps exist prior to the proposed installation location inside the building, and if all requirements are met for an internal installation including sufficient access to the assembly for testing and maintenance purposes

TYPES AND METHODS OF BACKFLOW PREVENTION

DOMESTIC BACKFLOW PREVENTION OPTIONS

1. DOUBLE CHECK VALVE IN LIEU OF REDUCED PRESSURE PRINCIPLE ASSEMBLY

   With approval of TMWA, the District Health Department a DC may be used in lieu of an RP. All requirements noted above in the section titled Reduced Level of Service Protection shall be met by the water customer. In addition, the DC requires a minimum of semi-annual testing and a possible higher level of testing as directed by TMWA or the District Health Department. This substitution may be considered for retrofit situations only under the following exclusive conditions:

   a. Where retrofit of an RP induces pressure losses which render the existing domestic system inoperable and there is not space for installation of a pump. The owner of the domestic system shall submit to TMWA calculations and a

detailed flow and pressure report to substantiate this claim. The calculations and report shall be provided by a licensed plumber or engineer.

b. Where safety or drainage problems exist with the installation of an RP which cannot be reasonably corrected. The owner of the system shall provide a written report from his contractor or engineer which details the problems or logistics of installing the RP.

IRRIGATION SERVICES

STOP AND WASTE VALVES

NAC 445A.67255 specifically defines stop and waste valves as a potential source of contamination to a distribution system and prohibits their use upstream of a backflow prevention assembly. Any existing irrigation system with a stop and waste valve between the meter (or point of connection) and the backflow prevention assembly shall be changed to meet current TMWA Backflow Prevention Requirements and Standards as a requirement for continued water service.

ATMOSPHERIC VACUUM BREAKERS

TMWA may accept the use of the existing atmospheric vacuum breakers (AVB) as system protection if it can be demonstrated that:

1. the AVB is functioning properly:
   - the air inlet opens when water supply is shut off
   - the air inlet closes when water supply is turned on
2. the AVB is installed correctly including
   - being installed at the proper height and
   - with the proper shut off and drain system
3. no stop and waste valve is installed upstream of the AVB.

At the time that this AVB no longer passes the test it shall be replaced with an assembly approved for service protection.

DOUBLE CHECK VALVE

TMWA may accept the use of the existing double check (DC) as system protection if it can be demonstrated that:

1. the DC passes the periodic functional test
2. the DC is installed correctly including
   - the proper shut off and drain system
3. no stop and waste valve is installed upstream of the DC.

At the time that this DC no longer passes the test it shall be replaced with an assembly approved for service protection.

FIRE SERVICES

REGULATORY REQUIREMENTS AND WATER QUALITY ISSUES

NAC 445A requires that all fire sprinkler systems be equipped with a backflow prevention assembly. The type of backflow prevention assembly is based upon the NFPA Classification of the particular fire sprinkler system and will be designated by a TMWA Backflow Prevention Group member.

TMWA has nearly 2000 fire protection service accounts. Based upon the results of early surveys, many of these fire protection services are not equipped with proper backflow prevention assemblies. Proper backflow prevention assemblies are testable double check valve assemblies (DC), or testable reduced pressure principle assemblies (RP) or air gap.

Based upon the water quality findings of the American Water Works Association Research Foundation (AWWRF), there is no doubt that fire sprinkler systems constitute a contaminant (health) hazard to TMWA's distribution system and shall be equipped with appropriate backflow prevention assemblies. However, since installation of a backflow prevention assembly will reduce the water pressure and may affect sprinkler performance, care must be exercised when installing backflow prevention, to not jeopardize a critical public safety requirement while providing for a public health concern. That fire sprinkler system must continue to perform hydraulically during a fire event. Therefore, any retrofit shall equally address public health (backflow prevention) and public safety (maintaining reliable fire flow).

Other issues that are a concern in retrofitting existing fire sprinkler systems are inadequate space and, in the case of reduced pressure principle assemblies, no drainage system or an inadequate drainage system necessary to handle full discharge from the relief valve. Another issue encountered in TMWA's backflow prevention program includes the safety issue of installing a reduced pressure principle assembly near electrical equipment. Safety requirements dictate that a reduced pressure principle assembly be installed away from electrical equipment.

FIRE SYSTEM BACKFLOW PREVENTION OPTIONS

1. NO BACKFLOW PREVENTION ASSEMBLY

   TMWA specifies that all fire services be equipped with backflow prevention assemblies consistent with NAC 445A. Based upon the water quality data presented in the AWWRF study and the potential acute and chronic health effects associated with backflow from fire sprinkler systems, the "no backflow prevention option" <u>is not an option</u>

2. INSTALLATION OF REQUIRED BACKFLOW PREVENTION

   This shall be per the requirements listed in the section titled General Backflow Prevention Requirements.

3. DELAYED INSTALLATION OF DOUBLE CHECK VALVES

   In situations where the retrofit is extremely difficult due to space limitations or where the backflow prevention assembly adversely affects sprinkler system operation, TMWA will consider a lengthening of the installation schedule under

the following conditions:

a. That the existing system is equipped with at least a non-testable single check valve.

b. That the owner of the system shall submit a report prepared by a licensed fire system contractor or engineer which adequately describes the space or hydraulic problems and provides the flow and pressure requirements of the Fire Department.

c. That the owner of the premise consent to a prescribed plan and schedule for eventual retrofit of the fire sprinkler system with a double check valve assembly and a tank-pump installation if necessary for pressure and flow. Such plan and schedule shall be with the approval of the District Health Department and the jurisdictional fire department.

4. DOUBLE CHECK VALVE IN LIEU OF REDUCED PRESSURE PRINCIPLE ASSEMBLY

With approval of TMWA, the District Health Department, and the jurisdictional Fire Department, a DC may be used in lieu of an RP on certain NFPA Class 4,5, & 6 fire sprinkler systems. All requirements noted above in the section titled Reduced Level of Service Protection shall be met by the water customer. In addition, the DC requires a minimum of semi-annual testing and a possible higher level of testing as directed by TMWA or the District Health Department. This substitution may be considered for retrofit situations only under the following exclusive conditions:

a. Where retrofit of an RP induces pressure losses which renders the existing fire system inoperable and there is not space for installation of a pump. The owner of the fire system shall submit to TMWA calculations and a detailed flow and pressure report to substantiate this claim. The calculations and report shall be provided by a licensed fire system contractor or engineer. A letter from the Fire Department listing required pressures and flows shall be provided to TMWA.

b. Where safety or drainage problems exist with the installation of an RP which cannot be reasonably corrected. The owner of the system shall provide a written report from his fire system contractor or engineer which details the problems or logistics of installing the RP

SECTION 6 CONSTRUCTION WATER & FIRE HYDRANT USAGE

CONSTRUCTION WATER DEFINITION

Backflow prevention is required by TMWA on all methods of using potable water for construction. During the course of construction for a particular premise, water may be used for various construction activities. Such activities include water used for dust control, site grading and compaction, on-site mixing of concrete and cement, water used for the pressure testing of pipes, and water used in the cleaning of tools and equipment.

CONSTRUCTION WATER SUPPLY

Several options available for construction water are as follows.

TRUCK FILL SITES

TMWA discourages the use of potable water for construction purposes and encourages the use of non potable supplies for construction water needs, particularly water used for dust control. To this end, TMWA has worked with the construction community and has developed a mix of potable and non-potable of construction water fill stations strategically located around the community. Each station is equipped with metering and appropriate backflow prevention equipment. TMWA encourages contractors and developers to utilize these stations and arrangements can be made with TMWA for their use.

TEMPORARY CONSTRUCTION WATER METER

If in fact a customer or developer requires construction water specifically at its construction site, then the owner/developer may request a temporary construction water service utilizing potable water from TMWA's distribution system. Temporary construction water service shall require metering, will be billed at the appropriate rate deemed by TMWA, shall be equipped with appropriate backflow prevention equipment which shall be tested by a Certified Tester, and shall be retired by the customer/developer at the end of the project. TMWA's backflow prevention group will specify the appropriate level of backflow prevention equipment on a case by case basis.

PERMANENT DOMESTIC OR IRRIGATION WATER METER

Another source of potable construction water is to use the permanent domestic or irrigation water service for that property. The meter box shall be set to subgrade in the final permanent location, the permanent backflow prevention assembly installed (with a hosebib at the downstream end of the backflow prevention assembly), inspected by TMWA Backflow Prevention Group, and tested by a Certified Tester. At the end of the construction project, the only change required is for the developer to remove the hose bib from the end of the backflow prevention assembly and contact the TMWA billing department to change the name on the account. All installation requirements and inspections shall be performed as noted in TMWA

Backflow Prevention Installation Requirements and Standards and this policy.

FIRE HYDRANT AND FIRE WATER SERVICE USE

At no time shall a private entity utilize water from a public or private fire hydrant or from a fire sprinkler water service inside a facility for any purpose other than fire fighting. TMWA shall designate the approved water supplies that shall be utilized by private entities (including contractors) for construction, or any, purposes.

Any municipal agency that uses water from a private or public fire hydrant or other water outlet shall:

1. Have written approval from TMWA for use of water from this non metered supply.
2. Have an approved Air Gap on each vehicle or equipment being filled from the hydrant.

Have the air gap on those vehicles and equipment approved by TMWA Backflow Prevention Group before water fill.

SECTION 7 CERTIFIED BACKFLOW ASSEMBLY TESTERS

TESTER CERTIFICATION

Persons wishing to perform tests on backflow prevention assemblies in Nevada shall have a California Nevada American Water Works Association (AWWA) Backflow Prevention Assembly Tester Certification pursuant to NAC 445A. Certification requires passing a tester class resulting in a certificate from the California Nevada section of the AWWA. Re-certification shall be obtained every three years or per the latest version of the USC Manual of Cross Connection Control.

All testers who perform tests on backflow prevention assemblies which provide service protection for TMWA shall be on the List of CA-NV AWWA Certified Testers. The District Health Department maintains this list. Any individual wishing to be placed on the tester's list should contact the Environmental Engineer, District Health Department. The District Health Department will place a tester on the list if AWWA certification has been obtained and if business licenses have been obtained from Reno, Sparks, and Washoe County. The tester's name will be automatically removed from the list if proof of re-certification has not been provided by the tester to the District Health Department.

TMWA reserves the right to remove any tester from the approved list for TMWA testing due to non performance reasons or for performing the tests in a method not consistent with TMWA's requirements.

TESTER RESPONSIBILITIES AND TESTING REQUIREMENTS

1. TMWA requires the tester to attend a yearly seminar presented by TMWA to review TMWA policy and standards. This is a requirement for the tester to remain eligible to perform tests for TMWA water customers. The tester will be notified of the time and place for this review.
2. TMWA's test form shall be used for backflow prevention assemblies installed for service protection for fire, domestic, and irrigation water services. At the request of the tester, TMWA will provide this form on a diskette. The form on the diskette has no TMWA logo. The tester may insert his own logo.
3. All data on the test form shall be legible and complete, otherwise the form will be returned to the tester for completion.
4. If the water meter number is not provided on the test form, the tester shall obtain a copy of the bill for the specific water service from the customer and attach this to the test form.
5. A successful, operational function test by a tester shall be completed and is due to TMWA within seven (7) days after the assembly is installed and water service is set and/or water service is established. Water service will be terminated after the meter is set if this requirement is not met.
6. Any tester who conducts tests of backflow prevention assemblies which protect fire

service connections shall also be a licensed fire system contractor or work under the direct supervision of a licensed fire system contractor. This directive is per the Health Agency.

7. TMWA Backflow Prevention Group members will perform tests on backflow prevention assemblies throughout the year on a random basis as a quality control measure.
8. TMWA may request the tester perform the test in the presence of a TMWA Backflow Prevention Group member.
9. TMWA may conduct periodic spot checks of a tester's work using the tester's own gage.
10. NAC 445A.67245 requires all test gages to be calibrated at least annually by a qualified firm capable of such calibration. The calibration certification forms, for any test gage used to test backflow prevention assemblies on TMWA water services, shall be provided to TMWA Backflow Prevention Group annually.
11. Both backflow prevention assemblies on a Detector Check assembly shall be tested. Designate the test for the bypass assembly as such on the test form. Read the bypass meter and record it on the test form.
12. Place in the comment field any items such as and including:
    - an incorrectly installed assembly (per TMWA Installation Standards)
    - an assembly which has been modified from the original factory configuration such as having a #1 shut off valve without a test cock or one in which a shut off valve has been detached from the body of the backflow assembly.
    - an installation which has a stop and waste valve between the meter and the assembly
    - an installation which has a water outlet, tap, tee, etc. upstream of the backflow prevention assembly
    - use of a test cock for water supply
    - a fire service which has a tap for non fire services upstream or downstream of the backflow prevention assembly
13. Test criteria for a passing test for an RP:
    - Minimum 2.0 PSID on relief valve opening
    - Minimum 1.0 PSID on check valve 1
    - Minimum 3.0 PSID buffer between relief valve opening and check valve 1
    - Both shut off valves shall not leak
14. Test criteria for a passing test for a DC:
    - Minimum 1.0 PSID on check valve 1 and check valve 2
    - Both shut off valves shall not leak
15. Test criteria for a passing test for a PVB:
    - The air inlet shall open at a minimum 1.0 PSID
    - Minimum 1.0 PSID on check valve 1
    - Both shut off valves shall not leak

SECTION 8 CROSS-CONNECTION CONTROL SPECIALISTS

SPECIALIST CERTIFICATION

Any person who wishes to conduct Cross Connection Surveys for TMWA water customers shall be a Cross Connection Control Specialist. This certification shall be obtained through either the specialist class presented by the California-Nevada section of AWWA or the USC Foundation for Cross-Connection Control and Hydraulic Research.

TMWA maintains its own list of Cross Connection Control Specialists. Specialists wishing to perform work for TMWA water users shall submit a copy of their certificate, along with copies of business licenses for Reno, Sparks and Washoe County, to TMWA Backflow Prevention Group.

TMWA requires the Cross Connection Control Specialist to attend a yearly seminar presented by TMWA to review TMWA policy and standards. This is a requirement for the specialist to remain eligible to perform surveys for TMWA water customers. The specialist will be notified of the time and place for this review.

TMWA reserves the right to remove any specialist from the list should he/she fail to perform the survey as required by TMWA.

SURVEY REQUIREMENTS

Surveys conducted for TMWA water users shall be complete, well written and concise. Surveys shall include the following minimum information:

1. A clear and complete description of the water service connections at the premises being surveyed including:
   - customer water account number
   - types of services and meter numbers
   - service address
   - owner name and address
   - a copy of TMWA's service map (may be obtained at TMWA)
   - If the water meter number is not provided on the survey, the specialist shall obtain a copy of the bill for the water services from the customer and attach this to the survey.
2. A recommendation for type of backflow prevention for service protection that is consistent with requirements of NAC 445A. Describe potential external and internal installation locations. Describe locations and sizes of drains, and locations of electric panels and/or electric equipment. Describe any logistical problems, such as space problems, meters in driveways, lack of drains, high water tables, water run off problems, etc.
3. A detailed review of the on-site water use and the health or pollutant level hazards

associated with such use. List backflow prevention that exists on internal plumbing hazards. Provide a copy of the last test if the assemblies have been tested.

4. A physical description of the facility and premises including a map showing pertinent data such as buildings and where water services are located in relation to buildings and parking lots, location of the service connection and description of the area immediately around and downstream of the service connection, etc.
5. Note any special factors such as:
    - Auxiliary approved potable water supplies on the premises.
    - Non potable auxiliary water supplies being used (seasonal or year round) on, adjacent to, or close to the premises: recycled, reclaimed, well, ditch, surface water.
    - Actual or possible unauthorized water taps or usage upstream of any backflow prevention assembly for service protection.
    - Existing backflow prevention assemblies, their purpose, general condition, size, manufacturer, model, serial number and any test history.
    - Relationships to other properties relating to services or private mains.
6. Surveys that address internal protection should also include the following:
    - A detailed description of internal plumbing, including existing or potential cross-connections.
    - A recommendation for "internal protection" consistent with industry codes and references including but not limited to: the Uniform Plumbing Code, city building codes, NAC 445A, 'Orange Book', etc.

SECTION 9 ENFORCEMENT ACTION

GENERAL

If, in the opinion of TMWA, and after consultation with the District Health Department, it is found that a customer is not meeting its responsibilities relative to service protection backflow prevention, TMWA may implement enforcement actions. Enforcement may include:

1. Denying or terminating water service to a customer's premises.
2. Requiring the water customer to install backflow prevention, for service protection, commensurate with the degree of hazard on the premise.
3. TMWA may install backflow prevention, for the purpose of service protection, commensurate with the degree of hazard on the premise.

BASIS FOR WATER SERVICE TERMINATION

When TMWA encounters a water use that represents a clear and immediate hazard to the potable water supply that cannot be immediately abated, TMWA will notify the District Health Department and will institute a procedure for discontinuing the water service. Conditions or water uses that create a basis for water service termination shall include, but are not limited to, the following:

1. Direct or indirect cross-connection between TMWA's water system and a sewer line.
2. Unprotected direct or indirect connection between the public water system and an unapproved auxiliary water system.
3. Refusal to install a required backflow prevention assembly. Unapproved delays by the water customer to install backflow prevention assemblies shall constitute such a refusal.
4. Refusal or unapproved delay to test a backflow prevention assembly.
5. Refusal or unapproved delay to repair a faulty backflow prevention assembly.
6. Refusal or unapproved delay to replace a faulty backflow prevention assembly.
7. Unprotected direct or indirect connection between the public water system and a system or equipment containing contaminants.
8. If a backflow prevention assembly has been removed, bypassed or disabled without prior approval from TMWA Backflow Prevention Group.
9. If a cross connection exists that is not controlled commensurate to the degree of hazard as assessed by TMWA Backflow Prevention Group.

TERMINATION PROCEDURE

For condition 1 or 2, the District Health Department will notify TMWA to terminate water service to a customer's premise immediately if the hazard to the potable water supply cannot be immediately abated.

For all other conditions, the District Health Department will notify TMWA to terminate service to a customer's premise after two written notices described in steps 1 and 2 below have been sent to the water customer specifying the corrective action needed and the time period in which it shall be completed. If the corrective action is not taken by the water customer within the specified time period, then water service may be terminated per the following steps:

1. TMWA shall notify the water customer of the requirements related to backflow prevention (installation, maintenance, relocation, testing, etc.). The customer shall be given ten (10) working days to comply and have inspections completed by TMWA Backflow Prevention Group.
2. TMWA shall send a second notice to the water customer who does not take action on the first notification. The second notice shall allow five (5) working days to comply.
3. TMWA shall send a third notice to the customer which will be a Disconnect Notice to be carried out within 48 hours.
4. TMWA will terminate water supply and lock service valve. The water service will remain inactive until all violations have been corrected, inspected and approved by TMWA and the District Health Department.

SECTION 10 PROCEDURE FOR A BACKFLOW OR CROSS CONNECTION INCIDENT

GENERAL

Whenever backflow occurs (either from backpressure or backsiphonage) the potential exists for contamination of TMWA's distribution system. Backflow incidents may be confined on site to a particular premise or may be more widespread in the event of sudden pressure loss in TMWA's distribution system. The following procedures will be used for responding to either type of backflow incident.

BACKFLOW EVENT CONFINED TO A PARTICULAR PREMISE OR PROPERTY

This type of backflow event may be communicated to the District Health Department or TMWA. The following will be the procedure followed by TMWA for an event isolated to a single property.

1. TMWA Backflow Prevention Group or water production staff will notify the District Health Department of the event and the nature of the event. Based upon the particular circumstances and with consultation with the District Health Department, TMWA may immediately implement one or more of the following actions: water quality testing, flushing of services and mains, boil water order to customers or areas of the system affected by the event. Water service may be terminated to the premise suspected of being the source of the backflow until correction actions are completed.
2. The owner of the premise allowing (or suspected of allowing) the backflow to occur will be required to install or repair and test backflow prevention equipment on the water service. Backflow prevention measures will be specified by TMWA's backflow prevention group. Such backflow prevention equipment will be installed and tested before service is restored.
3. TMWA will require the owner of the premise to complete a detailed cross-connection control survey of the premise by a certified backflow prevention and cross-connection control specialist. TMWA and the District Health Department will determine the scope of the survey and will utilize the survey to determine additional internal backflow prevention measures required of the affected premise.

BACKFLOW EVENT CAUSED BY A SYSTEM LOSS OF PRESSURE

1. TMWA will determine the extent of the incident and notify the District Health Department as soon as possible. After consultation with the District Health Department, a boil water order may be issued by TMWA to the media identifying the area affected by the event and those customers which should immediately boil their domestic water.
2. TMWA will isolate the area affected by the backflow event and will notify the jurisdictional fire department of curtailment of fire protection service to the affected

area. TMWA will continue to communicate with affected customers through use of the media.

3. Immediately after isolating the area affected by the backflow event, TMWA will initiate corrective action to restore service. This will include system repairs, flushing of mains and services and water quality sampling and monitoring.
4. After service is restored (mains and services are fully pressurized and flushed), the boil water order will be lifted upon receiving satisfactory results from water quality testing.

SECTION 11 NON POTABLE WATER USAGE & AUXILIARY WATER

Non potable water includes water from ditches, surface water, unapproved wells, reclaimed water, recycled water, gray water or any non approved water supply.

Any premise on which both TMWA water supply and a non potable water supply exist will be subject to an annual shut down test.

TYPE OF BACKFLOW PREVENTION REQUIRED

- An RP (Reduced Pressure Principle Assembly) backflow prevention assembly is required at the TMWA meter or point of connection on a water service which enters a property in which a non potable water supply is used and in which there are no cross connections between the non potable plumbing and the potable plumbing.
- An Air Gap backflow prevention method is required at the TMWA meter or point of connection for any plumbing system which will have a direct or indirect cross connection between both TMWA water and a non potable water supply.
- For a potable water service which enters a RESIDENTIAL property which is adjacent to a property where non potable water is used for irrigation: SEE SECTION 8A OF TMWA'S ENGINEERING AND CONSTRUCTION STANDARDS FOR SEPARATON AND BACKFLOW REQUIRMENTS.

DECLARATION OF USE OF RECLAIMED OR NON POTABLE WATER

The potential reclaimed water customer will provide to the Backflow Prevention Group a copy of the application for reclaimed water usage within a week after the application has been made.

The potential non potable water customer will provide to the Backflow Prevention Group a written declaration of the intent to use non potable water on the premise where TMWA will supply potable water.

Failure to declare intentions to use reclaimed or non potable water may result in additional expenses to the customer due to TMWA's backflow prevention requirements for potable versus non potable water use.

TEMPORARY POTABLE WATER SUPPLY

TMWA may provide temporary potable water to a system designed to distribute non potable water. The following are requirements for this service to be provided:

1. The water service shall be a separate tap on TMWA's distribution system.
2. The timeframe for the service to be retired shall be provided to TMWA in writing.
3. Backflow prevention shall be through an Air Gap on this temporary water service.

4. When non potable water service is connected to the non potable water system, the TMWA temporary water service shall be retired at the main. A bond shall be provided to TMWA for 150% of the amount estimated to retire the service. The additional 50% shall be considered a security deposit to ensure TMWA's potable service is retired.
5. TMWA will require the water customer to designate a water user supervisor for this premise.

SHUT DOWN TESTS

1. All tests shall be attended by TMWA as purveyor of the potable water.
2. The following requirements shall be followed for a shut down test:
3. Shut down tests of the on site potable and non potable systems shall be performed annually.
4. The customer shall bear all costs of the test. This test is in addition to the periodic (usually annual) functional test of the backflow prevention assemblies on the premises.
5. Performance and coordination of the shut down test shall be the responsibility of the end user of non-potable water supply. End user shall coordinate such tests with TMWA as potable water purveyor, the non potable water purveyor, the water customer's water user supervisor, and the District Health Department.
6. The shut down test director will be TMWA, the District Health Department or the Non Potable water Purveyor.

QUALIFICATIONS FOR WATER USER SUPERVISOR

The Water User Supervisor of a premise shall possess one of the following certifications:

1. USC Cross Connection Control Specialist
2. CA-NV AWWA Cross Connection Control Specialist

QUALIFICATIONS FOR DIRECTOR OF SHUT DOWN TEST

The director of a shut down test shall possess all the following certifications:

1. USC Cross Connection Control Specialist or CA-NV AWWA Cross Connection Control Specialist
2. Currently, AWWA is developing a curriculum and certification related to reclaimed water and/or non potable water. The director should obtain and maintain the certification once that certification has been defined.

WATER SERVICE TERMINATION

If any cross connections are detected between the potable water supply and the non potable water during the shut down test, potable water service will be terminated to the

facility immediately and remain off until the cross connection problem is located and removed to the satisfaction of TMWA.

AUXILIARY APPROVED WATER SUPPLY

If TMWA supplies water to a premises with an auxiliary approved water supply, backflow prevention shall be required at the point of connection. TMWA Backflow Prevention Group will specify the required type and location of backflow prevention assemblies for all TMWA water supply.

WELL ABANDONMENT

When a well is abandoned, the owner shall submit to TMWA Backflow Prevention Group a certified copy of the well plugging report prepared by the licensed driller in accordance with NAC 534.420. This report shall be recorded by the District Health Department.

REFERENCES TO OTHER SECTIONS OF THIS POLICY

Enforcement Action

APPENDIX A DENTAL FACILITY POLICY

PURPOSE

The purpose of this policy statement is to define backflow prevention requirements for domestic service protection for dental facilities. This policy statement has been developed based upon a review of current regulations and an in-depth balanced review of other sources of information.

REGULATORY REQUIREMENTS

The installation of backflow prevention assemblies is required on service lines whenever the possibility exists that any source of pollution or contamination could be drawn into the public water system as a result of a backflow incident.

Nevada Administrative Code 445A, clearly defines the responsibility of water purveyors with regard to backflow prevention and cross-connection control. Per NAC 445A.67185, purveyors shall:

1. Ensure that there are no unprotected connections between the supplies of water, systems for the pumping, storage and treatment of water, and distribution system of the public water system and any source of pollution or contamination pursuant to which any unsafe water or other degrading material can be discharged or drawn into the public water system as a result of backsiphonage or backpressure.
2. Develop and carry out a program for the control of cross-connections that is approved by the health authority

Pursuant to the requirements of NAC 445A and direction of the District Health Department, TMWA has implemented a comprehensive backflow prevention program. The program includes detailed backflow prevention reviews of all new customers and all existing commercial customers.

BACKFLOW PREVENTION REQUIREMENTS FOR DOMESTIC SERVICES

NEW SERVICES

NAC 445A specifies that the backflow prevention assembly to provide service protection for "A dental clinic shall consist of a reduced pressure principle assembly." This RP shall be installed immediately after the water meter and prior to any water uses or connections.

EXISTING SERVICES

Backflow prevention shall be installed immediately after the water meter and prior to any water uses or connections.

For retrofit purposes on existing services: TMWA may consider a reduction in service protection from an RP to a DC if all the following conditions are met:

- if the water customer uses contained water systems with no direct or indirect connection to potable water supply,
- if the water customers agree to meet all requirements listed in Requirements for Retrofit, Reduced Level of Service Protection.

DISCUSSION

The required installation of backflow prevention assemblies often becomes a heated and controversial issue with many water customers. Customers may object to the installation of testable backflow prevention assemblies due to costs, their own interpretation of what constitutes a cross-connection or health hazard, or a sense that they are already over burdened with too many regulations. The issue of health agencies and water utilities requiring backflow protection on the water services to dental offices is no different. This discussion will summarize the various points of view and TMWA's rationale when it comes to backflow prevention and cross-connection control for dental facilities.

Many in the dental industry believe that requiring backflow prevention devices in dental offices utilizing testable backflow prevention assemblies to be unjustified. They may also object based upon their perception that a non-testable check valve built into various water using equipment is sufficient to prevent backflow. The American Dental Society (from an April 1996 policy statement) also sets forth the following reasons:

1. The Centers for Disease Control and Prevention have not identified any evidence of a public health risk due to this theoretical phenomenon.
2. Blood borne viruses cannot reproduce outside their living host and therefore, unlike bacteria and fungi, cannot multiply in water.
3. Most dental offices do not use cuspidors, and cuspidors currently manufactured include an air gap.
4. Dental instruments with cross-connections to water systems are neither designed nor intended to ever be immersed in patient fluids.
5. The amount of fluid that could theoretically be aspirated is miniscule, and would be quickly diluted in the public water supply.
6. If water flow is disrupted for any reason, such as in the event of backsiphonage, the dental worker would automatically discontinue use of the instrument and attempt to resolve the problem
7. Current trends within the dental profession are towards dental units with contained water systems (not connected to the public water system).
8. Cost benefit analyses demonstrate that the expected returns from these safety requirements are negligible when weighed against the cost.

From a water purveyor's perspective, TMWA's response to the above discussion points is as follows:

- Regarding point 1: Backflow is a common phenomenon. Every day in the U.S. water utilities experience backflow events due to broken water mains, pump failures, and from backpressure from cross-connections to non-potable customer sources.
- Regarding points 2, 3 and 4: Water purveyors are concerned about all actual and potential sources of pollution and contamination on the customer's side of the water meter. Relative to dental offices, there is concern pertaining to the use of toxic chemicals in film developing operations and microbiological contamination from the use of the following devices: autoclaves, steam lines, grinding units, in-line filtering systems, water flushed cuspidors, water/air syringes, water cooled hand pieces, and vacuum pumps. Water purveyors are concerned about all sources of microbial contamination, not just blood borne pathogens. This concern is evident in the dental industry as well. In December 1995, the ADA's Board of Directors adopted a standard of 200 colony forming units as the maximum microbe load in water emitted from air/water syringes, hand pieces and similar equipment in dental facilities.
- Regarding points 2, 3 and 4: Another source of potential contamination from dental offices include potential microorganisms from biofilm buildup in the very small diameter lines used in dental equipment. From the March 1997 Clinical Research Associates Newsletter, colony forming units increase exponentially in dental equipment. The following numbers were cited: @ the dental chair junction box 10,000 cfu/ml; @ the dental chair control center 400,000 cfu/ml; @ the sterile hand piece 100,000 cfu/ml; @ the non-sterile air/water syringe 200,000 cfu/ml. These numbers are alarming from a water purveyor's perspective when the allowable number in drinking water is 500 cfu/ml (from the Total Coliform Rule under the Safe Drinking Water Act).
- Regarding point 5: From the water purveyor's perspective, the use of the community's water supply to "dilute" even minuscule amounts of backflow is unacceptable. The "solution by dilution" argument can not be accepted if one considers immune compromised customers may be severely affected by a very small amount of contaminated water.
- Regarding point 6: It is not prudent for water purveyors to assume that dental personnel will recognize a backflow event and will curtail usage of water using dental equipment.
- Regarding point 7: Some dentists are now using contained water systems. This option may eliminate the need for internal backflow prevention devices on equipment that formerly utilized the public water supply. However, it would not eliminate the need for service protection backflow prevention assemblies if other water using equipment such as vacuum pumps, x-ray machines, autoclaves, etc. are still connected to the public water supply.
- Regarding point 8: Cost/Benefit analysis is not the sole criteria when establishing health and safety regulations, particularly drinking water regulations. Health risk to all segments of the population must be considered as well.

SUMMARY

Due to the public health concerns cited above and regulatory requirements, TMWA requires service protection as defined in this section for dental offices.

TMWA strongly encourages dental clinics to implement proactive internal cross-connection control programs.

APPENDIX B SERVICE CONNECTIONS TO MULTI-UNIT COMMERCIAL BUILDINGS

PURPOSE

The purpose of this policy statement is to define backflow prevention requirements for domestic service protection for multi unit complexes that are water customers of TMWA Power Company. This policy statement has been developed based upon a review of current regulations.

BACKGROUND

TMWA has many customers whose premises consists of large buildings serving multiple tenants with one water service. These include, but are not limited to, multi-tenant office buildings, warehouses, and strip malls. Although in many instances an individual tenant's domestic water use may not constitute a pollutant or contaminant level hazard, when the number of units are considered along with a potential wide variety of uses, the risk associated with cross-connections from non-potable sources increases significantly. This risk is further exacerbated by the transient nature of tenancy and changing water use which is difficult, if not impossible, to monitor by the water supplier.

The inherent cross-connection risks and changing water use hazards associated with buildings serving multiple tenants are recognized by NAC 445A, Public Water System Regulations: to the degree that for any building where the business activity and water use cannot be reasonably identified, service protection is required in the form of a reduced pressure principle assembly (RP). In addition, many of the business activities commonly found in multi-unit facilities have been identified in the regulations as requiring a contaminant (health) level of service protection.

Therefore, the multi-tenant facility presents a contaminant (health) degree of hazard to the community's (TMWA's) water supply. For these regulatory reasons and for the risks cited above to TMWA's distribution system, the following are reasonable backflow prevention requirements for the domestic services serving such facilities.

BACKFLOW PREVENTION REQUIREMENTS FOR DOMESTIC SERVICES

NEW SERVICES

An approved reduced pressure principle backflow prevention assembly (RP) shall be required on all new services.

EXISTING SERVICES

For existing service connections, the following criteria will apply:

1. If, in the original utility plans for the project, a backflow prevention assembly was

called for but not installed, the backflow prevention assembly as called for on the utility plans shall be installed.

2. If a multi-unit facility is undergoing an expansion, remodel, or tenant improvement of a unit, then an RP shall be required on the domestic service as close as possible to the meter and before the first lateral take-off.
3. If a cursory survey by TMWA, or a detailed survey by a Cross Control Specialist, on a multi-unit facility indicates a contaminant or pollutant hazard, then an RP shall be required on the domestic service as close as possible to the meter and before the first lateral take-off, rather than on the individual water line to that tenant.
4. If a survey conducted on a multi-unit facility indicates no contamination or pollution level hazard, then no backflow prevention assembly for service protection would be required immediately. Each year, a written re-certification shall be required of the owner or property manager. After receipt and review of the certification, TMWA's Backflow Prevention Group shall then determine if service protection is required. The following will be included in the re-certification:

    - Changes in tenancy
    - Changes in water use
    - Plumbing changes
    - Use of non potable water

APPENDIX C RESIDENTIAL FIRE SPRINKLER SYSTEMS

BACKGROUND

Local fire department jurisdictions may require the installation of fire sprinkler systems for certain single family homes. Single family homes that are far removed from a hydrant, a fire station, or because of their size or nature, may require the installation of such a system.

Based on discussions with the District Health Department and the Reno and Sparks Fire Departments, the owner or developer of a single family residence requiring a fire sprinkler system may elect:

- to install a non-testable single check valve or
- to install a backflow prevention assembly (double check valve assembly or a reduced pressure backflow prevention assembly).

Installation requirements for both are described below.

SINGLE CHECK INSTALLATION REQUIREMENTS

1. Chemical additives or antifreeze shall not be in the system.
2. All piping shall be approved for potable water service.
3. The end of the fire main shall be plumbed into a water closet, to have water flow due to water usage.
4. A single check valve shall be installed at the fire riser. The valve shall be a Grinnell Number 3300 or equal.
5. Dead end branches in the fire suppression system shall be as short as possible and not to exceed 40 feet.
6. On-site storage is not allowed for fire suppression.

BACKFLOW PREVENTION ASSEMBLY REQUIREMENTS

1. The backflow prevention assembly shall meet all requirements for installation noted in the TMWA Backflow Prevention Installation Requirements and Standards and this policy.
2. The type of assembly and location will be designated by TMWA Backflow Prevention Group.
3. The installation shall be inspected by TMWA Backflow Prevention Group.
4. The backflow prevention assembly shall be tested on installation and annually thereafter.
5. The backflow prevention assembly shall be maintained in factory working condition.

REFERENCES TO OTHER SECTIONS OF THIS POLICY

Attached at Appendix D is a letter from the District Health Department reiterating the above requirements.

APPENDIX D HEALTH DEPARTMENT MEMO: RESIDENTIAL FIRE SPRINKLER REQUIREMENTS

CITY OF RENO

CITY OF SPARKS

APPENDIX E UNIFORM PLUMBING CODE: INTERNAL BACKFLOW PREVENTION REQUIREMENTS

Refer to Chapter 6 of the UPC, Water Supply and Distribution, for internal backflow prevention requirements, for the adopted version specific to the city or jurisdiction in question.

Backflow prevention and cross connection requirements are detailed in sections 602 through 603.

APPENDIX F NAC 445A EXCERPT

NEVADA ADMINISTRATIVE CODE

Containing All Permanent Regulations of State Agencies
Adopted under chapter 233B of NRS
Classified, Arranged, Revised, Indexed and Published
(Pursuant to NRS 233B.062 to 233B.065 inclusive)
by the
LEGISLATIVE COUNSEL
STATE OF NEVADA

Please direct any questions or suggestions
pertaining to NAC to:
Legislative Counsel Bureau
Capitol Complex
Carson City, Nevada 89701-4747
(702) 687-6830

AUTHORITY: NRS 439.200, 445A.855, 445A.860, 445A.863, 445A.880

CHAPTER 445A
WATER CONTROLS
PUBLIC WATER SYSTEMS

Design, Construction, Operation and Maintenance

NAC 445A.6553 "Air gap" defined. "Air gap" means a physical separation between a point of free-flowing discharge from a pipe that supplies liquid to an open or nonpressurized vessel and the overflow rim of that vessel which is:
1. At least twice the effective diameter of that pipe or, if the pipe is affected by side walls, at least three times the effective diameter of that pipe; and
2. In no case less than 1 inch.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.65535 "Air release valve" defined. "Air release valve" means a valve that is placed at a high point of a pipeline for the automatic release of air to prevent air binding and the buildup of pressure.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.65555 "Approved backflow testing laboratory" defined. "Approved backflow testing laboratory" means:
1. The Foundation for Cross-Connection Control and Hydraulic Research of the University of Southern California; or
2. Any other person or entity who the health authority determines:
(a) Is competent and possesses the necessary facilities to investigate and evaluate assemblies for the prevention of backflow;
(b) Adheres to the procedures for testing and certification set forth in the American Water Works Association Standards; and
(c) Is independent of any manufacturers of assemblies for the prevention of backflow.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.65575 "Atmospheric vacuum breaker" defined. "Atmospheric vacuum breaker" means a vacuum breaker that contains an air inlet valve, a check seat and one or more air inlet ports, in which:
1. The flow of water causes the air inlet valve to close the air inlet ports; and
2. When the flow of water stops:
(a) The air inlet valve falls and forms a check valve against backsiphonage; and
(b) The air inlet ports open to allow air to enter and satisfy the vacuum.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.65585 "Auxiliary supply of water" defined. "Auxiliary supply of water" means a supply of water or system for the supply of water which is available to the premises of a customer of a public water system, other than the supply or system of the public water system established to provide water to the premises, including another public water system or any natural source of water.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.65605 "Backflow" defined. "Backflow" means a hydraulic condition in which a relative difference in pressures causes a nonpotable liquid, gas or other substance to flow into a potable water system.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.6561 "Backpressure" defined. "Backpressure" means an elevation in the downstream pressure of a piping system above the supply pressure which:
1. Is caused by pumping, air pressure, steam or the elevation of piping; and
2. Could cause a reversal in the normal direction of flow at a particular point.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.65615 "Backsiphonage" defined. "Backsiphonage" means a backflow that results when a reduction in the pressure of a water system causes a subatmospheric pressure to exist at a particular site in the water system.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.6569 "Certified backflow prevention assembly tester" defined. "Certified backflow prevention assembly tester" means a person who is certified by the California/Nevada section of the American Water Works Association to test assemblies for the prevention of backflow.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.65695 "Check valve" defined. "Check valve" means a valve designed to open in the direction of normal flow and close with the reversal of normal flow.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.65725 "Class 1 fire sprinkler system" defined. "Class 1 fire sprinkler system" means a fire sprinkler system that:
1. Has a direct connection to a water main and no physical connection to any source of pollution or contamination;
2. Uses no pumps, tanks or reservoirs; and
3. Uses no antifreeze or other additives of any kind.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.6573 "Class 2 fire sprinkler system" defined. "Class 2 fire sprinkler system" means a fire sprinkler system that:
1. Has a direct connection to a water main and no physical connection to any source of pollution or contamination;
2. Has a booster pump installed at the connection to the water main;
3. Uses no tanks or reservoirs; and
4. Uses no antifreeze or other additives of any kind.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.65735 "Class 3 fire sprinkler system" defined. "Class 3 fire sprinkler system" means a fire sprinkler system that:
1. Has a direct connection to a water main;

2. Uses no antifreeze or other additives of any kind; and
3. Uses one or more of the following:
(a) An elevated tank for the storage of water.
(b) A pump that takes suction from a tank or covered reservoir located above ground.
(c) A pressure tank.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.6574 "Class 4 fire sprinkler system" defined. "Class 4 fire sprinkler system" means a fire sprinkler system that:
1. Has a direct connection to a water main;
2. Has available an auxiliary supply of water which is located on the premises or within 1,700 feet of a pumping connection for the system; and
3. Uses no antifreeze or other additives of any kind.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.65745 "Class 5 fire sprinkler system" defined. "Class 5 fire sprinkler system" means a fire sprinkler system that has a direct connection to a water main and:
1. An interconnection with an auxiliary supply of water, including, without limitation:
(a) A prohibited water well;
(b) A water system used for industrial purposes; or
(c) A pump that takes suction from a river, pond or reservoir; or
2. Uses antifreeze or another additive.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.6575 "Class 6 fire sprinkler system" defined. "Class 6 fire sprinkler system" means a fire sprinkler system that:
1. Is combined with a water system used for industrial purposes; and
2. Has a direct connection to a water main and no physical connection to any other supplies of water, except that the system may have gravity storage or a pump that takes suction from a tank.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.65795 "Contamination" defined. "Contamination" means an impairment of water quality by chemical substances or biological organisms which the health authority determines to be sufficient to create a risk or threat to the public health.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.6581 "Cross-connection" defined. "Cross-connection" means an unprotected connection or structural arrangement, whether actual or potential, between a public water system and any other source or system, through which it is possible to introduce into any part of the public water system any used water, industrial fluid, gas or substance other than the potable water intended to supply the system. The term includes any bypass arrangements, jumper connections, removable sections, swivel or change-over devices or other temporary or permanent devices through which or because of which backflow can occur.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.65855 "Double check detector check assembly" defined. "Double check detector check assembly"
means an assembly composed of a line-sized double check valve assembly and a bypass that contains a water meter and another double check valve assembly.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.6586 "Double check valve assembly" defined. "Double check valve assembly" means an assembly that:
1. Is composed of two independently acting, approved check valves;
2. Has tightly closing, resilient seated shutoff valves attached at each end;
3. Is fitted with properly located, resilient seated test cocks; and
4. Has been tested and approved, in accordance with American Water Works Association Standard C510, by an approved backflow testing laboratory.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.65945 "Fire sprinkler system" defined. "Fire sprinkler system" means a system of piping which is connected to a public water system and has sprinklers that automatically discharge water over the area of a fire.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.66055 "Health authority" defined. "Health authority" means the officers and agents of the district board of health of the health district in which the area of service of a public water system is located or, if none, the officers and agents of the health division.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.6623 "Pollution" defined. "Pollution" means an alteration of the chemical, physical, biological or radiological integrity of water that:
1. Impairs the quality of the water to such an extent that the impairment adversely and unreasonably affects those aesthetic qualities which would have made the water desirable for domestic use; and
2. Does not impair the quality of the water to such an extent that the health authority determines that the impairment creates a risk or threat to the public health.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.6625 "Pressure vacuum breaker" defined. "Pressure vacuum breaker" means a vacuum breaker that:
1. Contains an independently operating, internally loaded approved check valve and an independently operating, loaded air inlet valve located on the discharge side of the approved check valve; and
2. Is equipped with properly located, resilient seated test cocks and tightly closing, resilient seated shutoff valves which are attached at each end of the assembly.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.6631 "Reduced pressure detector assembly" defined. "Reduced pressure detector assembly" means an assembly designed to protect against pollution and contamination which is composed of a line-sized, reduced pressure principle

assembly and a bypass that contains a water meter and another reduced pressure principle assembly.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.66315 "Reduced pressure principle assembly" defined. "Reduced pressure principle assembly" means an assembly that:
1. Contains:
(a) Two independently acting approved check valves; and
(b) A hydraulically operating, mechanically independent pressure relief valve that is located between the approved check valves and below the upstream check valve;
2. Has properly located, resilient, seated test cocks and tightly closing, resilient, seated shutoff valves at each end of the assembly;
3. Is designed to protect against pollution and contamination under conditions of backsiphonage or backpressure; and
4. Has been tested and approved, in accordance with American Water Works Association Standard C511, by an approved backflow testing laboratory.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.66375 "Service connection" defined. "Service connection" means:
1. The point of connection between a public water system and the water system used by a customer of the public water system, at which the public water system loses its authority and control over the water;
2. If a meter is installed at a connection between a public water system and the water system used by a customer of the public water system, the downstream end of the meter; or
3. At a park for mobile homes or recreational vehicles, the riser for water service.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.6643 "Stop and waste valve" defined. "Stop and waste valve" means a valve installed in a meter box or valve box that allows a supply of water to a service line to be shut off and subsequently allows water from pipelines in the building or other property where the water is used to drain into the meter box or valve box.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.6648 "Supplier of water" defined. "Supplier of water" means a person or other entity, including a governmental entity, which owns or operates a public water system.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.67185 Cross-connections and backflow: General requirements. A supplier of water shall:
1. Ensure that there are no unprotected connections between the supplies of water, systems for the pumping, storage and treatment of water, and distribution system of the public water system and any source of pollution or contamination pursuant to which any unsafe water or other degrading material can be discharged or drawn into the public water system as a result of backsiphonage or backpressure.

2. Develop and carry out a program for the control of cross-connections that is approved by the health authority. Except for a program that has been approved by a health authority before February 20, 1997, a program for the control of cross-connections must:
(a) Be submitted to the health authority for its approval no later than:
(1) January 1, 1999; or
(2) Eighteen months after the public water system begins operation,
whichever is later.
(b) Include:
(1) A schedule for implementation.
(2) A plan for inspecting the properties served by the public water system to determine the potential risk of cross-connection and backflow.
(3) A plan for testing and tracking all primary assemblies for the prevention of backflow which are intended to protect the public water system upstream from a service connection. The plan must provide for the annual testing of those assemblies and for the retention of records from that testing.
(4) A list of the particular assemblies for the prevention of backflow which may be used in the public water system or on service connections to the public water system.
(5) A list of the measures the supplier of water will take to enforce the program if any customers of the system fail to comply with the program.
(c) Ensure compliance with NAC 445A.67185 to 445A.67255, inclusive.
(d) Except as otherwise provided in NAC 445A.67185 to 445A.67255, inclusive, comply with the provisions of:
(1) The Uniform Plumbing Code;
(2) Recommended Practice for Backflow Prevention and Cross-Connection Control; and
(3) The Manual of Cross-Connection Control.
If there is any conflict between any of the provisions described in this paragraph, the most stringent of those provisions prevails.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.6719 Cross-connections and backflow: Assemblies for prevention of backflow.
1. Each service connection must have an assembly for the prevention of backflow, of a type that is commensurate with the degree of hazard that exists on the property of the customer of a public water system. Except as otherwise provided in NAC 445A.67185 to 445A.67255, inclusive, the assembly may consist of any one of the following, as listed in the order of least to most protection:
(a) A double check valve assembly.
(b) A reduced pressure principle assembly.
(c) An air gap.
2. A reduced pressure principle assembly may be substituted for a double check valve assembly, and an air gap may be substituted for a reduced pressure principle assembly.
3. With the approval of the supplier of water:

(a) A double check detector check assembly may be substituted for a double check valve assembly; and
(b) A reduced pressure detector assembly may be substituted for a reduced pressure principle assembly.
4. A double check valve assembly or double check detector check assembly may be used only for protection against pollution.
5. A reduced pressure principle assembly or reduced pressure detector assembly may be used for protection against pollution or contamination, but a reduced pressure principle assembly must not be used for protection against sewage or reclaimed wastewater.
6. An assembly for the prevention of backflow must not be composed solely of a single check valve.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.67195 Cross-connections and backflow: Minimum types of protection for particular service connections. Except as otherwise provided in NAC 445A.67185 to 445A.67255, inclusive, or authorized by the health authority, the minimum type of protection from cross-connection required for a service connection to:
1. A public building or any building:
(a) That contains a hotel, motel, casino, condominium or town house, or any apartments;
(b) Used for commercial purposes where a specific business activity has not been identified; or
(c) In which one or more sewage pumps or sewage ejectors have been installed,
consists of a reduced pressure principle assembly.
2. A building that:
(a) Has multiple stories and booster pumps or elevated tanks to distribute potable water; or
(b) Exceeds 40 feet in height, as measured from the service connection to the highest water outlet,
consists of a double check valve assembly.
3. A class 1, class 2 or class 3 fire sprinkler system consists of a double check valve assembly.
4. A class 4, class 5 or class 6 fire sprinkler system consists of a reduced pressure principle assembly.
5. A hydronic heating system that contains any chemical additives consists of a reduced pressure principle assembly.
6. A baptismal font of a church consists of a reduced pressure principle assembly.
7. A facility for bottling beverages consists of a reduced pressure principle assembly.
8. A brewery consists of a reduced pressure principle assembly.
9. A cannery, facility for the processing of food, packing house or rendering facility consists of a reduced pressure principle assembly.
10. A facility for cold storage consists of a reduced pressure principle assembly.
11. A dairy processing facility consists of a reduced pressure principle assembly.
12. A restaurant or other facility in which food is served consists of a reduced pressure principle assembly.
13. A dental clinic consists of a reduced pressure principle assembly.

14. A hospital, medical building or clinic consists of a reduced pressure principle assembly.
15. A convalescent home or nursing home consists of a reduced pressure principle assembly.
16. A sanitarium consists of a reduced pressure principle assembly.
17. A morgue, mortuary or facility for conducting autopsies consists of a reduced pressure principle assembly.
18. A laboratory, including, without limitation, a laboratory of a teaching institution or another biological or analytical facility, consists of a reduced pressure principle assembly.
19. A facility of a school, college or university consists of a reduced pressure principle assembly.
20. A facility for the production of motion pictures consists of a reduced pressure principle assembly.
21. A facility for the publishing or printing of a newspaper consists of a reduced pressure principle assembly.
22. A veterinary clinic, pet shop or facility for grooming pets consists of a reduced pressure principle assembly.
23. A laundry or dry cleaning facility consists of a reduced pressure principle assembly.
24. A dyeing facility consists of a reduced pressure principle assembly.
25. A facility for mechanical, chemical or electrochemical plating consists of a reduced pressure principle assembly.
26. Any portable spraying or cleaning equipment consists of an air gap.
27. A pool or spa consists of a reduced pressure principle assembly.
28. A park for mobile homes or recreational vehicles consists of a reduced pressure principle assembly.
29. A facility located on a waterfront, including, without limitation, a fishery, fish hatchery, dock or marina, consists of a reduced pressure principle assembly.
30. A facility for the production of power consists of a reduced pressure principle assembly.
31. A facility for the production, storage or transmission of oil or gas consists of a reduced pressure principle assembly.
32. A facility that handles, processes or stores radioactive materials or substances consists of a reduced pressure principle assembly.
33. A facility for processing sand or gravel consists of a reduced pressure principle assembly.
34. A system for storm drainage, the collection of sewage or the distribution of reclaimed wastewater consists of an air gap.
35. A facility in which:
(a) Water is used to manufacture, store, compound or process chemicals for industrial purposes;
(b) Chemicals are added to water used in the compounding or processing of products;
(c) Chemicals are added to the supply of water; or
(d) The supply of water is used for the transmission or distribution of chemicals,
consists of a reduced pressure principle assembly.
36. A facility for the manufacture of aircraft or missiles consists of a reduced pressure principle assembly.

37. A facility for the manufacture, repair or washing of motor vehicles consists of a reduced pressure principle assembly.
38. A facility for the manufacturing or processing of film consists of a reduced pressure principle assembly.
39. A facility for the manufacturing of ice consists of a reduced pressure principle assembly.
40. A facility for the manufacturing, processing or cleaning of metal consists of a reduced pressure principle assembly.
41. A facility for the manufacturing of natural or synthetic rubber consists of a reduced pressure principle assembly.
42. A facility for the manufacturing of paper or paper products consists of a reduced pressure principle assembly.
43. Any other facility for manufacturing, processing or fabricating consists of a reduced pressure principle assembly.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.67205 Cross-connections and backflow: Minimum types of protection for service connection to auxiliary supply of water or irrigation system. Except as otherwise provided in NAC 445A.67185 to 445A.67255, inclusive, the minimum type of protection required for a service connection to:
1. An auxiliary supply of water must consist of a double check valve assembly or reduced pressure principle assembly, as determined by the supplier of water and approved by the health authority.
2. An irrigation system, including a system for irrigating median strips, must consist of:
(a) A pressure vacuum breaker or double check valve assembly, as determined by the supplier of water and approved by the health authority; or
(b) Except as otherwise authorized by the health authority, if facilities have been installed for pumping, injecting or applying fertilizers, pesticides or other hazardous systems, a reduced pressure principle assembly.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.6721 Cross-connections and backflow: Minimum types of protection for other service connections; resolution of conflicting requirements; imposition of more stringent requirements.
1. The health authority shall determine, on a case-by-case basis, the minimum type of protection from cross-connection required for any type of service connection which is not specified in NAC 445A.67185 to 445A.67255, inclusive.
2. If there is any conflict between any of the provisions of NAC 445A.67185 to 445A.67255, inclusive, regarding the type of protection from cross-connection required for a particular type of service connection, the most stringent of those provisions prevails.
3. The health authority or supplier of water may impose requirements regarding the installation and use of assemblies for the prevention of backflow which are more stringent than the provisions of NAC 445A.67185 to 445A.67255, inclusive.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.67215 Cross-connections and backflow: Service connection to fire sprinkler system.
1. A supplier of water shall ensure that:
(a) An appropriate assembly for the prevention of backflow is installed at each service connection between the public water system and a fire sprinkler system; and
(b) The assembly is:
(1) Tested upon installation; and
(2) Maintained and tested, and the results of those tests logged, annually.
The testing required by this subsection must be conducted by a certified backflow prevention assembly tester.
2. An assembly for the prevention of backflow installed on a service connection between a public water system and a fire sprinkler system must:
(a) Be of such a type and installed in such a manner that the assembly:
(1) Protects the public water system; and
(2) Does not interfere with the capability of the fire sprinkler system, as engineered, to protect the safety of persons in the public or private facility in which the fire sprinkler system is located; and
(b) Prevent any pollution or contamination of drinking water, by any nonpotable water contained in the fire sprinkler system, which may be caused by any backpressure or backsiphonage that may occur during normal or abnormal operation of the fire sprinkler system or the public water system.
3. The supplier of water shall determine the type of assembly required on a particular service connection between the public water system and a fire sprinkler system based upon the degree of risk posed by the fire sprinkler system to the supply of potable water, considering the chemical and biological contents of the fire sprinkler system, the materials used to construct the fire sprinkler system and the possibility that backflow will occur.
4. Any reduced pressure principle assembly or reduced pressure detector assembly used on a service connection between a public water system and a fire sprinkler system must not have any holes drilled in the check valve clappers.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.6722 Cross-connections and backflow: Design of fire sprinkler system.
The designer of a fire sprinkler system shall ensure that, based upon the placement of any reduced pressure principle assembly or reduced pressure detector assembly:
1. An antifreeze loop or the total line of the fire sprinkler system is able to accommodate the thermal expansion of any antifreeze; or
2. If necessary, an expansion tank is provided to accommodate the thermal expansion of any antifreeze.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.67225 Cross-connections and backflow: Conditions to provision of service to certain fire sprinkler systems. If any backflow involving a fire sprinkler system threatens a public water system, the supplier of water shall require, as a condition to the provision of service to the fire sprinkler system:
1. The installation of an assembly for the prevention of backflow in accordance with the requirements of NAC 445A.67215.

2. An analysis to determine how the assembly will affect the pressure and rate of flow of water available to the fire sprinkler system.
3. The modification of the fire sprinkler system, and the riser and water service lateral for the fire sprinkler system, in such a manner as necessary to ensure adequate fire flow.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.6723 Cross-connections and backflow: Installation of air gap. Except as otherwise authorized by the health authority, if an air gap is installed on a service connection:
1. The air gap must be located as closely as practicable to the service connection, on the opposite side of the service connection from the public water system.
2. All piping from the service connection to the receiving tank must be above grade and visible.
3. There must be no type of outlet, tee, tap, take-off or connection to or from the service line between the service connection and the air gap.
4. Expansion tanks or pressure relief valves must be provided as appropriate for the potential threat of water hammer and thermal expansion.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.67235 Cross-connections and backflow: Installation of reduced pressure principle assembly. Except as otherwise authorized by the health authority, if a reduced pressure principle assembly is installed on a service connection:
1. The reduced pressure principle assembly must be installed:
(a) In a horizontal and level position, except that the reduced pressure principle assembly may be installed in a vertical position if the assembly has been:
(1) Specifically designed for operation in that position; and
(2) Tested and certified to be suitable for operation in that position by an approved backflow testing laboratory.
(b) As closely as practicable to the service connection, on the opposite side of the service connection from the public water system.
(c) Above ground and, to the extent possible, not less than 12 inches nor more than 36 inches above the finished grade, as measured from the bottom of the assembly.
(d) At a site with adequate drainage, or with drain piping, for any fluid that is discharged when the assembly is activated.
(e) In such a manner that no part of the assembly will be submerged during normal conditions of operation and weather.
(f) In such a manner as to be readily accessible for maintenance and testing.
2. The reduced pressure principle assembly must not be installed below grade, in any subsurface vault, or in any vault, chamber or pit where there is any potential that the relief valve could become submerged.
3. The reduced pressure principle assembly must have a free-flowing drain with an air gap.
4. There must be no type of outlet, tee, tap, take-off or connection to or from the service line between the service connection and the reduced pressure principle assembly.
5. Expansion tanks or pressure relief valves must be provided as appropriate for the potential threat of water hammer and thermal expansion.

6. The reduced pressure principle assembly may be installed indoors if the installation complies with subsections 1 to 5, inclusive, and has a clearance of:
(a) At least 12 inches on top;
(b) At least 24 inches on the side with test cocks; and
(c) At least 12 inches on the other sides.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.6724 Cross-connections and backflow: Installation of double check valve assembly. Except as otherwise authorized by the health authority, if a double check valve assembly is installed on a service connection:
1. The double check valve assembly must be installed:
(a) In a horizontal and level position, except that the double check valve assembly may be installed in a vertical position if the assembly has been:
(1) Specifically designed for operation in that position; and
(2) Tested and certified to be suitable for operation in that position by an approved backflow testing laboratory.
(b) As closely as practicable to the service connection, on the opposite side of the service connection from the public water system.
(c) Above ground and, to the extent possible, not less than 12 inches nor more than 36 inches above the finished grade, as measured from the bottom of the assembly.
(d) In such a manner as to be readily accessible for maintenance and testing.
2. There must be no type of outlet, tee, tap, take-off or connection to or from the service line between the service connection and the double check valve assembly.
3. Expansion tanks or pressure relief valves must be provided as appropriate for the potential threat of water hammer and thermal expansion.
4. The double check valve assembly may, if above-grade installation is impracticable and the health authority approves of the installation, be installed in a below-grade vault in such a manner that:
(a) The top of the double check valve assembly is not more than 8 inches below grade.
(b) There is:
(1) At least 12 inches of clearance between the bottom of the vault and the bottom of the double check valve assembly;
(2) At least 24 inches of clearance between the side of the vault and the side of the double check valve assembly with test cocks; and
(3) At least 12 inches of clearance between the side of the vault and the other sides of the double check valve assembly.
(c) To the extent warranted by climatic conditions, the double check valve assembly is protected from freezing.
(d) The vault has adequate drainage to prevent the accumulation of water, which drains to daylight, to free-draining soil or to a sufficient amount of gravel placed under the vault to provide for free drainage and prevent the accumulation of water under the vault. A vault that does not have an integrated bottom must be placed on a layer of gravel which is not less than 3 inches deep.
(e) The vault is protected from vandalism.
(f) The vault is not located in an area subject to vehicular traffic.
5. The double check valve assembly may be installed indoors if:
(a) The installation complies with subsections 1 to 4, inclusive; and

(b) The double check valve assembly has a clearance of:
(1) At least 12 inches on top;
(2) At least 24 inches on the side with test cocks; and
(3) At least 12 inches on the other sides.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.67245 Cross-connections and backflow: Duties of certified backflow prevention assembly tester. A certified backflow prevention assembly tester shall:
1. Perform his field testing of assemblies for the prevention of backflow in accordance with the provisions of the Manual of Cross-Connection Control.
2. Use, for the testing of reduced pressure principle assemblies, double check valve assemblies and pressure vacuum breakers, a differential pressure gauge that has:
(a) A differential range of at least zero to 15 psi; and
(b) Graduations of not more than 0.2 psi.
3. Ensure that his testing equipment:
(a) Is calibrated to the manufactures' specifications not less than annually; and
(b) Has all necessary hoses and fittings.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.6725 Cross-connections and backflow: Use of vacuum breakers.
1. An atmospheric vacuum breaker or pressure vacuum breaker may be used only for protection against pollution or contamination under conditions of backsiphonage.
2. If an atmospheric vacuum breaker is used:
(a) The vacuum breaker must be installed not less than 6 vertical inches above the highest point of the downstream piping.
(b) Any associated shutoff valve must be installed upstream from the vacuum breaker.
(c) The vacuum breaker must not be subjected to operating pressure for more than 12 hours in any 24-hour period.
(d) Flow from the protected fixture must be to the atmosphere.
3. If a pressure vacuum breaker is used, the vacuum breaker:
(a) Must be installed:
(1) Upstream from the terminal shutoff valve; and
(2) Not less than 12 vertical inches above the highest point of the downstream outlet, valve or piping.
(b) Must not be installed at a location where backpressure will occur.
(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.67255 Cross-connections and backflow: Restrictions on use of certain valves and piping assemblies.
1. A stop and waste valve must not be used on a service line.
2. If a valve or piping assembly, including a frost-free riser, has an opening that is subject to flooding, the valve or piping assembly must not be used on a service line unless:
(a) The valve or piping assembly is adequately protected by an assembly for the prevention of backflow; and

(b) If the piping assembly is a frost-free riser, the riser is equipped with appropriate valves and a connection for the introduction of compressed air, pursuant to which water may be purged and the system prepared for winter.
(Added to NAC by Bd. of Health, eff. 2-20-97)

APPENDIX G TMWA BACKFLOW PREVENTION INSTALLATION REQUIREMENTS AND STANDARDS DOCUMENT

Installation Requirements and Standards are available from the TMWA Backflow Prevention Group on request.

IRRIGATION SYSTEM CONSTRUCTION

PRIVATE RECLAIMED WATER IRRIGATION SYSTEMS

1. When deemed necessary by the County, an approved backflow prevention device shall be installed, to the satisfaction of the County, immediately downstream of the meter. All aboveground piping shall be painted purple (Pantone Color #512) and a purple tag, with the wording "WARNING: RECLAIMED WATER - DO NOT DRINK" in English and Spanish, attached to the assembly (T. Christy Enterprises, Valve Identification Tag, ID-STD-P2-RC1P2 or approved equal).

2. All valve box covers for isolation valves, electrical control valves, pressure reducing valves, pressure regulating valves, quick coupler valves, and similar appurtenances shall be purple in color as supplied by the manufacturer and labeled "Reclaimed Water". A purple tag, with the wording "WARNING: RECLAIMED WATER - DO NOT DRINK", shall be attached to all valves (see above). All valve box covers will be capable of being bolted closed, bolts will be in place and secured.

3. All quick coupler valves shall have purple, lockable covers, i.e. Rain Bird 44NP or equal.

4. All irrigation controllers shall be labeled inside and outside warning that the system uses reclaimed water (T. Christy Enterprises, Controller Marking Decal, Part Number #4100 or approved equal).

5. All irrigation mains, any line upstream of an electrical control valve shall be purple plastic, or be encased in purple polyethylene bags labeled "CAUTION: RECLAIMED WATER LINE" at intervals no greater than 5 feet. If purple pipe or bags are not available, purple vinyl adhesive tape shall be attached to the pipe, continuously, in a longitudinal direction. The tape shall have the wording "CAUTION: RECLAIMED WATER LINE" at intervals of no more than 5 feet, have a minimum width of 3 inches, and be installed along the top of the pipe.

   All laterals downstream of an electric control valve shall be purple plastic or have purple reclaimed warning tape placed on top of the pipe. This does not apply to flexible polyethylene tubing used in drip zones.

6. Purple, 3 inch warning tape, with wording "CAUTION: RECLAIMED WATER LINE BELOW", shall be installed 12 inches above all irrigation mains.

7. Signage shall be posted, in obvious locations, at the entry to all properties, landscape islands, medians, and other use sites. Maximum spacing for roadway landscaping shall be determined by the Utility Services Division, however, will in no case exceed 500'. Signs shall have the wording "TREATED WASTEWATER EFFLUENT USED FOR IRRIGATION- DO NOT DRINK- AVOID CONTACT". Minimum sign size shall be 8" X 12", larger signs will be required at primary access points.

8. Reclaimed waterlines, including irrigation main lines, shall be treated as on-site sewer lines and all applicable separation from on-site waterlines maintained.

9. Direct connections between potable water piping and reclaimed water piping shall not exist under any condition with or without backflow protection per UPC (1997 edition) Section 603.3.4.

10. Hose bibs will not be installed on reclaimed water systems.

Washoe County

STANDARDS FOR RECLAIMED WATER

IRRIGATION SYSTEM CONSTRUCTION

DEDICATED RECLAIMED WATER LINES

1. All construction shall conform to the Standard Specification for Public Works Construction (1996) and Washoe County Standards.

2. All reclaimed water lines constructed out of PVC or polyethylene shall be purple plastic, or be encased in purple polyethylene bags labeled "CAUTION: RECLAIMED WATER LINE" at intervals no greater than 5 feet. If purple pipe or bags are not available, purple vinyl adhesive tape shall be attached to the pipe, continuously, in a longitudinal direction. The tape shall have the wording "CAUTION: RECLAIMED WATER LINE" at intervals of no more than 5 feet, have a minimum width of 6 inches, and be installed along the top of the pipe. Reclaimed water lines constructed out of ductile iron shall be encased in purple polyethylene bags labeled "CAUTION: RECLAIMED WATER LINE" at intervals no greater than 5 feet.

3. Tracer wire shall be placed on top of bedding material prior to pipe installation. At 500 foot intervals, wire shall be extended into separate test stations consisting of risers and valve boxes. A minimum of 18 inches of wire shall be left at the top of the riser and connected with the appropriately sized wire nut. The tracer wire shall be placed under laterals, extended into the meter box and up to the meter cover. Wire shall be # 12 AWG, insulated, stranded copper. Prior to acceptance of the reclaimed waterline, the contractor shall perform a continuity test after backfilling the trench to the satisfaction of the Utility Services Division Inspector.

4. Purple warning tape, at least 3 inches in width, with wording "CAUTION: RECLAIMED WATER LINE BELOW", shall be installed 12 inches above all pipe.

5. All covers for valve boxes, flush valves, pressure reducing stations, air/vac stations, and all other appurtenances requiring vaults or boxes shall be purple in color (Pantone Color #512) and labeled "RECLAIMED WATER" or "R.C.W.". Purple coloration shall be obtained from the manufacturer or be applied by powder coating or epoxy paint. All appurtenances shall have a purple tag attached with the wording "WARNING: RECLAIMED WATER - DO NOT DRINK" in English and Spanish (T. Christy Enterprises, Valve Identification Tag, ID-STD-P2-RC1P2 or approved equal). A debris cap with purple coloration shall be installed inside of all round valve boxes.

6. All aboveground piping shall be painted purple (Pantone Color #512) and a purple tag, with the wording "WARNING: RECLAIMED WATER - DO NOT DRINK" in English and Spanish, attached to the assembly (T. Christy Enterprises, Valve Identification Tag, ID-STD-P2-RC1P2 or approved equal).

7. All meter box covers shall be purple in color (see above) and a purple tag, with the wording "WARNING: RECLAIMED WATER - DO NOT DRINK" in English and Spanish, attached to the meter (T. Christy Enterprises, Valve Identification Tag, ID-STD-P2-RC1P2 or approved equal).

8. The minimum horizontal separation between parallel reclaimed waterlines and potable waterlines shall be 10 feet. When reclaimed waterlines cross potable waterlines, the reclaimed line shall be installed below the potable line. A minimum of 18 inches vertical separation shall be maintained from the bottom of a potable waterline to the top of a crossing reclaimed waterline. Reclaimed waterline pipe joints shall be kept as far away as possible from crossing potable waterlines.

9. Direct connections between potable water piping and reclaimed water piping shall not exist under any condition with or without backflow protection per UPC (1997 edition) Section 603.3.4 .

APPENDIX E-CITY OF SPARKS EAST REUSE SITE INFORMATION AND EFFLUENT DEMANDS

City of Sparks East Effluent Discharge Permit Site Information and Effluent Demands

Property	Total Area (Acre)	Irrigated Area (Acre)	Acre-Feet per Year	Peak Demand (gpm)	Maximum Daily Flow (mgd)	30-Day Average (mgd)	Physical Address	Latitude/ Longitude	Township/ Range/ Section
Pagni Ranch Park	4.6	3.7	13.79	137	0.066	0.028	Festa Way	39°32'38" N 119°41'57" W	S2 T19N. R20E
Woodtrail Park	2.4	1.7	7.12	65	0.031	0.013	1899 Woodtrail Drive	39°32'47" N 119°42'35" W	S2 T19N. R20E
D'Andrea HOA	29.6	16.4	65.00	400	0.192	0.103	N. & S. D'Andrea Parkway, Vista Blvd, & San Marino Drive	39°33'16" N 119°42'15" W	Portions of S35 & S36. T20N. R20E
Rail City	3.7	1.5	7.20	21.6	0.017	0.011	1720 Brierley Way	39°31'44"N 119°42'34"W	S11 T19N. R20E
TEC Trucking	5.0	0.5	1.21	13	0.006	0.002	1955 E. Greg St.	39°31'18"N 119°42'23"W	S11 T19N. R20E
Copper Canyon	1320.0	50.0	200.00	600	0.288	0.206	Intersection of Vista Blvd and Brierly Way	39°31'42"N 119°42'2"W	Portions of S1, S2, S11, & S12. T19N. R20E & Portion of S36. T20N. R20E
Pelican Park& Walking Path	6.0	4.8	26.00	85	0.041	0.035	Silverton Way	39°36'31"N 119°41'39"W	S12. T20N. R20E
Stonebrook	440.0	25.0	90.00	1542	0.740	0.630	South of La Posada, east of Pyramid Highway	39°37'44"N 119°42'14"W	S2. T20N. R20E
Spanish Springs Nursery	5.0	1.0	7.95	68 (24 Hour)	0.100	0.080	7655 Pyramid Highway	39°38'05" N 119°42'58" W	S3. T20N. R20E & S35. T21N. R20E
TOTAL	**1816.3**	**104.50**	**418.27**	**2931.60**	**1.481**	**1.109**	-	-	-

APPENDIX F-NDEP CONSUMPTIVE USE REQUIREMENTS WORKSHEET (WTS-1B)

WTS-1B: APPENDIX ONE

PLANT CONSUMPTIVE USE WORKSHEET

The consumptive use equation for determining the crop's water requirement takes into account precipitation, evapotranspiration, the efficiency of the irrigation system, and the salt tolerance of the plant species. The salt tolerance of the plant species is used to calculate the leaching requirement (Lr) to remove excess salts from the root zone. Excess salts within the soil cause the plant cells to expend more energy adjusting the salt concentration within the plant tissues, and therefore, less energy is available for vigorous plant growth. The hydraulic loading rate and the TDS to ECw conversion equation included below are derived from Wastewater Engineering: Treatment, Disposal, and Reuse, (Metcalf and Eddy, 1991), the equation for the leaching requirement is from the Nevada Irrigation Guide, (USDA, Soil Conservation Service, 1981).

$$Lw_{(c)} = \frac{(ET-P)}{[E \times (1-Lr)]} \qquad Lr = \frac{ECw}{[(5 \times ECe)-ECw]}$$

where:

- $Lw_{(c)}$ = Allowable Hydraulic Loading Rate Based on Crop Water Needs (in/yr);
- ET = Evapotranspiration Rate (in/yr);
- P = Precipitation Rate (in/yr);
- Lr = Leaching Requirement (%, expressed as a fraction);
- E = Efficiency of Irrigation System (%, expressed as a fraction)
  For example: 75% = 75/100 = 0.75; example efficiencies are included below;
- ECe = Salinity Tolerance of Plant Crop (mmho/cm or dS/m)[1];
- ECw = Salinity of Applied Effluent (mmho/cm); If TDS is supplied by the laboratory, see conversion below; and
- TDS = Average Total Dissolved Solids in Applied Effluent (mg/l).

"ET" - Evapotranspiration

Evapotranspiration is defined as the "loss of water from the soil both by evaporation and by transpiration from the plants growing thereon" (Websters Dictionary, 1990). Since different plants transpire at different rates, a crop coefficient (Kc) can be used to modify the potential ET for a particular area. Values for Kc vary depending upon the geographical location of the crop, and the species grown. If a crop coefficient can be determined, when multiplied by the potential ET rate, the result is a more accurate estimate of ET for an irrigation site. The Division recommends that reusers contact local agriculture representatives identified in Appendix Five for further crop-specific and regional information.

"E" - Irrigation Efficiency

The irrigation system efficiency is related to how effective the method is in delivering the irrigation water equally to all parts of the crop. Example values for efficiency are[4]:

Sprinkler Irrigation Type	Application Efficiency	Surface Irrigation Type	Application Efficiency
Solid Set	0.70 - 0.80	Narrow Graded Border (< 15' wide)	0.65 - 0.85
Portable Hand Move		Wide Graded Border (<100' wide)	0.65 - 0.85
Wheel Roll		Level Border	0.75 - 0.90
Center Pivot or Traveling Lateral		Straight or Graded Contour Furrows	0.70 - 0.85
Traveling Gun		Drip	0.70 - 0.85

"ECe" - Salinity Tolerance of Plant Crop

The plant salt tolerance is crop-specific, and can be obtained from the local Extension Service, literature, or other reputable sources. The low end of the range identifies the ECe value which would result in a 0% reduction of crop yield. The upper end of the range identifies the ECe value which could result in a 25% reduction of crop yield[4].

Example ECe's:

Annual Ryegrass[2] = 3 to 6 mmho/cm or dS/m
Perennial Ryegrass[2,4] = 5.6 to 8.9 mmho/cm or dS/m
Bermudagrass[2,4] = 6.9 to 10.8 mmho/cm or dS/m
Tall Fescue[2,4] = 3.9 to 8.6 mmho/cm or dS/m
Alfalfa[3,4] = 2.0 to 5.4 mmho/cm or dS/m

"ECw" - Salinity of Applied Effluent

Direct measurement of ECw is typically preferred. However, if the laboratory has supplied the reuser with a concentration of TDS, an approximate conversion[4] is ECw ≈ TDS ÷ 640. This conversion is considered accurate within 10%. The value for ECw or TDS is obtained from the treatment plant supplying the effluent. For site design, an average value can be used. For completion of the required annual balance report, the actual analytical results from Discharge Monitoring Reports should be used.

(1) For clairty in this document, the unit for electrical conductivity (EC) is expressed as mmho/cm. However, EC can also be expressed in decisiemens per meter, dS/m.
1 mmho/cm = 1 dS/m

(2) Wastewater Reuse for Golf Course Irrigation, US Golf Association, 1994.
(3) Nevada Irrigation Guide, USDA Soil Conservation Service, 1981.
(4) Wastewater Engineering: Treatment, Disposal, and Reuse, (Metcalf and Eddy, 1991)

Worksheet 1-A

CONSUMPTIVE USE REQUIREMENT WORKSHEET:
Maximum Loading Rate Based on Plant Water Use Requirements

Page 1 of 1 Crop Type = Annual Ryegrass

$Lw_{(c)} = \frac{(ET-P)}{[E \times (1-Lr)]}$; $Lr = \frac{ECw}{[(5 \times ECe)-ECw]}$; $ECw \approx TDS \div 640$

(A) Annual Evapotranspiration (ET, in/yr) = (47" × 0.9) = 42.30"
(Multiply by Crop Coefficient (Kc) if value is known) kc = .9

(B) Annual Precipitation (P, in/yr) = 7.5"

(C) (A) - (B) = 34.8 (in/yr)

(D) Salinity of Applied Effluent (ECw, mmho/cm) or ≈ (TDS, mg/l) ÷ 640 = 0.58
(Indicate which method was used to determine ECw, Direct Measurement or Approximation by Calculation.)

(E) Salinity Tolerance of Plant Crop (ECe, mmho/cm) = 3

(F) 5 x (E) = 15 (mmho/cm)

(G) (F) - (D) = 14.42 (mmho/cm)

(H) Leaching Requirement (Lr, %, expressed as a fraction) = (D) ÷ (G) = $\frac{0.58}{14.42} = 0.04$

(I) 1 - (H) = 0.96

(J) Efficiency of Irrigation System (E, %, expressed as a fraction) = 80/100

(K) (J) x (I) = 0.77

(L) (C) ÷ (K) = $Lw_{(c)}$ = 45.19 (inches/year)

If the water use rate calculated in ("L") above is the lowest application volume calculated between the annual Consumptive Use Limit (This Worksheet) and the Nitrogen Limit (Worksheet 2-A), then fill out Worksheet 1-B to estimate the planned maximum daily flow for the site.

Worksheet 1-B

CONSUMPTIVE USE REQUIREMENT WORKSHEET:
Maximum Loading Rate Based on Plant Water Use Requirements

Page 1 of 1 Crop Type = Annual Ryegrass

$Lw_{(c)} = \frac{(ET-P)}{[E \times (1-Lr)]}$; $Lr = \frac{ECw}{[(5 \times ECe)-ECw]}$; $ECw \approx TDS \div 640$

Monthly values for evapotranspiration are dependent on the crop type and regional area of the site, as well as the crop coefficient if known. Monthly precipitation is also regional. The values for ET and P can be obtained from the local extension service, literature, or other reputable source. Please see the explanation in the "WTS-1B: Appendix One" text for futher discussion of crop coefficients.

To calculate the monthly value for $Lw_{(c)}$, perform the calculation for each month as outlined in Worksheet 1-A, and input the result in the table below. Since this form is crop-specific, a value of zero is acceptable when the crop is not in season; however, use of a zero should be explained.

Million Gals/Mo = $Lw_{(c)}$ in/mo x _____ ac ÷ 12 in/ft x 43,560 ft^2/ac x 7.481 gals/ft^3 ÷ 1,000,000
(Enter and use the number of acres for the crop type being irrigated)

MGD (Million gallons/day) = M Gallons/mo ÷ Days/mo

Month	Days/Mo	ET (in/mo)	P (in/mo)	$Lw_{(c)}$ (in/mo)	M Gals/Mo	MGD
Jan	31					
Feb	28					
Mar	31					
Apr	30					
May	31					
Jun	30					
Jul	31					
Aug	31					
Sep	30					
Oct	31					
Nov	30					
Dec	31					
Totals (in/yr):					Note: These totals should approximate the annual values calculated in Worksheet 1-A	

WTS-1B: APPENDIX TWO

NITROGEN LOADING LIMIT WORKSHEET

The nitrogen loading equation takes into account precipitation, evapotranspiration, plant nitrogen uptake, nitrogen content of the applied effluent, nitrogen denitrification and volitilization in the soils, and allowable percolate nitrogen concentration. The equation included below is from Wastewater Engineering: Treatment, Disposal, and Reuse, (Metcalf and Eddy, 1991)

$$Lw_{(n)} = \frac{[(Cp, mg/l) \times (P\text{-}ET, in/yr)] + [(U, lb/acre\text{-}yr) \times (4.4)]}{[(1\text{-}f) \times (Cn, mg/l)] - (Cp, mg/l)}$$

where:

$Lw_{(n)}$ = Allowable Hydraulic Loading Rate Based on Nitrogen Loading rate (in/yr);
Cp = Total Nitrogen Concentration in Percolating Water (mg/l);
ET = Evapotranspiration Rate (in/yr);
P = Precipitation Rate (in/yr);
U = Nitrogen Uptake Rate by Crop (lb/acre-yr);
4.4 = Combined Conversion Factor;
Cn = Total Nitrogen Concentration in Applied Wastewater (mg/l); and
f = Fraction of Applied Total Nitrogen Removed by Denitrification and Volatilization.

"Cp" - Nitrogen in Percolating Water

A conservative value for Total N in the water that percolates past the root zone (Cp) is 7 mg/l, which is the first "red flag" value for Nitrate as N in monitoring well samples. Setting the Cp limit at a constant value aids in obtaining an hydraulic nitrogen loading rate ($Lw_{(n)}$) which should be protective of groundwater resources. The drinking water standard for Nitrate as N is 10 mg/l, which would be the maximum allowable value for Cp.

"ET" - Evapotranspiration

Evapotranspiration is defined as the "loss of water from the soil both by evaporation and by transpiration from the plants growing thereon" (Websters Dictionary, 1990). Since different plants transpire at different rates, a crop coefficient (Kc) can be used to modify the potential ET for a particular area. Values for Kc vary depending upon the geographical location of the crop, and the species grown. If a crop coefficient can be determined, when multiplied by the potential ET rate, the result is a more accurate estimate of ET for an irrigation site. The Division recommends that reusers contact local agriculture representatives identified in Appendix Five for further crop-specific and regional information.

"U" - Crop Nitrogen Uptake

Plant nitrogen uptake rates (U) are crop-specific, and can be obtained from the local Extension Service, literature, or other reputable sources. Using the accepted value for U in this equation assumes that the harvested portion of the crop is removed from the site. If plant cuttings are not removed from the area, then the amount of nitrogen removed by uptake should be offset by the amout of nitrogen returned to the soil by decomposing cutting materials. If alfalfa, or another legume, is the site's crop, then similar considerations should be made for atmospheric nitrogen which is fixed into the soil by alfalfa. A discussion with the local agricultural extension service is recommended prior to finalizing a "U" value.

"Cn" - Nitrogen in Applied Wastewater
The total nitrogen in the applied effluent water (Cn) can be obtained from the treatment plant that is supplying the effluent. For site design, an average value can be used. For completion of the required annual balance report, the actual analytical results from Discharge Monitoring Reports shall be used.

"f" - Nitrogen lost to Denitrification and Volatilization
The amount of nitrogen lost to denitrification and volatilization varies depending upon the nitrogen characteristics of the applied wastewater and the microbial activity in the soil. Microbial denitrification, in soils with a sufficient carbon source for the biological activity, may account for as much as 15 to 25 percent of the applied nitrogen during warm, biologically active months. Volatilization of ammonia may be as much as 10 percent, depending upon the ammonia fraction in the total nitrogen applied. (Metcalf & Eddy, 1991) For arid climates, such as Nevada, the value typically used for the "f" term is 0.2.

Nitrogen Addition by Chemical Fertilizers
If the allowable reuse water application volume is limited by plant consumptive use (Worksheet 1-A), nitrogen may need to be added by commercial fertilizer. In the design of a reuse site, and preparation of an EMP, this should be estimated to provide the site operator with a guideline for fertilizer application, in addition to the nitrogen being applied via the treated effluent. **The application of fertilizer must then be incorporated into the required annual report to demonstrate that the application of commercial nitrogen and effluent nitrogen did not exceed the plant crop's uptake rate.**

Worksheet 2-C is designed to be used to provide the Division with the required annual report of effluent and fertilizer usage. Reuse permits require that the annual evaluation of the effluent application include, "the total nitrogen in the applied wastewater, nitrogen from fertilizer applications, nitrogen uptake by plant materials, evapotranspiration rate, precipitation rate, and fraction of applied nitrogen removed by denitrification and volatilization." While Worksheet 2-C does not take precipitation and evapotranspiration into account, the permittee should compare each year's P and ET rates to those that were used during the site design and EMP preparation phases to ensure that the original assumptions remain valid.

Worksheet 2-C can also be utilized as a site management tool to *estimate* the amount of commercial fertilizer which may be required in an upcoming month. However, use of the worksheet in this manner does not preclude the responsible use of good irrigation and nutrient management practices.

Worksheet 2-A

WATER REQUIREMENT DESIGN WORKSHEET:
Maximum Hydraulic Loading Rate Based On Annual Nitrogen Balance Evaluation

Page 1 of 1 Crop Type = Annual Ryegrass

$$Lw_{(n)} = \frac{[Cp \times (P-ET)] + (U \times 4.4)}{[(1-f) \times Cn] - Cp}$$

(A) Total Nitrogen in Percolating Water (Cp, mg/l) = 0.1

(B) Annual Precipitation (P, in/yr) = 7.5

(C) Annual Evapotranspiration (ET, in/yr) = (47 x 0.9) = 42.30
(Multiply by Crop Coefficient (Kc) if value is known) Kc = .9

(D) (B) - (C) = -34.80 (in/yr) (Note: In Nevada, P is less that ET; therefore a negative number is correct to use in this worksheet.)

(E) (A) x (D) = -3.48

(F) Crop Nitrogen Uptake (U, lb/ac-yr) = 178

(G) (F) x 4.4 = 783.2

(H) (E) + (G) = 779.7

(I) Fraction of Applied Total Nitrogen Lost to Denitrification and Volatilization (f) = 20%

(J) 1- (I) = 80%

(K) Total Nitrogen in Applied Effluent (Cn, mg/l) = 1.74

(L) (J) x (K) = 1.39

(M) (L) - (A) = 1.29

(N) (H) ÷ (M) = $Lw_{(n)}$ (inches/year) = 604

If the Water Use Rate calculated in ("N") above is the lowest application volume calculated for the annual Consumptive Use Limit (Worksheet 1-A) or the Nitrogen Limit (This Worksheet), then fill out Worksheet 2-B to estimate the planned maximum daily flow for the site.

Worksheet 2-B

WATER REQUIREMENT DESIGN WORKSHEET:
Maximum Hydraulic Loading Rate Based On Annual Nitrogen Balance Evaluation

Page _____ of _____ Crop Type = _____

$$Lw_{(n)} = \frac{[Cp \times (P-ET)] + (U \times 4.4)}{[(1-f) \times Cn] - Cp}$$

Monthly values for evapotranspiration are dependant on the crop type and regional area of the site, as well as the crop coefficient if known. Monthly precipitation is also regional. The values for ET and P can be obtained from the local extension service, literature, or other reputable sources. Please see the explanation in the "WTS-1B: Appendix Two" text for futher discussion of crop coefficients.

The monthly value of the crop nitrogen uptake (U) can be calculated according to the equation included on the Table. Please see the discussion in the "WTS-1B: Appendix Two" text regarding "U" values for alfalfa crops or sites that do not remove crop cuttings. If a different distribution of monthly "U" is used, due to circumstances such as germination or dormancy periods, then provide documentation explaining the difference.

To calculate the monthly value for $Lw_{(n)}$, perform the calculation for each month as outlined in Worksheet 2-A, using the monthly values for "U", "P", "ET", and "Cn", and input the result in the table below. Since this form is crop-specific, a value of zero is acceptable when the crop is not in season; however, use of a zero should be explained.

Monthly U (lb/ac-mo) = U (lb/ac-yr) x ET(in/mo) ÷ ET (total in/yr)

Million Gallons Per Month = $Lw_{(c)}$ in/mo x _____ (ea. crop type) # acres ÷ 12 in/ft x 43,560 ft^2/ac x 7.481 gallons/ft^3 ÷ 1,000,000

MGD (Million gallons/day) = M Gallons/mo ÷ Days/mo

Month	Days/Mo	P (in/mo)	ET (in/mo)	U (lb/ac-mo)	$Lw_{(n)}$ (in/mo)	M Gals/Mo	MGD of Reclm'd Water
Jan	31						
Feb	28/29						
Mar	31						
Apr	30						
May	31						
Jun	30						
Jul	31						
Aug	31						
Sep	30						
Oct	31						
Nov	30						
Dec	31						
	Totals:					Note: The totals for P, ET and $Lw_{(n)}$ should approximate the annual values used or calculated in Worksheet 2-A	

Worksheet 2-C: *Regardless of the limiting hydraulic loading rate that was defined during the design phase, Worksheet 2-C is designed to be used to provide the Division with the required annual report of effluent and fertilizer usage.*

Effluent N Applied = _____ x _____ (mg/l) x 8.34 x _____ ÷ _____ x (1 -"f") (i.e. 0.2.)
(lb/ac-mo) MGD Applied Effluent N Conc. # days/mo # Acres

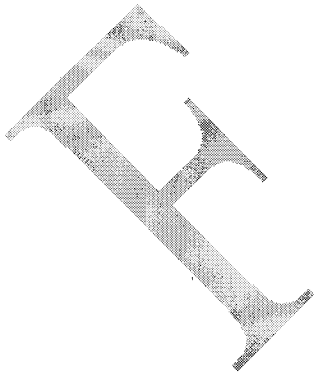
Fertilizer N Applied = _____ Monthly Fertilizer used (lbs/mo) x _____ % N in Fertilizer (as a fraction) ÷ _____ acres
(lb/ac-mo)

Crop Name and Nitrogen Uptake Requirement = _____ (lbs/ac-yr)

Month	Days/Mo	Million Gallons Applied (mo)	MGD of Irrigation Water Applied	Effluent N Concentration (mg/l)	Effluent N Applied (lb/ac-mo)	Fertilizer N Applied (lb/ac-mo)	Total N Applied (Effl. N + Fert. N) (lb/ac-mo)
Jan	31						
Feb	28/29						
Mar	31						
Apr	30						
May	31						
Jun	30						
Jul	31						
Aug	31						
Sep	30						
Oct	31						
Nov	30						
Dec	31						
						Total** =	

** The Total N Applied to the crop should be less than the crop's Nitrogen Uptake Requirement. Please see your permit for directions if it is not.

APPENDIX G- AGENCY APPROVALS



APPENDIX H-PAGNI RANCH PARK

Pagni Ranch Park

1.1 SITE LOCATION AND DESCIPTION

Pagni Ranch Park is located on Festa Way in Sparks, Nevada. Refer to Figure H-1. Adjacent developments to Pagni Ranch Park include Festa Way to the west, and residential housing to the north, east, and south. Site location information for Pagni Ranch Park is given in Table H-1 below.

Table H-1-Pagni Ranch Park Site Information

Property	Physical Address	Latitude/ Longitude	Township/ Range/ Section
Pagni Ranch Park	Festa Way	39°32'38"N 119°41'57"W	S2.T19N.R20E

Pagni Ranch Park is identified in the Flood Insurance Rate Map as Zone X (areas of 500-year flood, areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile, and areas protected by levees from 100-year flood).

1.2 SOILS

The Soil Conservation Service describes several native soils for the Pagni Ranch Park site. A brief description of each of the soil types is listed below. Figure H-2 shows the soil distribution at this location.

110 - **Jowec variant sandy loam, 4 to 8 percent slopes.** This very deep, well drained soil is on alluvial fans. The surface layer is grayish brown sandy loam about 10 inches thick. The upper 10 inches of the subsoil is light brown clay. The lower 46 inches is light yellowish brown sandy clay loam.

Permeability of this soil is very slow. Runoff is medium, and the hazard of water erosion is slight. The high clay content results in high swelling potential. Roads should be provided with drainage.

The present vegetation is mainly sagebrush and Indian rice grass.

450 - **Voltaire loam.** This very deep, somewhat poorly drained soil is on alluvial fans. Slopes are 0 to 2 percent. The surface area is gray loam about 20 inches thick. Underlying surface material goes to a depth of 60 inches and is mainly comprised of gray silty clay through loamy sand.

Permeability of this soil is slow. Runoff is slow, and the hazard of water erosion is high.

The present vegetation in most areas is grass.

850 - **Washoe gravelly sandy loam, 0 to 4 percent slopes.** This is a very deep, well drained soil on terraces and alluvial fans. Approximately 15 to 30 percent of the surface area is covered with gravel. The surface layer is grayish brown and is about 8 inches thick. The substratum goes to a depth of 60 inches or more and is gravelly loamy course sand.

Other soils included in this unit include Oest soils along the upper edge of the unit. While Orr soils are on the tops of the terrace remnants and Truckee soils in swales. The unit is about 5 percent Oest soils, 5 percent Orr soils, and 5 percent Truckee soils.

Permeability of this soil is moderately slow in the subsoil and very rapid in the substratum. The hazard of the soil blowing is slight. Runoff is slow, and the hazard of water erosion is slight.

The vegetation of this soil is mainly big sagebrush.

The soils listed above are the natural soil in the area. The construction of the Pagni Ranch Park caused many disruptions of this soil and possibly other important material. It is difficult to predict the conditions of the soil that may influence ponding, runoff and infiltration.

1.3 IRRIGATION PLAN

Pagni Ranch Park is a 4.6-acre park. The park will use effluent for spray and drip irrigation of the park landscaping. Pagni Ranch Park will be served from a future effluent line in Primo Way. Refer to figures H-3 and H-4 for park landscape and irrigation plans.

Majority of irrigation will occur at night to minimize the possibility of public contact with the effluent. All irrigation will be done with automatic sprinklers. The length of time each zone will be irrigated will be adjusted according to seasonal temperature and precipitation data. Spray irrigators will discharge near the ground surface and away from areas of frequent public use. Adjustments will be made to the sprinkler heads as required to prevent ponding and runoff. If ponding or line breaks should occur they will be quickly identified and repaired.

Potable water line will be identified and necessary adjustments made to provide the required separation between effluent and potable water lines. Any component of the irrigation system that is exposed will be posted and painted purple to clearly identify the

component as an effluent fixture. All areas of the site shall be posted to notify the public that the landscaping is irrigated with effluent.

The irrigation control system will control the time and duration of the effluent application. Each system controls a set of valves independent of the master valve at the service connection. In case of emergency the system should be shut down at the gate valve that connects the system to the main water supply. See Figure H-4.

1.4 IRRIGATION SYSTEM

An existing 4" effluent line is located within Festa Way at the point of connection. The effluent water meter is located at the point of connection as shown on Figure H-4.

1.5 EFFLUENT DEMAND

The estimated effluent demand for Pagni Ranch Park is shown in Table H-2.

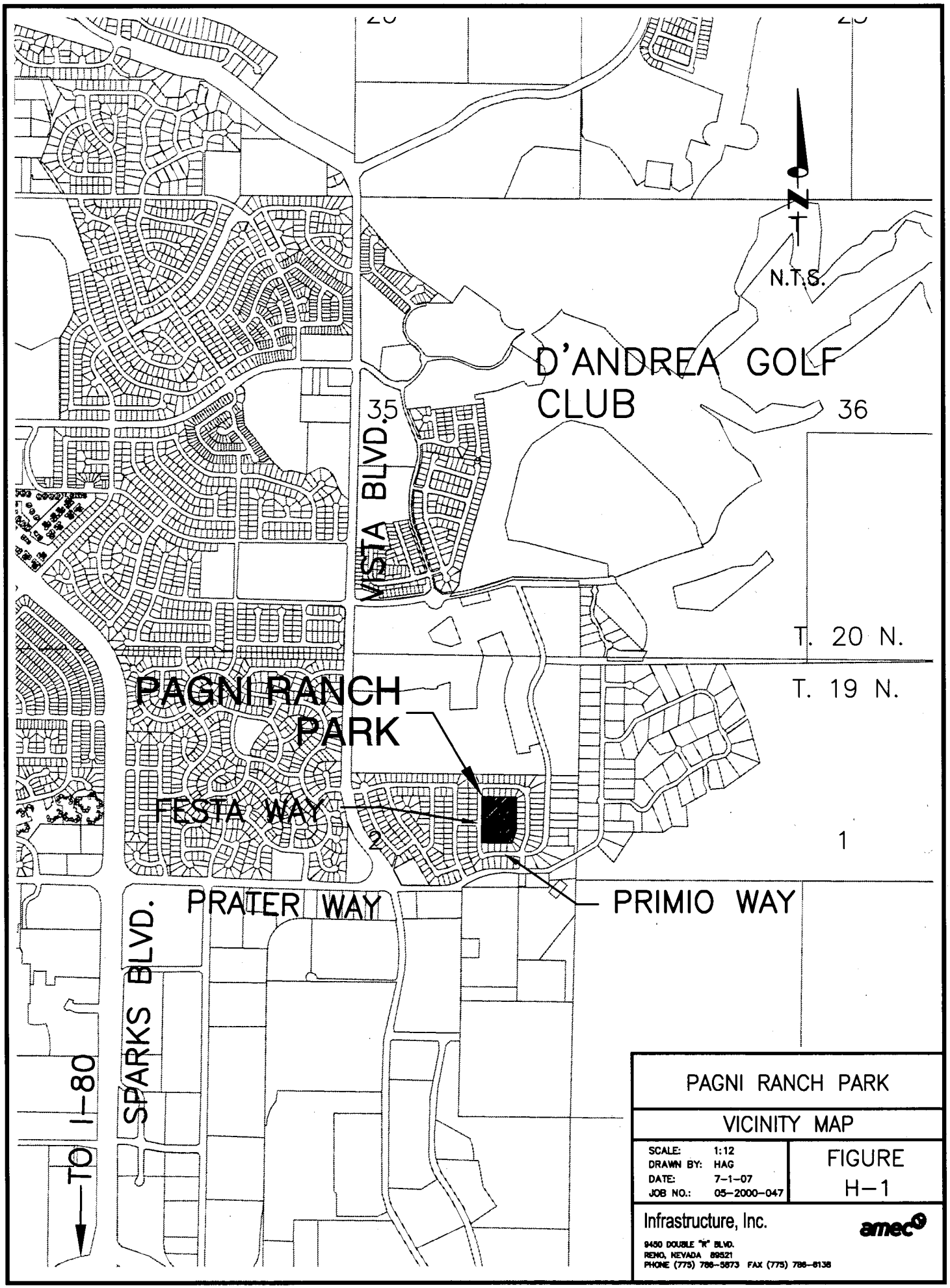
Table H-2 – Pagni Ranch Park Effluent Demands

Property	Total Area (Acres)	Irrigated Area (Acres)	Acre-Feet per Year	Peak Demand (gpm)	Maximum Daily Flow (mgd)	30-Day Average (mgd)
Pagni Ranch Park	4.6	3.7	13.8	137	0.066	0.028

Irrigation demands are based on recorded irrigation flows for July 2002-June 2003.

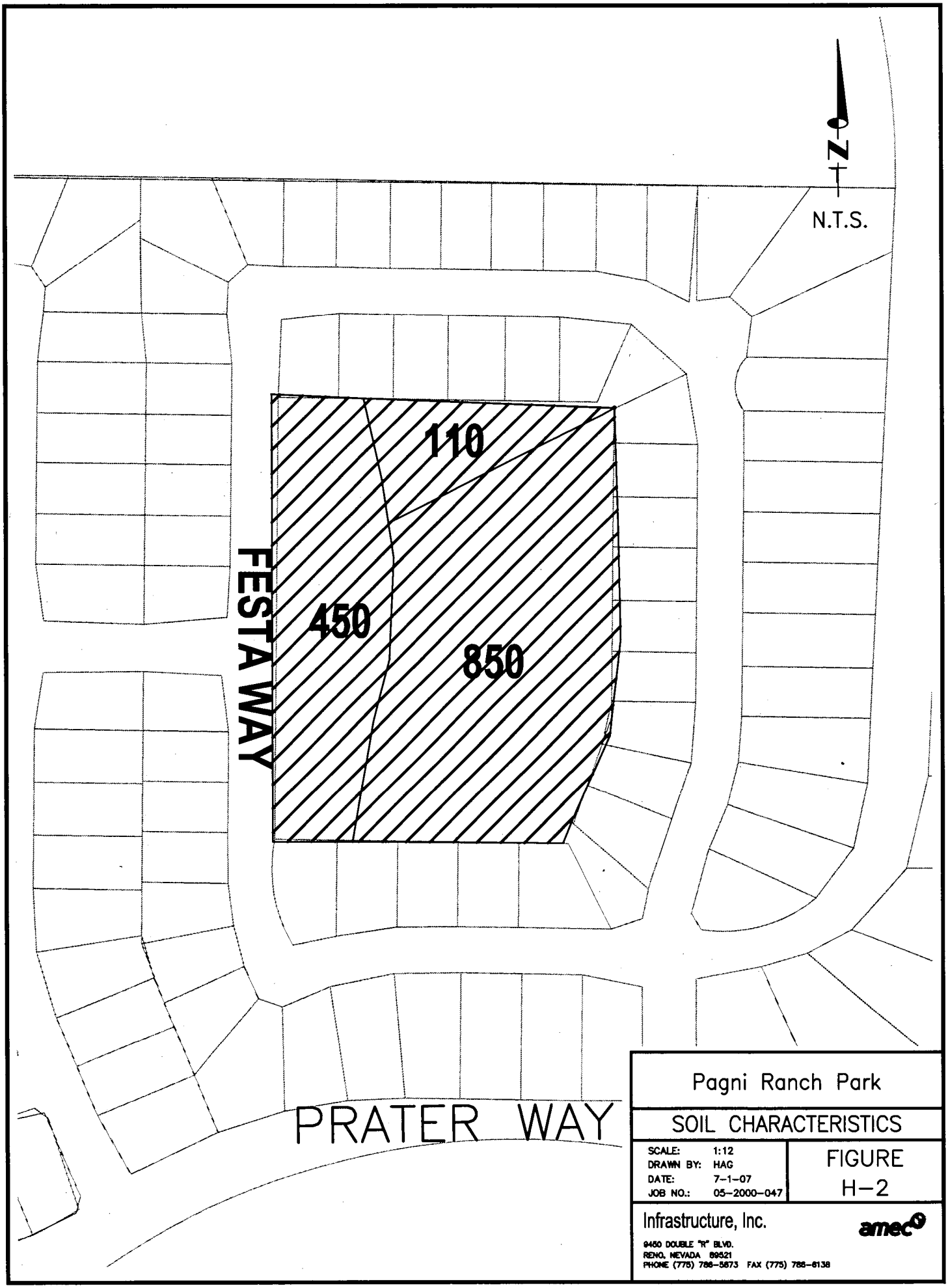
1.6 RUNOFF CONTROL PLAN

In the event of an emergency, the effluent irrigation system for Pagni Ranch Park should be shut down by closing the gate valve located at the effluent meter vault.



PAGNI RANCH PARK	
VICINITY MAP	
SCALE: 1:12 DRAWN BY: HAG DATE: 7-1-07 JOB NO.: 05-2000-047	FIGURE H-1

Infrastructure, Inc.
amec
9450 DOUBLE "R" BLVD.
RENO, NEVADA 89521
PHONE (775) 786-5873 FAX (775) 786-6138



Pagni Ranch Park

SOIL CHARACTERISTICS

SCALE:	1:12
DRAWN BY:	HAG
DATE:	7-1-07
JOB NO.:	05-2000-047

FIGURE H-2

Infrastructure, Inc.
amec
9450 DOUBLE "R" BLVD.
RENO, NEVADA 89521
PHONE (775) 788-5673 FAX (775) 788-6138

PETE'S WAY

PRIMIO WAY

FESTA WAY

COE WAY

FOR INSTALLATION OF DRIP EMITTERS IN D G, REFER TO DETAIL THIS SHEET

A21 15 GPM 1"
A23 86 GPM 2"
A24 89 GPM 2"
A20 86 GPM 2"
A19 80 GPM 2"
A18 86 GPM 2"
A15 35 GPM 1½"
A14 91 GPM 2"
A13 64 GPM 2"
A12 30 GPM 1½"
A11 72 GPM 2"
A10 75 GPM 2"
A9 60 GPM 2"
A8 76 GPM 2"
A7 72 GPM 2"
A17 25 GPM 1½"
A16 86 GPM 2"
A22 100 GPM 2"
A25 31 GPM 1½"
A24 98 GPM 2"
A26 80 GPM 2"
A27 91 GPM 2"
A28 80 GPM 2"
A29 25 GPM 1"
A30 80 GPM 2"
A2 98 GPM 2"
A32 37 GPM 1½"
A1 50 GPM 2"
A3 50 GPM 2"
A6 50 GPM 2"
A4 50 GPM 2"
A5 60 GPM 2"

DRIP LINE, TYPICAL.
INSTALL DRIP EMITTERS TO EACH TREE AND SHRUB IN ALL PLANTED AREAS EXCEPT FOR THE TREES INSTALLED IN TURF. (TYPICAL FOR ALL DRIP VALVES) FOR ALL DRIP VALVES).
REFER TO LEGEND AND DETAILS ON THIS SHEET FOR INSTALLATION REQUIREMENTS FOR THE DRIP SYSTEM.

CONTROLLER AND CLUSTER CONTROL UNIT LOCATION. THE CONTRACTOR SHALL INSTALL A CONTROLLER PER DETAIL 8/L6. EXACT LOCATION SHALL BE APPROVED BY THE CITY.

POINT OF CONNECTION. THE CONTRACTOR SHALL TIE INTO THE WATER METER. COORDINATE INSTALLATION AS PER APPLICATION OF THE CITY WITH SIERRA PACIFIC. REFER TO DETAIL 5/L6 FOR INSTALLATION DIAGRAM. THIS SYSTEM IS DESIGNED FOR A MAXIMUM DEMAND OF 100 GPM WITH A MINIMUM OF 70 PSI.

emergency shut off valve

Spray Irrigation

Drip Irrigation

REFER TO SHEET L2 FOR IRRIGATION LEGEND AND NOTES

0 30' 60' 90'
SCALE 1"=30'-0"

FINISH GRADE OF D G, SEE DETAIL
TREE, SEE TREE STAKE DETAIL
EMITTER-SEE IRRIGATION LEGEND
4" PVC PERFORATED PIPE W/CAP FILL W/ PEA GRAVEL (2' LENGTH) SET BELOW DECOMPOSED GRANITE BED
1/2" DISTRIBUTION TUBING
SET AT 18" FROM BASE OF TREE AT THREE EQUAL LOCATIONS AROUND PLANT PIT

DRIP PLACEMENT IN D G
NOT TO SCALE SECTION

Automatic Flush Valve Detail

Multi-Outlet Emitter Detail

Drip Irrigation Layout Detail

LANDSCAPE ARCHITECTS & PLANNERS

The HLA Group
Landscape Architects
& Planners, Inc.

1990 Third Street
Suite 500
Sacramento
California 95814
916/447-7400
FAX 916/447-5270

CSLA 1559

CITY OF SPARKS
PARKS
PAGNI RANCH PARK
SPARKS, NEVADA

IRRIGATION PLAN

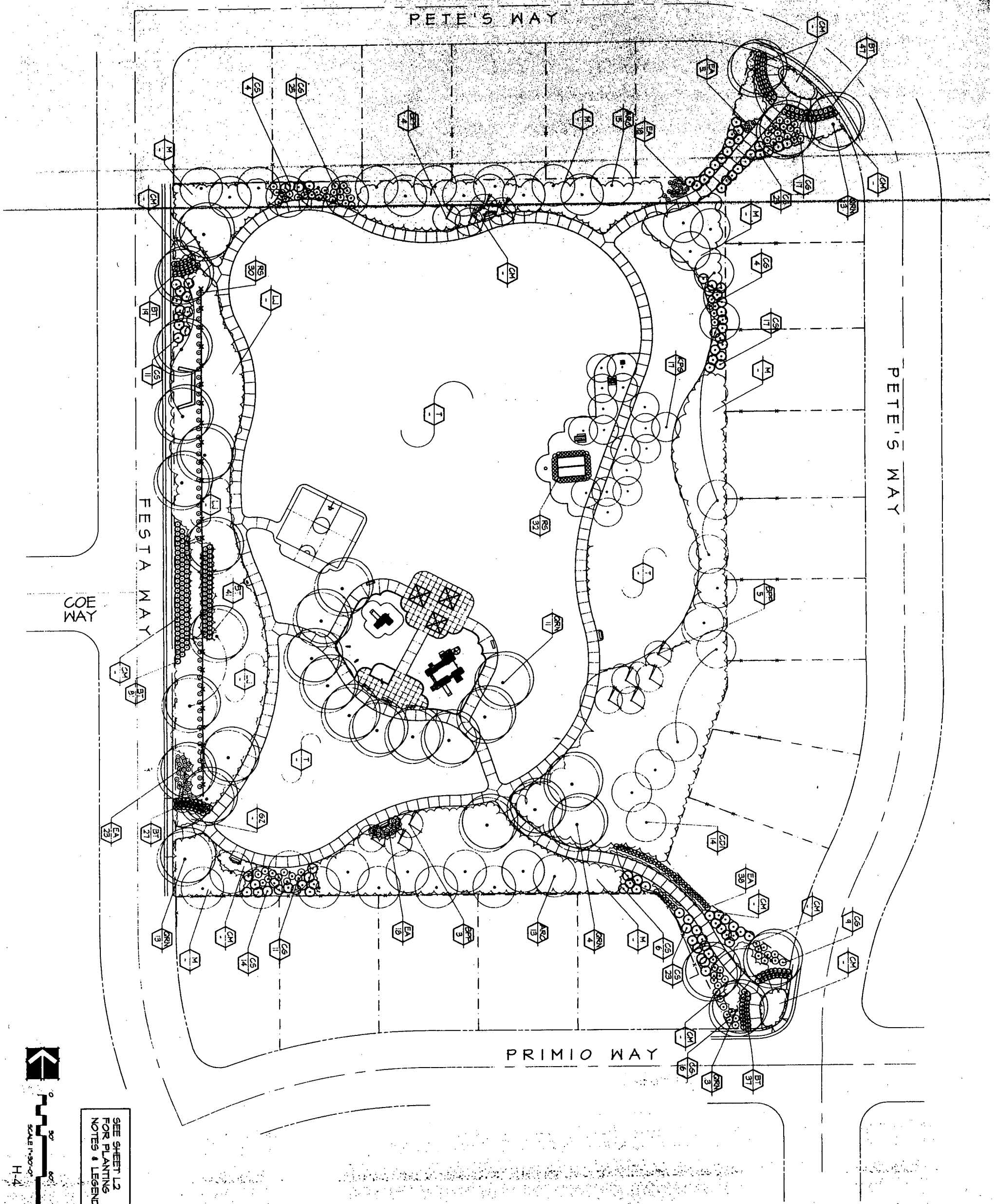
Drawn By: SL
Checked By: RDH
Job No. 81495.01
Date 8.2.96
Revisions

This drawing is not final and shall not be used for construction work until it has been signed by the Landscape Architect

Drawing Number: L7

Drawings in this set: 13

P:\DWG\P-SPKS_PARKS.DWG



SEE SHEET L2 FOR PLANTING NOTES & LEGEND

SCALE 1"=30'-0"

H-4

CITY OF SPARKS

PAGNI RANCH PARK

SPARKS, NEVADA

The HLA Group
Landscape Architects & Planners, Inc.
1990 Third Street
Suite 600
Sacramento
California 95814
916/447-7400
FAX 916/447-8870
CSLA 1869

LANDSCAPE ARCHITECTS & PLANNERS

PLANTING PLAN

Drawn By: SL
Checked By: RDH
Job No. 019950.01
Date 8.2.96
Revisions

This drawing is an instrument of service and is the property of the Landscape Architect

Drawing Number: L8

Drawings in Set: 12

APPENDIX I-WOODTRAIL PARK

Woodtrail Park

1.1 SITE LOCATION AND DESCIPTION

Woodtrail Park is located at 1899 Woodtrail Drive on the northwest corner of the intersection of Golden Spike Drive and Berkshire Drive in Sparks, Nevada. Refer to Figure I-1. Adjacent developments to Woodtrail Park include Woodtrail Drive to the north, Berkshire Drive to the east and Golden Spike Drive to west and south. Site location information for Woodtrail Park is given in Table I-1 below.

Table I-1 – Woodtrail Park Site Information

Property	Physical Address	Latitude/ Longitude	Section/Township/ Range
Woodtrail Park	1899 Woodtrail Drive	39°32'47" N 119°42'35" W	S2 T19N, R20E

Woodtrail Park is identified in the Flood Insurance Map as Zone X (areas of 500-year flood, areas of 100-year flood with average depth of less than 1 foot or with drainage areas less than I square mile, and areas protected by levees from 100-year flood).

1.2 SOILS

The Soil Conservation Service describes several native soils for the Woodtrail Park site. A brief description of each soil type is listed below. Figure I-2 shows the soil distribution at this location.

850- **Washoe gravelly sandy loam, 0-4 percent slopes**. This very deep, well drained soil is on terraces and alluvial fans. Typically, 15-30 of the surface is covered by gravel. The surface layer is about 8 inches thick and is grayish brown sandy loam. The subsoil is light brown and is about 30 inches thick. The substratum is about 60 inches thick and is light yellowish brown gravelly sand.

Included in this unit are Oest soils on the upper edge of the unit and Truckee soils are in swales.

Permeability of this soil is moderately slow in the subsoil. Runoff is slow, and the hazard for blowing is slight.

Present vegetation is sagebrush.

The soils listed above are the natural soils for the area. When Woodtrail Park was constructed there was a disruption of the soil and possibly other important material. It is

difficult to predict the current soil conditions of the soil that may exist such as ponding, runoff, and infiltration.

1.3 IRRIGATION PLAN

Woodtrail Park is a 2.4-acre park. The park will use effluent for spray and drip irrigation of the park landscaping. Woodtrail Park will be served effluent from a future effluent line in Berkshire Drive. Refer to Figure I-3 for a park irrigation plan.

Majority of irrigation will occur at night to minimize the possibility of public contact with effluent. All irrigation will be done with automatic sprinklers. The length of time each zone will be irrigated will be adjusted according to seasonal temperature and precipitation data. Spray irrigators will discharge near ground surface and away from areas of frequent public use. Adjustments will be made to the sprinklers heads as required to prevent ponding and runoff. If ponding or line breaks should occur they will be quickly identified and repaired.

Potable water line will be identified and necessary adjustments made to provide the required separation between effluent and potable water lines. Any component of the irrigation system that is exposed will be posted and painted purple to clearly identify the component as effluent fixture. All areas of the site shall be posted to notify the public that the landscaping is irrigated with effluent.

The irrigation control system will control the time and duration of the effluent application. Each system controls a set of valves independent of the master valve at the service connection. In case of emergency the system should be shut down at the gate valve that connects the system to the main water supply. See figure I-3.

1.4 IRRIGATION SYSTEM

Come back to

1.5 EFFLUENT DEMAND

The estimated effluent demand for Woodtrail Park is shown in Table I-2.

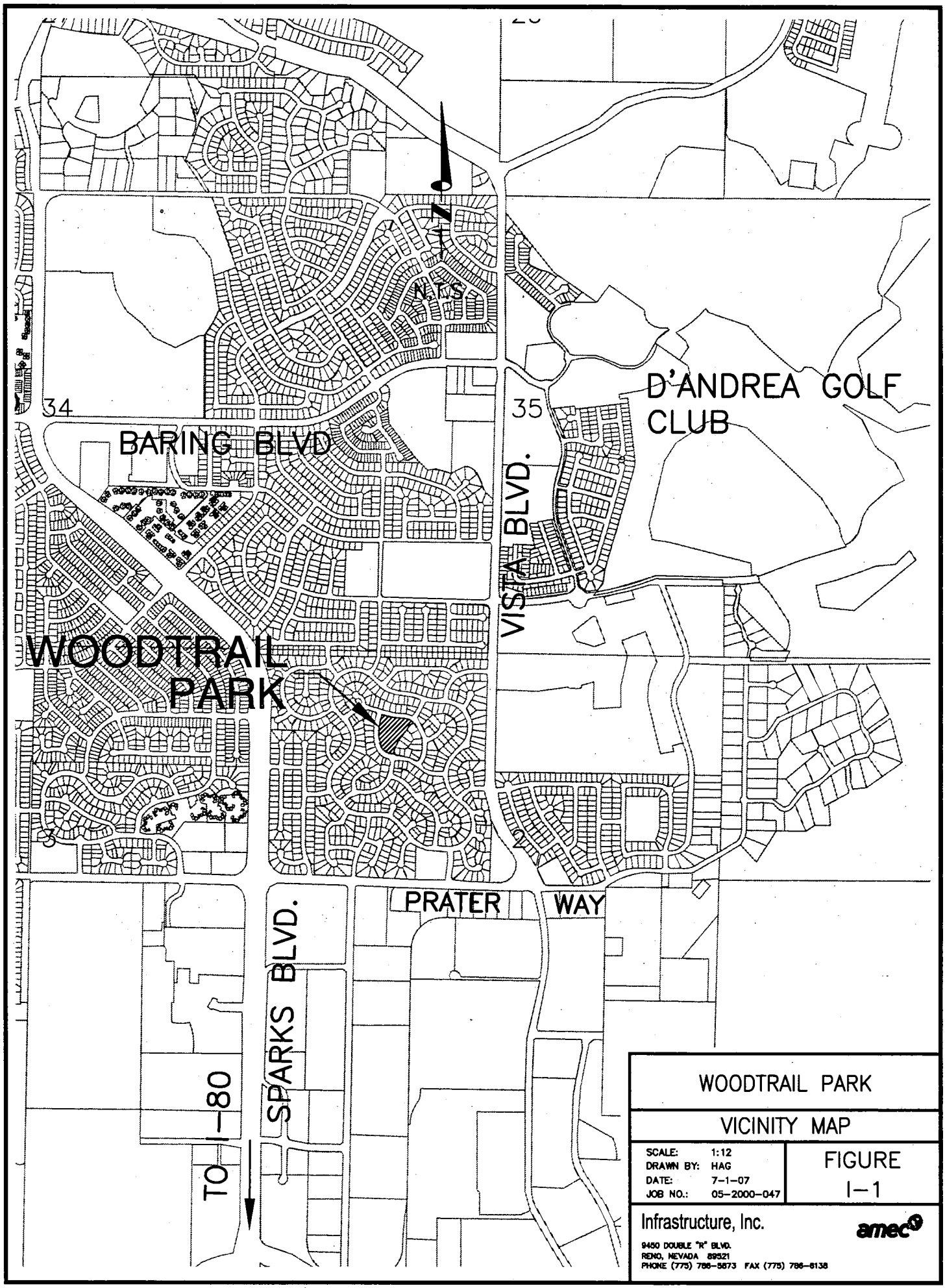
Table I-2 – Woodtrail Park Effluent Demands

Property	Total Area (Acres)	Irrigated Area (Acres)	Acre-Feet per Year	Peak Demand (gpm)	Maximum Daily Flow (mgd)	30-Day Average (mgd)
Woodtrail Park	2.4	1.7	7.1	65	0.031	0.013

Irrigation demands are based on recorded irrigation flows for July 2002-June 2003.

1.6 RUNOFF CONTROL PLAN

In the event of an emergency, the effluent irrigation system for Woodtrail Park should be shut down by closing the gate valve located at the meter vault. This is shown in figure I-2.



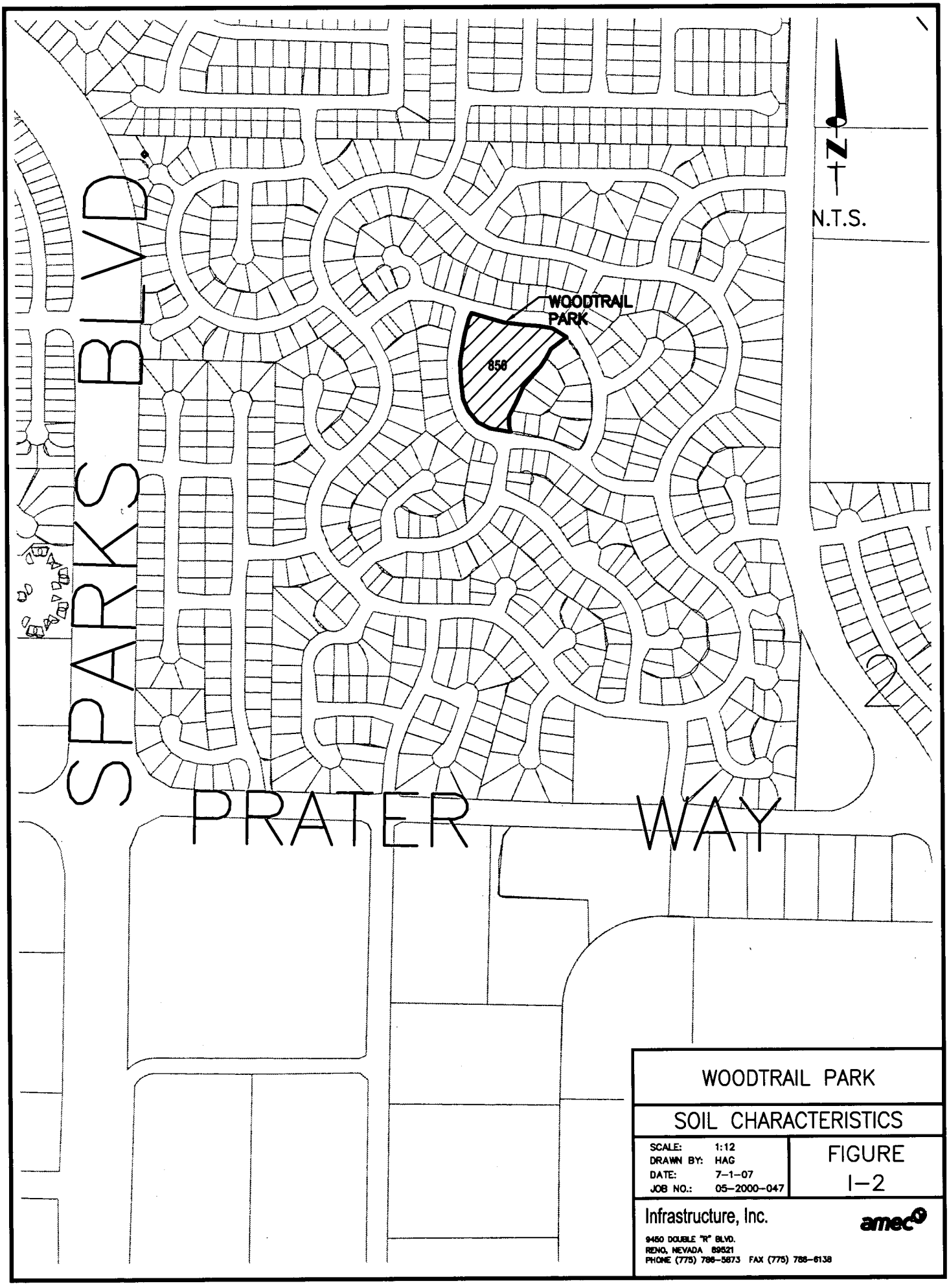
WOODTRAIL PARK

VICINITY MAP

SCALE:	1:12
DRAWN BY:	HAG
DATE:	7-1-07
JOB NO.:	05-2000-047

FIGURE
I-1

Infrastructure, Inc.
amec
9450 DOUBLE "R" BLVD.
RENO, NEVADA 89521
PHONE (775) 786-5873 FAX (775) 786-6138



WOODTRAIL PARK

SOIL CHARACTERISTICS

SCALE:	1:12
DRAWN BY:	HAG
DATE:	7-1-07
JOB NO.:	05-2000-047

FIGURE
I-2

Infrastructure, Inc.
amec
9450 DOUBLE "R" BLVD.
RENO, NEVADA 89521
PHONE (775) 786-5873 FAX (775) 786-6138

GOLDEN SPIKE

DRIVE

DRIVE

DRIVE

BERKSHIRE

WOODTRAIL

Drip Irrigation

Spray Irrigation

Scale 1" = 20'

-10 3 20 40 60

Irrigation Notes

1. Plan is schematic in ... turns. Coordinate ... planter beds where ... Water meter (by Westpac). Route lines to minimize sharp ... ing plan. Locate valves and quick couplers in ...
2. All Piping except Sta... Sch. 40.
3. Sleeve drip lines unde... Provide 1 EM-10 emit... ...ubing to be Pepco 5" dia. poly pipe or approved equal. ...no 3 per tree.
4. Sleeve controller wire... wires every 10 feet ...red areas. Common trench wiring where possible. Route ...
5. Controller to be Rainbird Prisma 150-G/200-DZ-075. Backflow pre... Use shrubs shown on pl... to be Rainbird 44 RC n... ...Maxi-Controller on PED pedestal. Spray irrigation valves to be ...s as shown on valve schedule. Drip valves to be Rainbird ... FEBCO Mod. 825 3" Reduced Pressure Backflow Preventer. ...n to hide backflow preventer as much as possible. Quick couplers ...king fountain to be Haws mod. 3380.
6. Provide concrete thrust ... size to be 1". ...T's and elbows for all lines 2" or greater in size. *Minimum size
7. Provide 3/4" manual dr... ...ve at low points on main and laterals.
8. Provide individual control v... per control valve. ...rom controller to each valve. Group valves logically at controller.

Electric Remote Control Valve (A F-2)

Impact Spray Head (radius as indicated) (B F-2)

Pop-Up Spray Head (Adjust nozzle as indicated).

Drip tubing (schematic layout- adjust for full coverage) (C F-2)

Irrigation Main

Backflow Preventer (D F-2)

Irrigation Controller (E F-2)

Water Meter (by Westpac)

Quick Coupler Valve (H F-2)

Drinking Fountain (A L-1)

Pipe in sleeve under paving

6" WESTPAC MAIN

1" DOMESTIC POTABLE WATER SUPPLY

(H F-2) WASHDOWN STANDPIPE

Concrete Pad

CONTROLLER STATIONING
Rainbird 12SM-150 MAXI-CONTROLLER

STA.	VALVES	GPM
1	1	94.9
2	2	90.4
3	3	87.6
4	4	104.0
5	5	RT 4
6	6	98.5
7	7	DRIP
8	8	
9	9	
10	10	
11	11	
12	12	

DESIGNED BY SJD DATE JUNE 1988
DRAWN BY SJD DATE 5/5/88
CHECKED BY DATE
APPROVED BY DATE

REVISIONS | BY

cfa

William Cline Park

Irrigation Plan

SHEET I-2 OF 2

APPROVED AS NOTED. ADJUST PAN NOZZLES AS REQ'D.

APPENDIX J-D'ANDREA HOA

D'Andrea Homeowners Association

1.1 SITE LOCATION

The D'Andrea Homeowner's Association (HOA) irrigates the streetscapes of North D'Andrea Parkway, South D'Andrea Parkway, San Marino Drive, and a portion of Vista Boulevard in Sparks, Nevada. Refer to Figure **J-1**. Adjacent developments to the roadways include commercial and residential developments. Site location information for D'Andrea HOA is given in **Table J-1** below.

Table J-1 – D'Andrea HOA Site Information

Property	Physical Address	Latitude/ Longitude	Section/Township/ Range
D'Andrea HOA	North & South D'Andrea Parkway, San Marino Drive, and Vista Boulevard	39°33'16" N 119°42'15" W	Portions of S35 & S36. T20N. R20E

D'Andrea HOA is identified in the Flood Insurance Rate Map as Zone X (areas of 500-year flood, areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile, and areas protected by levees from 100-year flood).

1.2 SOILS

The Soil Conservation Service describes several native soils for the D'Andrea HOA site. A brief description of each of the soils is listed below. Figure J-2 shows the soil distribution at this location.

101- **Aquinas sandy loam, 4 to 8 percent slopes**. This is moderately deep, well drained soil is on alluvial fans and terraces. The surface layer is brown sandy loam and about 7 inches thick. The subsoil is light brown sandy clay loam about 30 inches thick. The upper 9 inches of the substratum is a silica-cemented hardpan. The lower part to a depth of 60 inches is stratified valley fill. Depth to the hardpan ranges from 30 to 40 inches.

Soils included in this unit are Jowac Variant soils which are on the toe slopes of alluvial fans; Greenbrae soils are located on inset alluvial fans at the lower part of the unit, and Northmore soils on alluvial fan collars on the upper part of the unit. The unit is about 5 percent Jowec Variant soils, 5 percent Greenbrae soils, and 5 percent Northmore soils.

Permeability is slow for this soil. Runoff is medium, and the hazard of water erosion is slight.

Present vegetation of this soil is big sagebrush, Douglas rabbit brush, and bottlebrush squirrel tail

440-**Jubilee sandy loam**. This very deep, poorly drained soil is on alluvial fans and flood plains. Slopes are 0 to 2 percent. Typically, the surface layer is black sandy loam about 22 inches thick. The underlying material to a depth of 60 inches is mottled, stratified loamy coarse sand through fine sand loam. Included in this map unit are Ophir soils and 2 percent Jubilee Variant soils.

Permeability of this Jubilee soil is moderately rapid. Runoff is very slow, and the hazard of water erosion is slight. The present vegetation in most areas is mainly grasses, juncos, sedges, and various clovers.

600-**Idelwild clay loam, drained**. This very deep, somewhat poorly drained soil is on alluvial fans and terraces. The drainage has been altered. Slopes are 0 to 2 percent. Typically, the surface layer is very dark grayish brown clay loam about 13 inches thick. The subsoil is olive brown silty clay and silty clay loam about 23 inches thick. The substratum is olive brown stratified sandy clay loam and silty clay loam about 26 inches thick. Included in this unit are Fleishmann soils on high terraces, Orr soils on alluvial fan and Truckee soils on lower flood plains. This unit is about 5 percent Fleishmann soils, 5 percent Orr soils, and 5 percent Truckee soils. Permeability of this Idelwild soil is slow. Runoff is slow, and the hazard of water erosion is slight. This has a high clay content, which causes high shrink-swell potential.

876- **Xman-Oppio-Old Camp association**. This map unit is on uplands. The unit of the Xman is very stony loam with 15-50 percent slopes. Oppio unit is very stony fine sandy loam with 15-50 percent slopes. Old Camp unit is extremely stony sandy loam with 30-50 percent slopes. The Oppio soil is on smooth, lower slopes. The Old Camp soil is on narrow ridges.

In this unit there are Reywat soils on east and north-facing upland slopes; Yuko soils on south-facing slopes; Skedaddle soils on convex, eroded side slopes of ridges; and Rock outcrop that occurs as peaks and ridges. The unit is about 2 percent Reywat soils, 4 percent Yuko soils, 5 percent Skedaddle soils, and 4 percent Rock outcrop. Xman soils are shallow and well drained. Typically, 3 to 10 percent of the surface is covered with stones. The surface layer is grayish brown loam about 2 inches thick. The subsoil is brown clay about 12 inches thick. Xman soil is shallow and well drained. Mainly, 3 to 10 percent of the surface is covered with stones. The surface layer is typically grayish brown very stony loam about 2 inches thick. The subsoil is brown clay about 12 inches thick. Oppio soil is moderately deep and well drained. Typically, 3 to 10 percent is covered with stones. The surface layer is a pale brown fine sandy loam about 6 inches thick. Old Camp soil has 15 to 25 percent of surface covered with stones. The surface layer is pale brown and is about 2 inches thick. The subsoil is brown cobbly clay loam about 12 inches thick.

Permeability of the Xman soil is slow. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is slight. Oppio has a low permeability. The Old Camp soil is shallow and well drained. Runoff is rapid, and the hazard of water erosion is high.

The present vegetation in the area is mainly different types of sagebrush ranging from low sagebrush, Douglas Rabbitbrush, and cheatgrass.

1194-**Spasprey stony sandy loam, 4 to 8 percent slopes**. This moderately deep, well drained soil is on alluvial fans and lake terraces. Typically, 1 to 3 percent of the surface is covered with stones. The surface layer is grayish brown stony sandy loam about 3 inches thick. The subsoil is brown clay substratum is a light brownish gray loam and the lower part goes to a depth of 60 inches which is generally a pale brown with varying cementation.

Permeability of this soil is moderately slow. Runoff is slow, and the hazard of water erosion is slight.

There are three types of vegetation present they are big sagebrush, spiny hopsage, and Douglas Rabbitbrush.

1.3 IRRIGATION PLAN

The D'Andrea Homeowners Association irrigates approximately 16.4 acres of streetscape. The streetscapes are currently irrigated with effluent as part of the D'Andrea Golf Course discharge permit **NEV2000509**. The D'Andrea Homeowners streetscape irrigation will be removed from the D'Andrea Golf Course permit and become the responsibility of the City of Sparks as part of the Sparks East discharge permit. Refer to Figures **J-3** through **J-7** for a portion of the streetscape landscape and irrigation plans. The irrigation plans for North D'Andrea Parkway, South D'Andrea Parkway, San Marino Drive, and Vista Boulevard consist of 21 plan sheets all of which have not been included as part of this effluent management plan. A copy of the irrigation drawings can be provided if requested.

Majority of irrigation will occur at night to minimize the possibility of public contact with effluent. All irrigation will be done with automatic sprinklers. The length of time each zone will be irrigated will be adjusted according to seasonal temperature and precipitation data. Spray irrigators will discharge near ground surface and away from areas of frequent public use. Adjustments will be made to the sprinklers heads as required to prevent ponding and runoff. If ponding or line breaks should occur they will be quickly identified and repaired.

Potable water line will be identified and necessary adjustments made to provide the required separation between effluent and potable water lines. Any component of the irrigation system that is exposed will be posted and painted purple to clearly identify the component as effluent fixture. All areas of the site shall be posted to notify the public that the landscaping is irrigated with effluent.

The irrigation control system will control the time and duration of the effluent application. Each system controls a set of valves independent of the master valve at the

service connection. In case of emergency the system should be shut down at the gate valve that connects the system to the main water supply. See figure_____.

1.4 IRRIGATION SYSTEM

The irrigation system is combination of drip and spray. An example of some of this system will be located on Figures .

1.5 EFFLUENT DEMAND

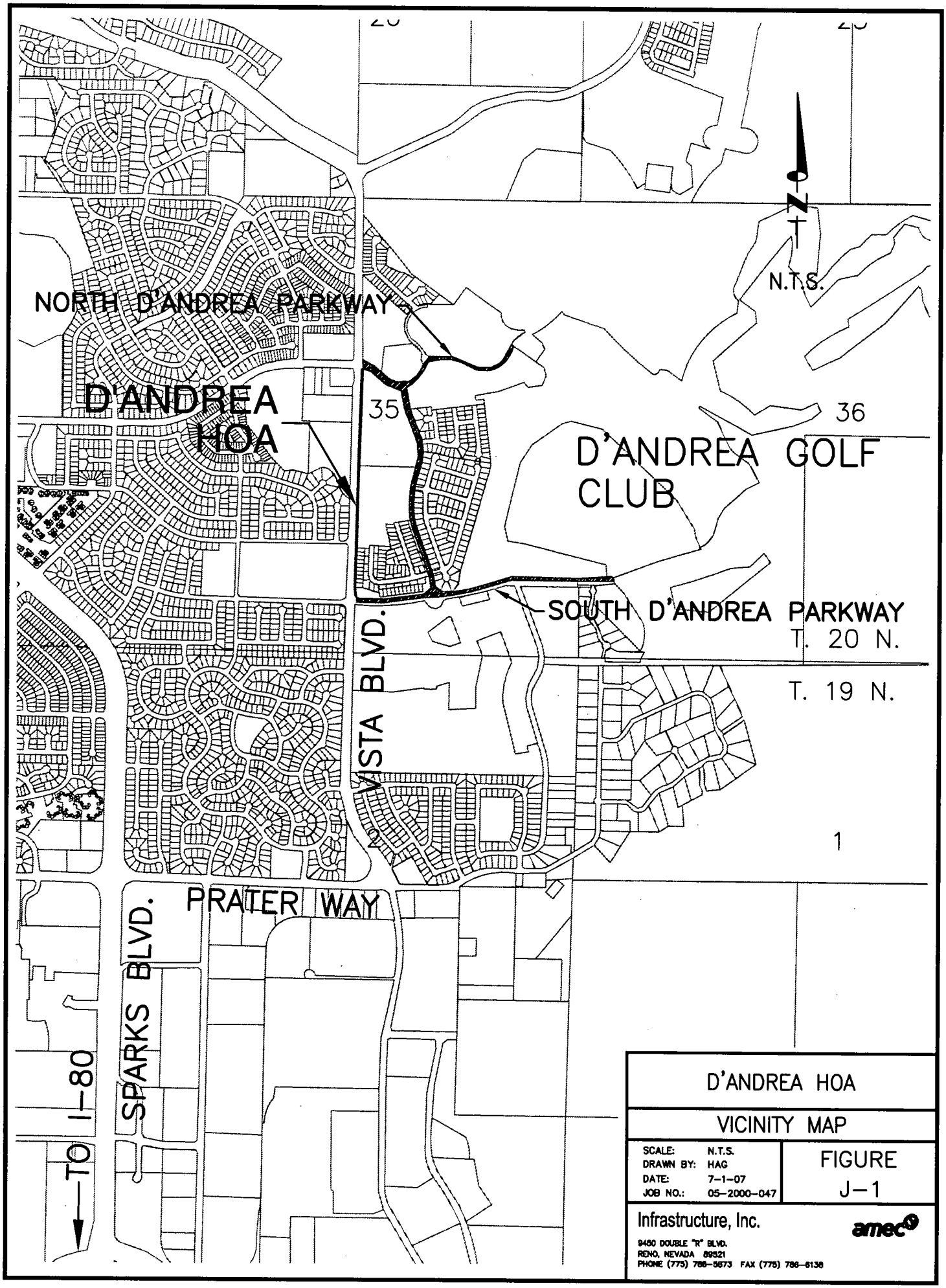
The estimated effluent demand for the D'Andrea Homeowners Association is shown in Table J-2.

Table J-2 – D'Andrea HOA Effluent Demands

Property	Total Area (Acres)	Irrigated Area (Acres)	Acre-Feet per Year	Peak Demand (gpm)	Maximum Daily Flow (mgd)	30-Day Average (mgd)
D'Andrea HOA	29.6	16.4	65	400	0.192	0.103

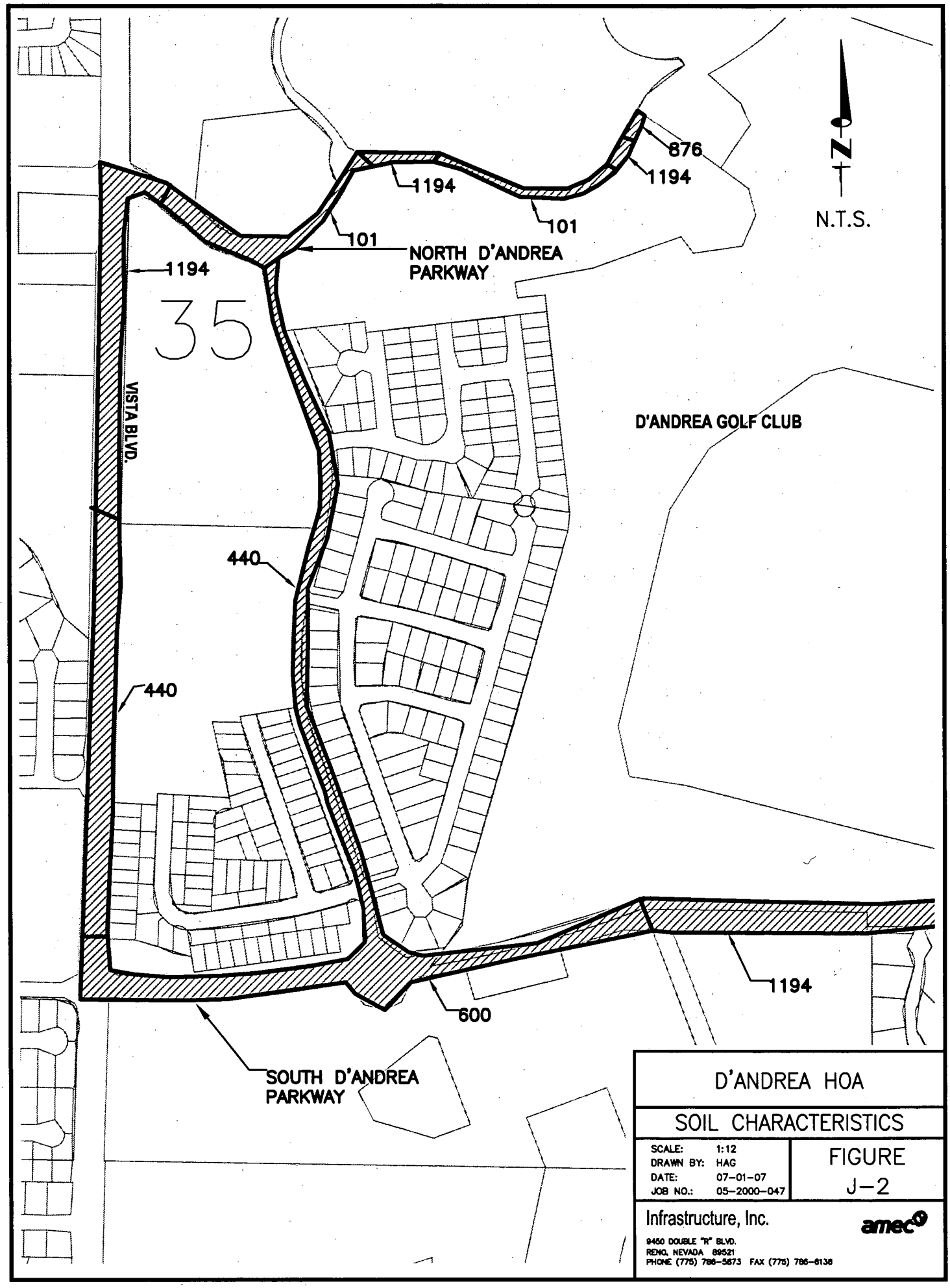
1.6 RUNOFF CONTROL PLAN

In the event of an emergency, the effluent irrigation system for D'Andrea HOA should be shut down by closing the gate valve located at the effluent meter vault.



D'ANDREA HOA	
VICINITY MAP	
SCALE: N.T.S. DRAWN BY: HAG DATE: 7-1-07 JOB NO.: 05-2000-047	FIGURE J-1

Infrastructure, Inc.
amec
9460 DOUBLE "R" BLVD.
RENO, NEVADA 89521
PHONE (775) 786-5873 FAX (775) 786-6136



D'ANDREA HOA

SOIL CHARACTERISTICS

SCALE:	1:12
DRAWN BY:	HAG
DATE:	07-01-07
JOB NO.:	05-2000-047

FIGURE J-2

Infrastructure, Inc.
amec
9450 DOUBLE "R" BLVD.
RENO, NEVADA 89521
PHONE (775) 786-5673 FAX (775) 786-6138

NOTE:
FOR COMPLETE TREE AND SHRUB IDENTIFICATION,
SEE TITLE SHEET FOR LEGEND

JUN VIR 'HIL' (2)
TIL COR (8)
JUN VIR 'HIL' (2)
MATCHLINE SEE SHEET
FOR ENTRY PLANTING & DESIGN, SEE SHEET L-30
NORTH D' ANDREA PARKWAY
PYR CAL 'CHA' (15)
TIL COR (3)
JUN VIR 'HIL' (6)
DOUBLE-HEAD STREET LIGHT, THIS AREA: INSTALL PER MFR (SEE DET. SHEET D-)
JUN VIR 'HIL' (6)
DOUBLE-HEAD STREET LIGHT
TIL COR (5)
MATCHLINE SEE SHEET
JUN VIR 'HIL' (20)
MATCHLINE SEE SHEET
PYR CAL 'CHA' (5)
SINGLE-HEAD STREET LIGHT
NORTH D'ANDREA PARKWAY
CAL DEC (2)
SAN MARINO DRIVE
JUN VIR 'HIL' (2)
CHIANTI PATH LANDSCAPING (BY OTHERS)
STUB TRAIL (COORD. W/ CHIANTI GRADING)

LANDSCAPE

SPRINKLER LEGEND

SYMBOL	DESCRIPTION
●●	RAINBIRD 1804-SAM-PRS-18-VAN SERIES POP-UP SPRAY 30 PSI OPERATING PRESSURE 18' RADIUS VARIABLE ARC 18 DEGREE TRAJECTORY
●●	RAINBIRD 1804-SAM-PRS-D-VAN SERIES POP-UP SPRAY 30 PSI OPERATING PRESSURE 12' RADIUS VARIABLE ARC 15 DEGREE TRAJECTORY
●	RAINBIRD 1804-SAM-PRS-12 FULL CIRCLE POP-UP SPRAY 30 PSI OPERATING PRESSURE 12' RADIUS 360 DEGREE ARC 360 DEGREE TRAJECTORY
●	HUNTER I-20-ARS-18 POP-UP ROTOR 360 PSI OPERATING PRESSURE 360' RADIUS ADJUSTABLE ARC 20 DEGREE TRAJECTORY

NORTH D'ANDREA PARKWAY
G.V.
WIRE SPLICE
QUICK COUPLER VALVE (TYP.)
DD7 1" DBV
DD1 1" DBV
DD4 1" DBV
DD2 1" DBV
DD3 1" DBV
NOTE: SEE SHT. L-29 FOR PIPE SIZING AND DATA INFO. RE: FLORAL DISPLAY
AST 1.5 HP
MATCHLINE SEE SHEET
NORTH D'ANDREA PARKWAY
SAN MARINO DRIVE
MATCHLINE SEE SHEET
Spray Irrigation
KEY MAP
NOT TO SCALE

IRRIGATION

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ENGINEERING & PLANNING / LAND SURVEYORS
405 CRISTINA STREET
RENO, NEVADA 89502
PHONE 702-332-4030 FAX 702-332-4033
FPE-RENO.COM

NEVADA

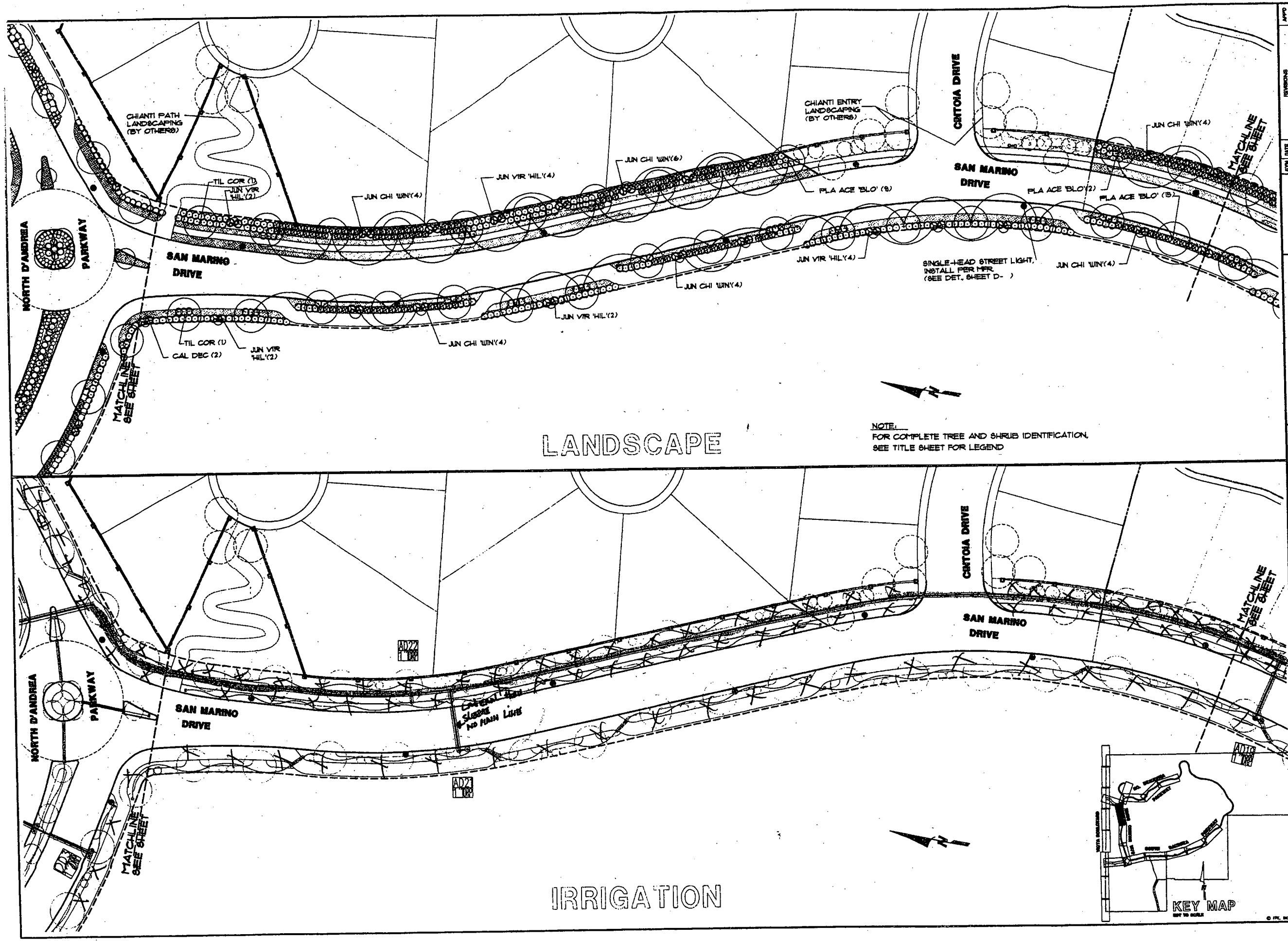
LANDSCAPE AND IRRIGATION PLAN
FOR
D' ANDREA RANCH
MASTER STREETSCAPE PLAN

WASHOE COUNTY

SPARKS

SCALE	
Horiz.	1"= 30'
Vert.	
Designed	DRL/MAC
Drawn	MAC
Dwg. No.	2008.DSLS
Checked	DRL
Date	12/21/98

Sheet No.
L1
1 of 25 sheets
JOB NO.
2008.05



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LANDSCAPE ARCHITECTS & PLANNERS / LAND SURVEYORS
300 CRAMPTON STREET
RENO, NEVADA 89502
E-MAIL
PHONE 702-329-4880
FAX 702-329-4955

APP'D	DATE	REVISIONS

LANDSCAPE AND IRRIGATION PLAN
FOR
D' ANDREA RANCH
MASTER STREETSCAPE PLAN
WASHOE COUNTY NEVADA

SPARKS

SCALE	
Horiz.	1"= 30'
Vert.	
Designed	DRL/MAC
Drawn	MAC
Dwg. No.	2008.05LS
Checked	DRL
Date	12/21/98
Sheet No.	L6
	6 of 25 sheets
JOB NO.	2008.05

LANDSCAPE AND IRRIGATION PLAN
FOR
D' ANDREA RANCH
MASTER STREETSCAPE PLAN

WASHOE COUNTY

SPARKS

NEVADA

FPE
ENGINEERS & PLANNERS & LAND SURVEYORS
350 CRAMPTON STREET
RENO, NEVADA 89502
PHONE 702-856-4880
FAX 702-856-4883
E-MAIL FPE@SBCGLOBAL.COM

NO.	DATE	REVISIONS	APP'D

SCALE	
Horiz.	1"= 30'
Vert.	
Designed	DRL/MAC
Drawn	MAC
Dwg. No.	2008.05#L9
Checked	DRL
Date	12/21/09
Sheet No.	L9
	9 of 25 sheets
JOB NO.	2008.05

KEY MAP

Spread Irrigation

IRRIGATION

LANDSCAPE

MATCHLINE SEE SHEET

MATCHLINE SEE SHEET

MATCHLINE SEE SHEET

QUICK COUPLER VALVE (TYP.)

EXISTING SUPPLY STUB & VALVE TO FOUNTAIN FEATURE. REMOVE INDEPENDENT CONTROLS & ELEC. SOURCE AS REQ'D.

CONTRACTOR TO ADJUST EXISTING SPRINKLER HEADS AS REQ'D BY MAIN-PRESSE EDITION

RETAINING WALL, PER SIENNA TENT. MAP

TIL COR (4)

ILE CRE CON

PIC ADI (4)

WOOD GRAPE ARBOR STRUCTURE, PER DET.

HID STR

JUN VIR CUP (6)

WOOD 4 WIRE GRAPE ARBOR STRUCTURE, PER DETAIL.

ILE CRE CON

WOOD 4 WIRE GRAPE ARBOR STRUCTURE, PER DETAIL.

JUN VIR HIL. (6)

TIL COR (2)

PTR CAL DRA (2)

COT ACU MOO

SPI JAP ALP

PTR CAL DRA (3)

TIL COR (2)

PTR CAL CHA (6)

DAP BIR

FOUNTAIN, PER DET.

LON NV ALP

DOUBLE-HEAD STREET LIGHT, THIS AREA. INSTALL PER PPRE (SEE DET. SHEET D-)

PTR CAL CHA (9)

JUN VIR HIL (2)

TIL COR (2)

COT ACU MOO

SPI JAP ALP

DAP BIR

JUN VIR HIL (4)

HID STR

WOOD 4 WIRE GRAPE ARBOR STRUCTURE, PER DETAIL.

JUN VIR HIL (8)

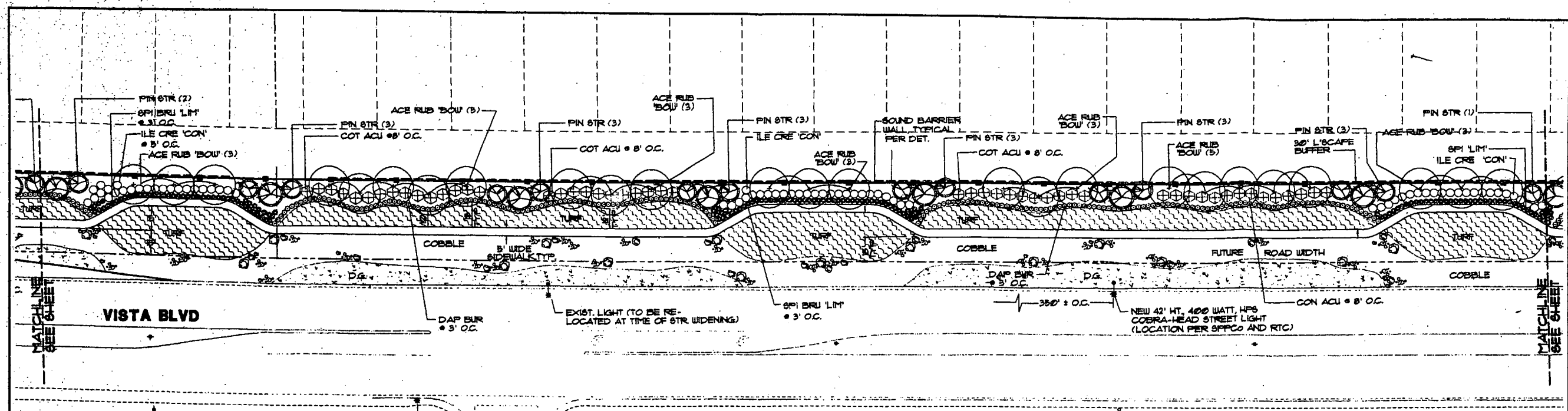
WOOD 4 WIRE GRAPE ARBOR STRUCTURE, PER DETAIL.

WOOD GRAPE ARBOR STRUCTURE, PER DETAIL.

RETAINING WALL, PER SIENNA TENT. MAP

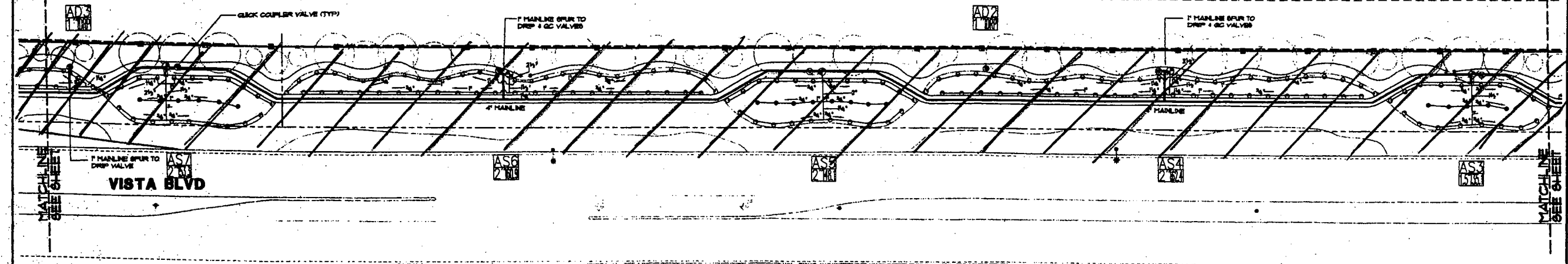
TIL COR (4)

NOTE:
FOR COMPLETE TREE AND SHRUB IDENTIFICATION, SEE TITLE SHEET FOR LEGEND



LANDSCAPE

NOTE:
FOR COMPLETE TREE AND SHRUB IDENTIFICATION, SEE TITLE SHEET FOR LEGEND



IRRIGATION

Drip Irrigation

KEY MAP

LANDSCAPE AND IRRIGATION PLAN FOR D' ANDREA RANCH MASTER STREETSCAPE PLAN

WASHOE COUNTY NEVADA

SPARKS

FPE
ENGINEERING ● PLANNING ● LAND SURVEYING
350 CRAMPTON STREET
RENO, NEVADA 89502
PHONE 702-852-4820
FAX 702-352-4033
FPE-RENO.COM

APP'D	REVISIONS	BY/M	DATE

SCALE
Horiz. 1"= 30'
Vert. -
Designed DRL/MAC
Drawn MAC
Dwg. No. 2008.05L8
Checked DRL
Date 12/21/98
Sheet No. L16
18 of 25 sheets
JOB NO. 2008.05

LANDSCAPE PLANTING PLAN
WINGFIELD PARK #4
RED HAWK LAND COMPANY
WASHOE COUNTY

No.	Revision Date

FILE No.	06-010-06-04
Designed	EG
Drawn	BS
Checked	RH
CAD File	06-010-L4
Date	10/27/06

Sheet
L-4
of
15

Scale: 1" = 20'
0' 20' 40' 60'

BRUSH

4475
4470
4470
4475
4475
4475

MATCHLINE "A"
MATCHLINE "A"

PLANT LEGEND

SYM.	QNT.	BOTANICAL NAME/COMMON NAME	MIN. SIZE	SPACING
		DECIDUOUS TREES		
	12	*Acer rubrum 'Bowhall'/Bowhall Maple*	2.5" Cal.	15' o.c.
	13	*Malus 'Indian Summer'/Indian Summer Crabapple*	2.5" Cal.	20' o.c.
	6	*Pyrus calleryana 'Redspire'/Redspire Pear*	2.5" Cal.	30' o.c.
	6	*Robinia x ambigua 'Idahoensis'/Idaho Locust*	2.5" Cal.	35' o.c.
		EVERGREEN TREES		
	6	*Cupressus arizonica 'Blue Pyramid'/Blue Cypress*	6' Min. Ht.	15' o.c.
	11	*Pinus nigra/Austrian Pine*	10' Min. Ht.	25' o.c.
	55	*Pinus strobiformis/Border Pine*	10' Min. Ht.	30' o.c.
		SHRUBS		
	87	*Berberis thunbergii 'Crimson Pygmy'/Dwarf Japanese Barberry*	2 gal.	4' o.c.
	33	*Cornus sericea 'Isanti'/Red Twig Dogwood*	1 gal.	5' o.c.
	17	*Euonymus alatus 'Compactus'/Dwarf Burning Bush*	5 gal.	6' o.c.
	24	*Euonymus japonicus 'Grandifolius'/Japanese Euonymus*	5 gal.	6' o.c.
	28	*Forsythia x intermedia 'Spring Glory'/Forsythia*	1 gal.	6' o.c.
	126	*Juniperus horizontalis 'Blue Chip'/Blue Chip Juniper*	5 gal.	6' o.c.
	83	*Juniperus scopulorum 'Grey Gleam'/Grey Gleam Juniper*	5 gal.	6' o.c.
	40	*Mahonia Repens/Creeping Mahonia*	1 gal.	3' o.c.
	66	*Prunus mugo pumilio/Dwarf Mugo Pine*	5 gal.	5' o.c.
	35	*Prunus x cistena/Dwarf Purple-leaf Plum*	5 gal.	6' o.c.
	91	*Delosperma cooperi/Pink Hardy Ice Plant*	2 gal.	4' o.c.
		GROUNDCOVERS		
		Kentucky Blue Grass 'Derby' Blend (Western Turf)		
		Revegetation seed blend (see specifications)		

HANSEN LANDSCAPE ARCHITECTS, LLC
Park Planning & Landscape Architecture
1422 C Street • Reno, NV 89502
Ph: (775)322-4474 • Fax: (775)322-4442 • E-mail: hansen@hansenreno.com
Nevada License # 440, EXP. 12/08 • California License # LA-4254
Idaho License # LA-225

NEVADA

SPARKS

WASHOE COUNTY

APPENDIX K-RAIL CITY

Rail City Garden Center

1.1 SITE LOCATION AND DESCRIPTION

The Rail City Garden Center is located at 1720 Brierley Way in Sparks, Nevada. Refer to Figure **K-1**. Adjacent developments to the Rail City Garden Center include the railroad to the north and east, Brierley Way to the south, and the North Truckee Drain to the west. Site location information for the Rail City Garden Center is given in Table **K-1** below.

Table K-1 – Rail City Garden Center Site Information

Property	Physical Address	Latitude/ Longitude	Section/Township/ Range
Rail City Garden Center	1720 Brierley Way	39°31'44"N 119°42'34"W	S11 T19N. R20E

The Rail City Garden Center is identified in the Flood Insurance Rate Map as Zone AE (in which base flood elevations have been determined) only the southern have of the property and Zone X (Areas determined to be outside 500-year floodplain) on the northern half of the property).

1.2 SOILS

The Soil Conservation Service describes several native soils for the Rail City Garden Center site. A brief description of each soil type is listed below. Figure K-2 shows the soil distribution at this location.

456-**Voltaire clay loam, gravelly substratum.** This very deep, poorly drained soil is on flood plain. Slopes are 0 to 2 percent. The surface layer is a dark gray clay loam about 9 inches thick. The upper part of the material goes to 36 inches and is gray. Below a depth of 36 inches is gravelly course sand through sandy clay loam. This unit is comprised of 5 percent Fettic soil, 5 percent Jubilee soil and 5 percent Truckee soil.

Permeability of the Voltaire soil is slow. Runoff is slow, and the hazard of water erosion is slight.

The soils listed above are the natural soils for the area. When Woodtrail Park was constructed there was a disruption of the soil and possibly other important material. It is difficult to predict the current soil conditions of the soil that may exist such as ponding, runoff, and infiltration.

1.3 IRRIGATION PLAN

The Rail City Garden Center is a 3.7-acre commercial business site. The Rail City Garden Center will use effluent for spray and drip irrigation of the site's nursery and landscaping. The point of connection/effluent meter vault will be located at the south side of the site along Brierley Way. Irrigation drawings are not available at this time.

Majority of irrigation will occur at night to minimize the possibility of public contact with effluent. All irrigation will be done with automatic sprinklers. The length of time each zone will be irrigated will be adjusted according to seasonal temperature and precipitation data. Spray irrigators will discharge near ground surface and away from areas of frequent public use. Adjustments will be made to the sprinklers heads as required to prevent ponding and runoff. If ponding or line breaks should occur they will be quickly identified and repaired.

Potable water line will be identified and necessary adjustments made to provide the required separation between effluent and potable water lines. Any component of the irrigation system that is exposed will be posted and painted purple to clearly identify the component as effluent fixture. All areas of the site shall be posted to notify the public that the landscaping is irrigated with effluent.

The irrigation control system will control the time and duration of the effluent application. Each system controls a set of valves independent of the master valve at the service connection. In case of emergency the system should be shut down at the gate valve that connects the system to the main water supply.

1.4 IRRIGATION SYSTEM

Currently we do not have an irrigation plan for this site. We will be providing this information when it becomes available.

1.5 EFFLUENT DEMAND

The estimated effluent demand for the Rail City Garden Center is shown in Table K-2.

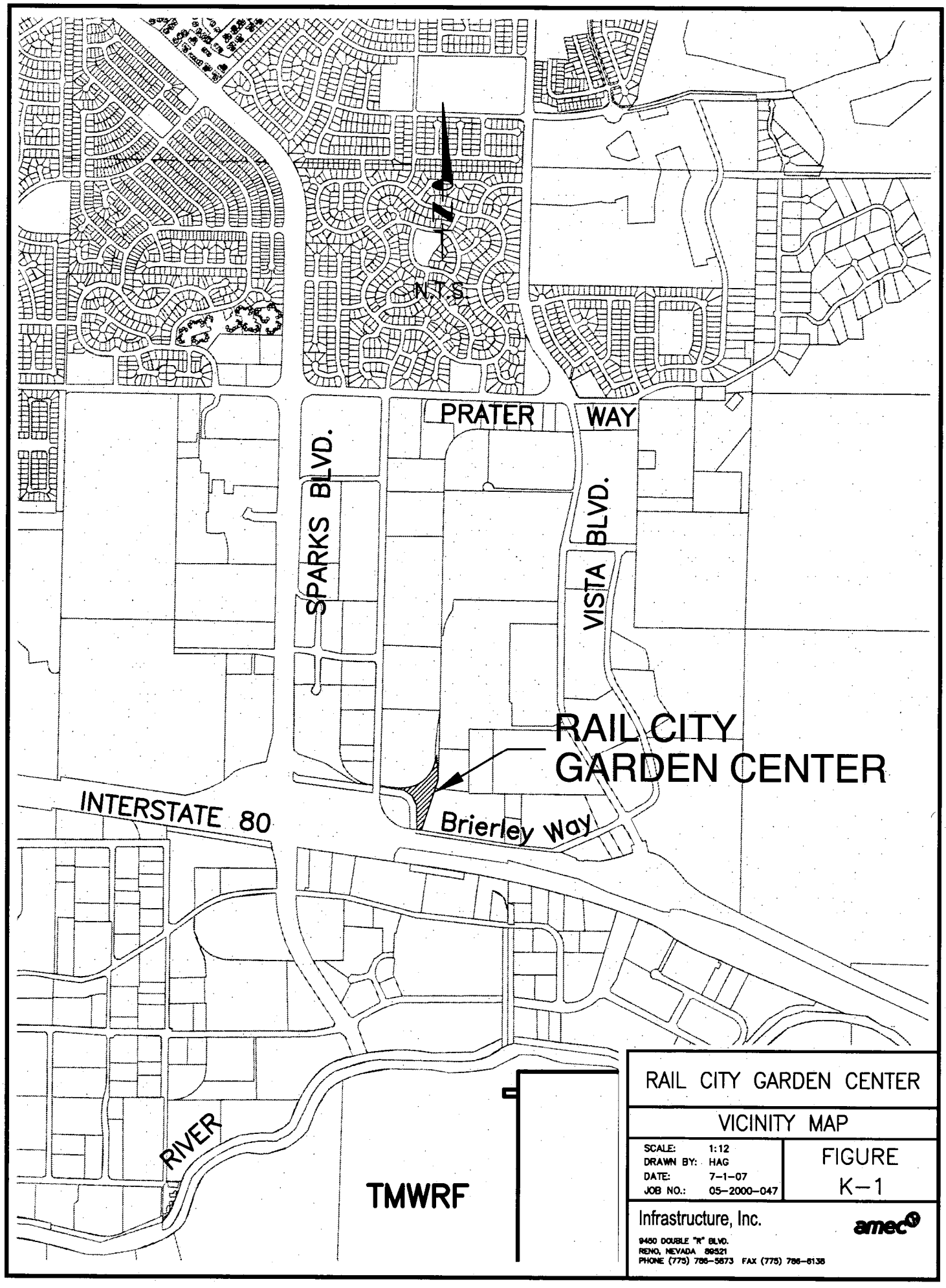
Table K-2 – Rail City Garden Center Effluent Demands

Property	Total Area (Acres)	Irrigated Area (Acres)	Acre-Feet per Year	Peak Demand (gpm)	Maximum Daily Flow (mgd)	30-Day Average (mgd)
Rail City Garden Center	3.7	1.5	7.2	21.6	0.017	0.011

Irrigation demands were obtained from the effluent management plan and discharge permits information form.

1.5 RUNOFF CONTROL PLAN

In the event of an emergency, the effluent irrigation system for the Rail City Garden Center should be shut down by closing the gate valve located at the effluent meter vault. This information will be provided when the irrigation plans become available.



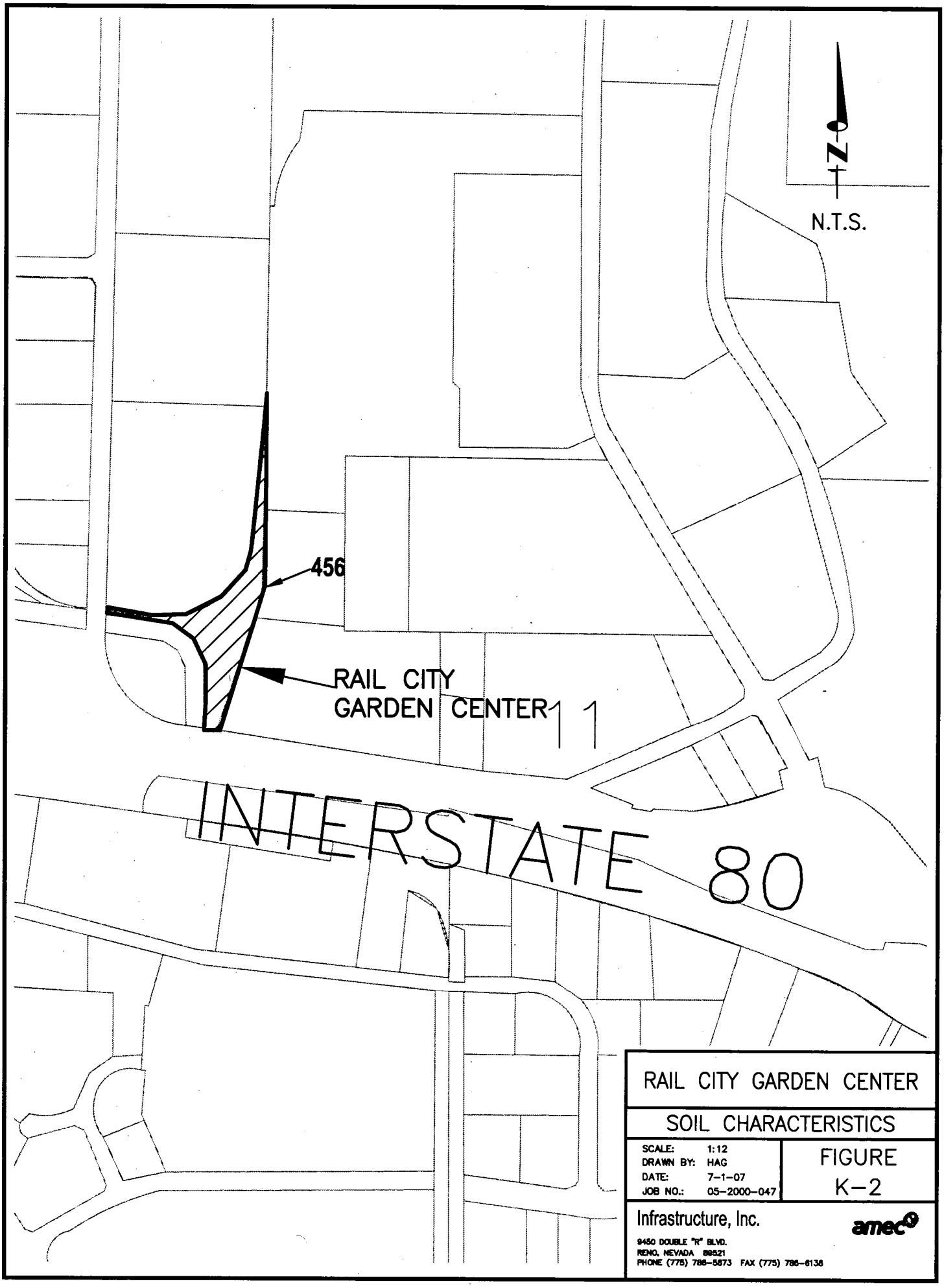
RAIL CITY GARDEN CENTER

VICINITY MAP

SCALE:	1:12
DRAWN BY:	HAG
DATE:	7-1-07
JOB NO.:	05-2000-047

FIGURE K-1

Infrastructure, Inc.
amec
9450 DOUBLE "R" BLVD.
RENO, NEVADA 89521
PHONE (775) 786-5873 FAX (775) 786-6138



RAIL CITY GARDEN CENTER

SOIL CHARACTERISTICS

SCALE:	1:12
DRAWN BY:	HAG
DATE:	7-1-07
JOB NO.:	05-2000-047

FIGURE
K-2

Infrastructure, Inc.
amec
9450 DOUBLE "R" BLVD.
RENO, NEVADA 89521
PHONE (775) 786-5873 FAX (775) 786-6138

APPENDIX L-TEC EQUIPMENT

TEC Equipment Inc.

1.1 SITE LOCATION AND DESCRIPTION

TEC Equipment Inc. is located at 1955 E. Greg St. in Sparks, Nevada. Refer to Figure L-1. Adjacent developments to the TEC Equipment Inc. include E. Greg St. to the north, a commercial business development to the east, the Truckee River to the south, and undeveloped land to the west. Site location information for TEC Equipment Inc. is given in Table **L-1** below.

Table L-1 – TEC Equipment Inc. Site Information

Property	Physical Address	Latitude/ Longitude	Section/Township/Range
TEC Equipment Inc.	1955 E. Greg St.	39°31'18"N 119°42'23"W	S11 T19N. R20E

The Tec Equipment Inc. is identified in the Flood Insurance Map as Zone AE (Base Flood elevations have been determined).

1.2 SOILS

The Soil Conservation Service describes several native soils for the Tec Equipment Inc. site. A brief description of each of the soils types is listed below. Figure L-2 shows the soils distribution at this location.

454-**Voltaire silty clay, drained**. This is a very deep, poorly drained soil on a floodplain. Slopes are 0 to 2 percent. Typically, the surface layer is gray, mottled silty clay about 20 inches thick. The underlying material goes 60 inches in depth and it is a gray, mottled silty clay loam with thin strata of silt loam to loamy sand. This unit is comprised of 5 percent Fettic soil, 5 percent is the Jubilee Variant soil and about 5 percent Truckee soil.

Permeability of this soil is slow. Runoff is slow, and the hazard of water erosion and blowing is slight.

455-**Voltaire-Truckee complex, drained**. This unit is on flood plains. This unit is 45 percent Voltaire silty clay, 0 to 2 percent slopes and 40 percent Truckee silt loam, 0 to 2 percent slopes. Voltaire is located on the lower part of the flood plain and the Truckee is located on the higher part of the flood plain. The upper layer is dark gray clay loam about 9 inches thick. The underlying material which is about 36 inches thick is gray stratified clay. Below 36 inches the soil is stratified gravelly coarse sand through sandy clay loam. This soil unit has Fettic soils on the terraces, Jubilee Variant soils on alluvial fans, and Truckee soils on the high parts of the flood plains. The unit has 5 percent Fettic soils, 5 percent Jubilee Variant soils, and 5 percent Truckee soils.

Permeability of this Voltaire soil is slow. Runoff is slow, and the hazard of water erosion is slight.

The soils listed above are the natural soils for the area. When Woodtrail Park was constructed there was a disruption of the soil and possibly other important material. It is difficult to predict the current soil conditions of the soil that may exist such as ponding, runoff, and infiltration.

1.3 IRRIGATION PLAN

TEC Equipment Inc. is a 5.0-acre commercial business site. TEC Equipment Inc. will use effluent for spray and drip irrigation of the site's landscaping. A connection to the City of Sparks existing 30" effluent pipeline located to the east of the site will serve TEC Equipment Inc. Irrigation drawings are not available at this time. Refer to Figure L-3 for a landscape concept plan.

Majority of irrigation will occur at night to minimize the possibility of public contact with effluent. All irrigation will be done with automatic sprinklers. The length of time each zone will be irrigated will be adjusted according to seasonal temperature and precipitation data. Spray irrigators will discharge near ground surface and away from areas of frequent public use. Adjustments will be made to the sprinklers heads as required to prevent ponding and runoff. If ponding or line breaks should occur they will be quickly identified and repaired.

Potable water line will be identified and necessary adjustments made to provide the required separation between effluent and potable water lines. Any component of the irrigation system that is exposed will be posted and painted purple to clearly identify the component as effluent fixture. All areas of the site shall be posted to notify the public that the landscaping is irrigated with effluent.

The irrigation control system will control the time and duration of the effluent application. Each system controls a set of valves independent of the master valve at the service connection. In case of emergency the system should be shut down at the gate valve that connects the system to the main water supply.

1.4 IRRIGATION SYSTEM

The irrigation plan is not available at this time.

1.5 EFFLUENT DEMAND

The estimated effluent demand for TEC Equipment Inc. is shown in Table **L-2**.

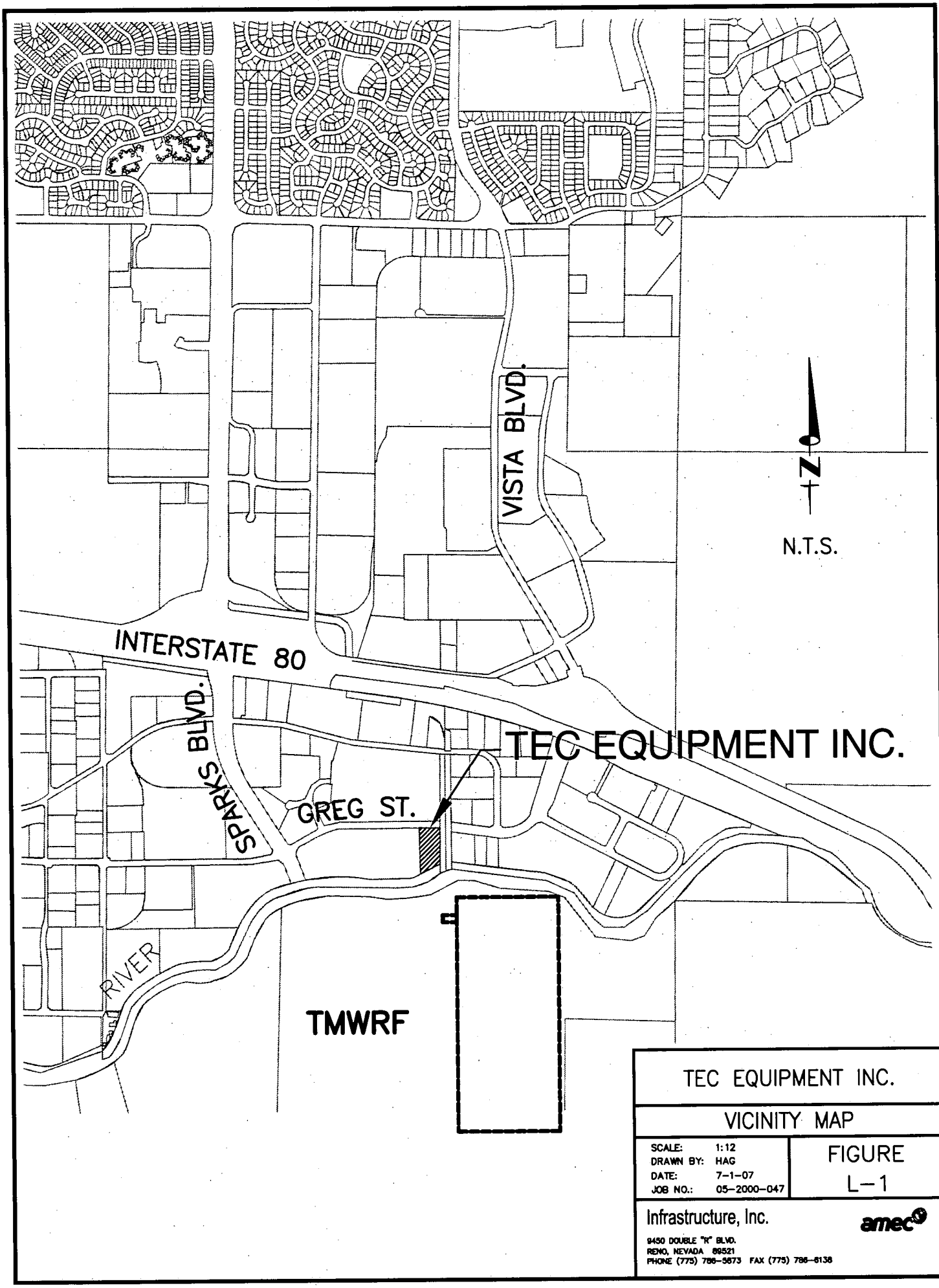
Table L-2 – TEC Equipment Inc. Effluent Demands

Property	Total Area (Acres)	Irrigated Area (Acres)	Acre-Feet per Year	Peak Demand (gpm)	Maximum Daily Flow (mgd)	30-Day Average (mgd)
TEC Equipment Inc.	5.0	0.5	1.21	13	0.006	.002

Irrigation demands were obtained from TEC landscape architect estimate of landscape water use.

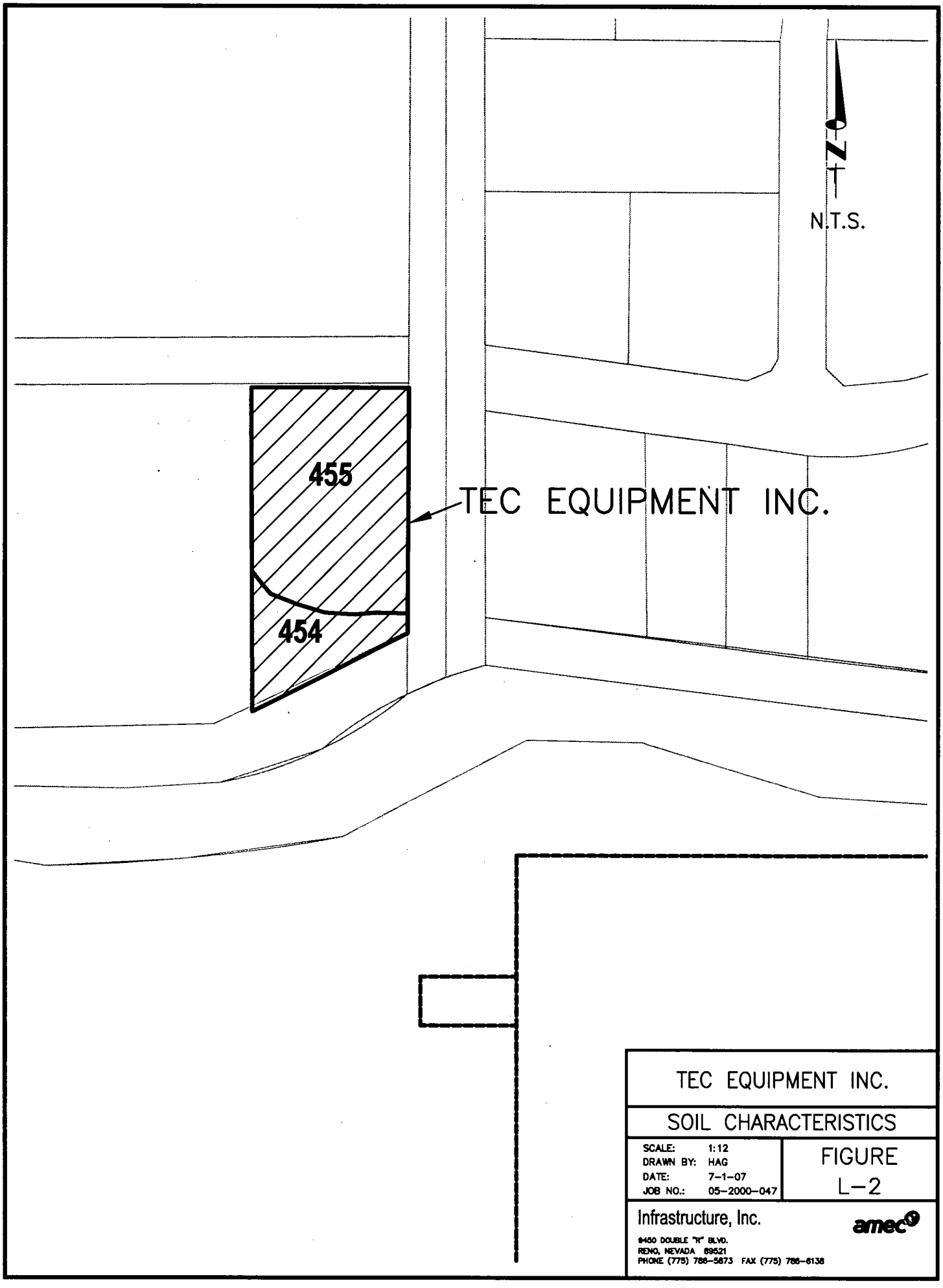
1.6 RUNOFF CONTROL PLAN

In the event of an emergency, the effluent irrigation system for TEC Equipment should be shut down by closing the gate valve located at the effluent meter vault.



TEC EQUIPMENT INC.	
VICINITY MAP	
SCALE: 1:12 DRAWN BY: HAG DATE: 7-1-07 JOB NO.: 05-2000-047	FIGURE L-1

Infrastructure, Inc.
amec
9450 DOUBLE "R" BLVD.
RENO, NEVADA 89521
PHONE (775) 786-5673 FAX (775) 786-6138



TEC EQUIPMENT INC.	
SOIL CHARACTERISTICS	
SCALE: 1:12 DRAWN BY: HAG DATE: 7-1-07 JOB NO.: 05-2000-047	FIGURE L-2

Infrastructure, Inc.
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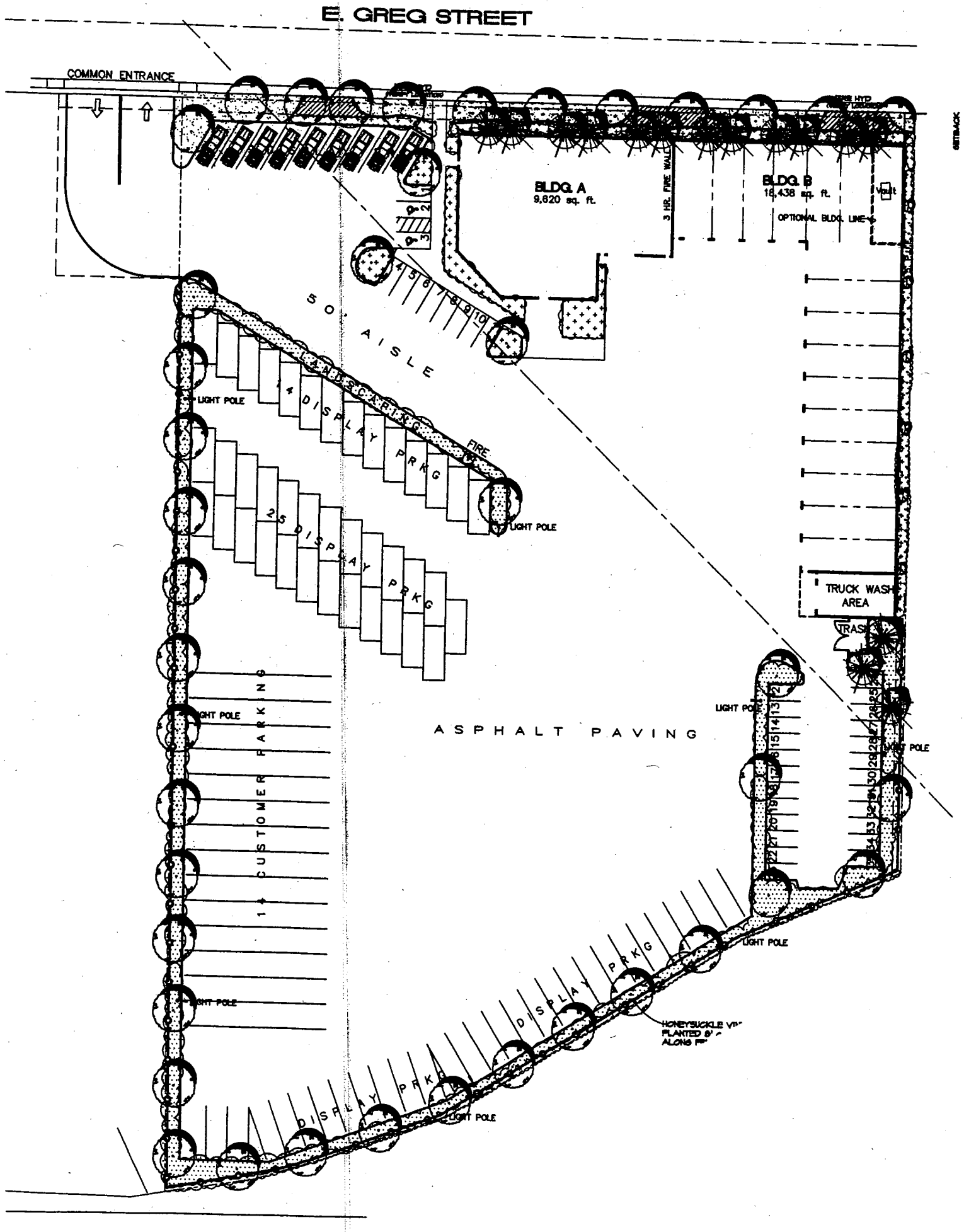
PHONE (775) 786-5873 FAX (775) 786-6136



PLANT LIST:

BOTANICAL NAME	COMMON NAME	SIZE	REMARKS
DECIDUOUS TREES			
MALUS 'CORALBURST'	FLW. CRABAPPLE	24" BOX or B & B	2.5" MIN. CAL. MATCHED
ACER PLATANOIDES	NORWAY MAPLE	24" BOX or B & B	2.5" MIN. CAL. MATCHED
FRAXINUS P. 'MARSHALL'	MARSHAL ASH	24" BOX or B & B	2.5" MIN. CAL. MATCHED
EVERGREEN TREES			
CALOCEDRUS DECURRENS	INCENSE CEDAR	24" BOX or B & B	18' MIN. HEIGHT
PICEA PUNGENS 'GLAUCA'	COLORADO SPRUCE	24" BOX or B & B	18' MIN. HEIGHT
JUNIPERUS C. 'PATHFINDER'	COLUMNAR JUNIPER	15 GAL. or B & B	6' MIN. HEIGHT
SHRUBS			
JUNIPERUS C. 'TAMARISCIFOLIA'	TAM JUNIPER	5 GAL.	24" MIN. SPREAD
PHOTINIA FRASERI	PHOTINIA	5 GAL.	36" MIN. HEIGHT
SPIRAEA B. 'GOLDFLAME'	SPIRAEA	5 GAL.	24" MIN. HEIGHT
HIBISCUS SYRIACUS	ROSE OF SHARON	5 GAL.	36" MIN. HEIGHT
BUXUS M. J. 'WINTER GEM'	BOXWOOD	5 GAL.	18" MIN. HEIGHT
EUONYMUS J. 'GOLDSPOT'	GOLD EUONYMUS	5 GAL.	24" MIN. HEIGHT
PRUNUS LAUROCERASUS	LAUREL	5 GAL.	36" MIN. HEIGHT
PRUNUS CISTENA	DEL PURPLELEAF PLUM	5 GAL.	36" MIN. HEIGHT
PRUNUS GLANDULOSA 'ROSEA'	FLW. ALMOND	5 GAL.	24" MIN. HEIGHT
GROUNDCOVERS			
EUONYMUS F. 'COLORATA'	WINTERCREEPER	1 GAL.	18" MIN. SPREAD
JUNIPERUS H. 'MUSHER'	JUNIPER	5 GAL.	24" MIN. SPREAD
GENISTA PILOSA 'VANCOUVER GOLD'	DEL GOLD BROOM	5 GAL.	24" MIN. SPREAD
VINCA MINOR	DEL PERIWINKLE	1 GAL.	12" MIN. SPREAD
LONICERA J. 'HALLIANA'	HONEYSUCKLE VINE	5 GAL.	36" MIN. RUNNERS
PERENNIALS			
CERASTIUM TOMENTOSUM	SNOW IN SUMMER	1 GAL.	12" MIN. SPREAD
RUDBECKIA HIRTA	BLACK EYED SUSAN	1 GAL.	12" MIN. HEIGHT
STACHYS BYZANTINA	LAMBS EAR	1 GAL.	12" MIN. SPREAD
GAURA LINDHEIMERI	GAURA	1 GAL.	12" MIN. HEIGHT
SANTOLINA VIRENS	SANTOLINA	1 GAL.	12" MIN. SPREAD
GAILLARDIA GRANDIFLORA	BLANKET FLOWER	1 GAL.	12" MIN. HEIGHT

LEGEND

- LARGE EVERGREEN TREE
- LARGE DECIDUOUS TREE
- SMALL FLOWERING ACCENT TREE
- SMALL EVERGREEN TREE
- SHRUBS/PERENNIAL AREA
- GROUNDCOVER AREA
- PLANTER AREAS IN FLOOD ZONE ROCK MULCH ONLY MINIMAL SHRUBS 8' OC +- 24" IN HEIGHT OR LESS
- TURF AREA

LANDSCAPE LEGEND

DECOMPOSED GRANITE MULCH - ALL PLANTER AREAS UNLESS DESIGNATED FOR ROCK. D.G. SHALL BE MINIMUM OF 3" DEPTH (NOT SHOWN)

ROCK MULCH AREA- 4" MINUS FRACTURED ROCK COLOR RANGE OF BROWN TO TAN, MIN. OF 4" DEPTH.

NOTE :
MULCH SHALL BE A MINIMUM OF A 4" DEPTH IN ALL PLANTER AREAS.
A SAMPLE OF ALL MULCH AND ACCENT MATERIAL SHALL BE SUBMITTED FOR APPROVAL PRIOR TO DELIVERY TO THE SITE.

LANDSCAPE CALCULATIONS

TOTAL SITE AREA: 27,467 S.F.
LANDSCAPE AREA REQUIRED: 13,648 S.F. (6%)
LANDSCAPE AREA PROVIDED: 22,168 S.F. (10%)
TOTAL PARKING SPACES: 49
TREES REQUIRED:
1/600 S.F. OF REQUIRED LANDSCAPE AREA = 26
1/1 PARKING SPACES = 7
1/30 LF PERIMETER LANDSCAPE = 26
TREES REQUIRED: 59
TREES PROVIDED: 63

NOTE:
PERIMETER LANDSCAPE TREE REQUIREMENTS PER THE CITY OF SPARKS NON-RESIDENTIAL DEVELOPMENT DESIGN STANDARDS HAVE BEEN DECREASED IN THE FLOOD ZONE AREAS TO A MINIMUM OF 40' OC. DECIDUOUS TREES ARE SITED IN LIEU OF EVERGREEN TREES TO MINIMIZE FLOOD IMPACT.

TEC Equipment

Greg Street
Reno, Nevada

Barbara M. Hatch ASLA
Landscape Architect
Nevada License No. 385
California License No. 4511

1464 Popinjay Drive
Reno, Nevada
89509

phone 775.829.1364
fax 775.829.1364
BHatch00@charter.net

REGISTERED LANDSCAPE ARCHITECT BARBARA M. HATCH 385 STATE OF NEVADA
Expires 12-31-07

N

SCALE: 1" = 30'

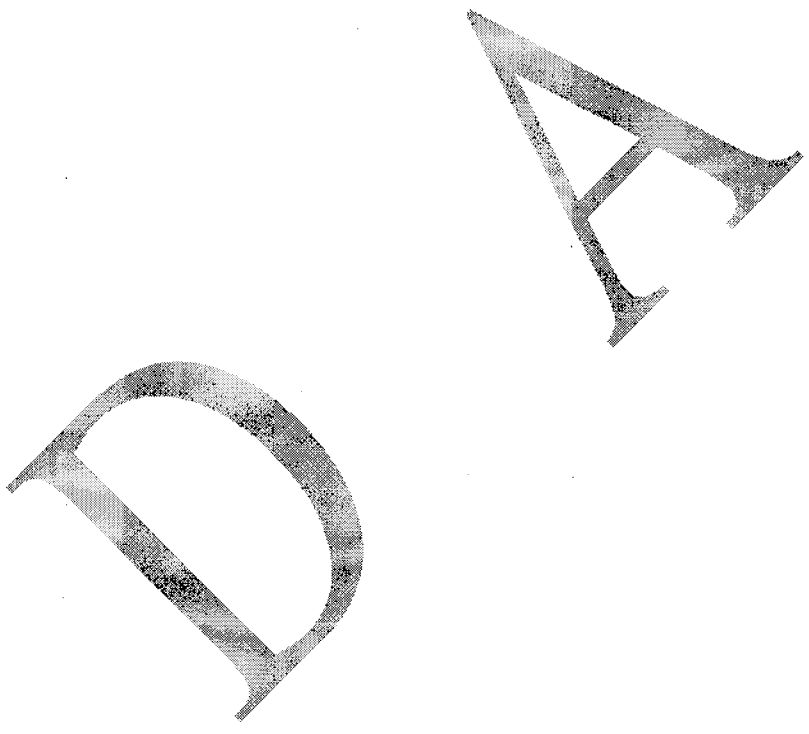
Landscape Concept

date July, 2008
job no.

L-C

Figure L-3

APPENDIX M-COPPER CANYON



COPPER CANYON

1.1 SITE LOCATION AND DESCRIPTION

Copper Canyon is located at Vista Boulevard at Copper Canyon Parkway & Brierley Way in Sparks, Nevada. Refer to Figure **M-1**. Adjacent developments to the Copper Canyon include residential and commercial developments to the west and north, undeveloped land to the east, and Interstate 80 to the south. Site location information for Copper Canyon is given in Table **M-1** below.

Table M-1 – Copper Canyon Site Information

Property	Physical Address	Latitude/ Longitude	Section/Township/ Range
Copper Canyon	Vista Boulevard at Copper Canyon Parkway (Brierley Way)	39°31'42"N 119°42'02"W	Portions of S1, S2, S11, & S12. T19N. R20E & Portion of S36. T20N. R20E

The Copper Canyon site is identified in the Flood Insurance Map as Zone X (Areas of 500-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood).

1.2 SOILS

The Soil Conservation Service describes several native soils for the Copper Canyon site. A brief description of each of the soils types is listed below. Figure M-2 shows the soils distribution at this location.

The soils listed above are the natural soils for the area. When Woodtrail Park was constructed there was a disruption of the soil and possibly other important material. It is difficult to predict the current soil conditions of the soil that may exist such as ponding, runoff, and infiltration.

1.3 IRRIGATION PLAN

Copper Canyon is located at Vista Boulevard at Copper Canyon Parkway & Brierley Way in Sparks, Nevada. Refer to Figure M-2. Adjacent developments to the Copper Canyon include residential and commercial developments to the west and north, undeveloped land to the east, and Interstate 80 to the south

Majority of irrigation will occur at night to minimize the possibility of public contact with effluent. All irrigation will be done with automatic sprinklers. The length of time each zone will be irrigated will be adjusted according to seasonal temperature and precipitation data. Spray irrigators will discharge near ground surface and away from areas of frequent public use. Adjustments will be made to the sprinklers heads as

required to prevent ponding and runoff. If ponding or line breaks should occur they will be quickly identified and repaired.

Potable water line will be identified and necessary adjustments made to provide the required separation between effluent and potable water lines. Any component of the irrigation system that is exposed will be posted and painted purple to clearly identify the component as effluent fixture. All areas of the site shall be posted to notify the public that the landscaping is irrigated with effluent.

The irrigation control system will control the time and duration of the effluent application. Each system controls a set of valves independent of the master valve at the service connection. In case of emergency the system should be shut down at the gate valve that connects the system to the main water supply.

1.4 IRRIGATION SYSTEM

A preliminary irrigation plan has been attached refer to figure M-3.

1.5 EFFLUENT DEMAND

The estimated effluent demand for TEC Equipment Inc. is shown in Table **M-2**.

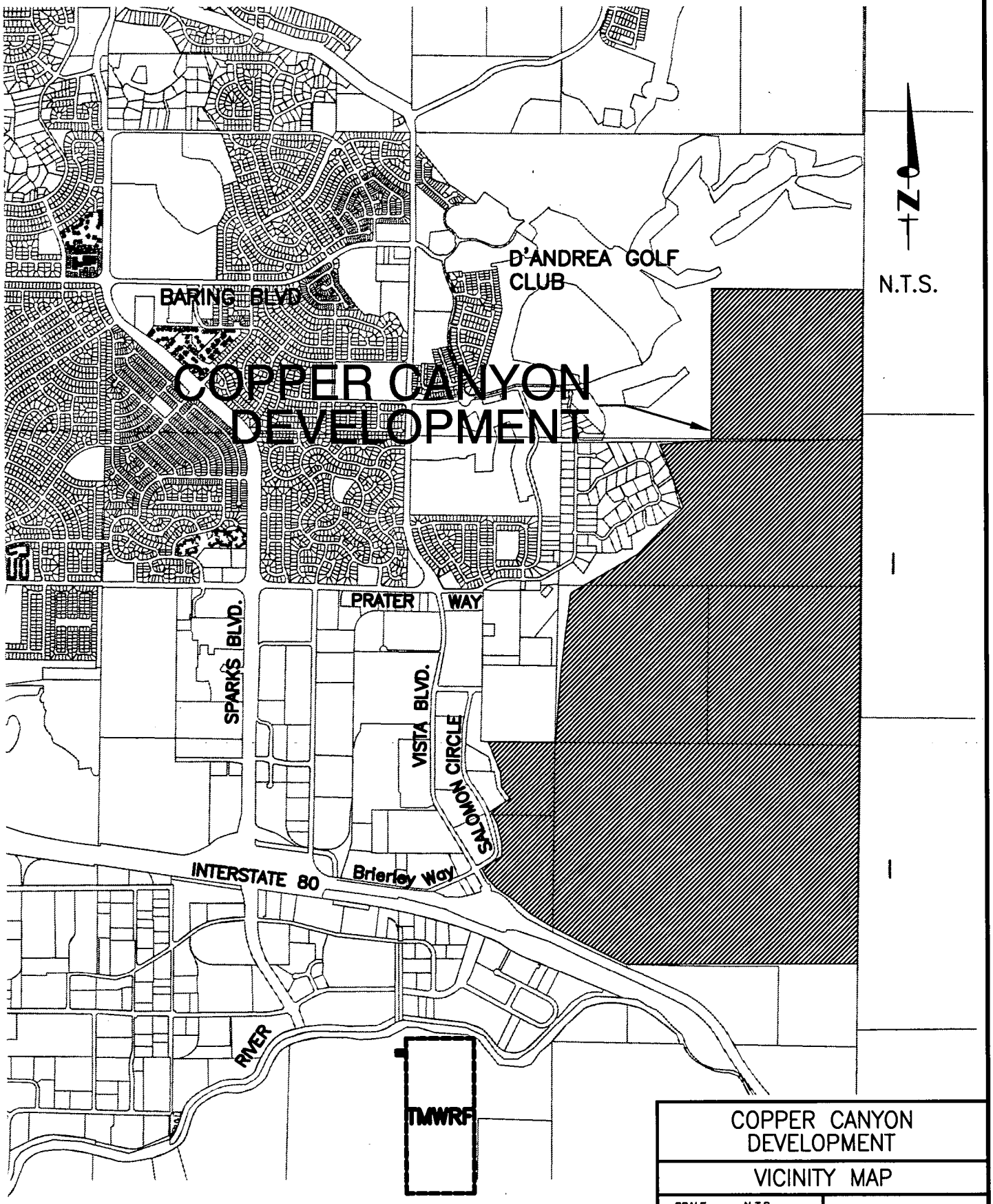
Table M-2 – TEC Equipment Inc. Effluent Demands

Property	Total Area (Acres)	Irrigated Area (Acres)	Acre-Feet per Year	Peak Demand (gpm)	Maximum Daily Flow (mgd)	30-Day Average (mgd)
TEC Equipment Inc.	5.0	0.5	1.21	13	0.006	.002

Irrigation demands were obtained from TEC landscape architect estimate of landscape water use.

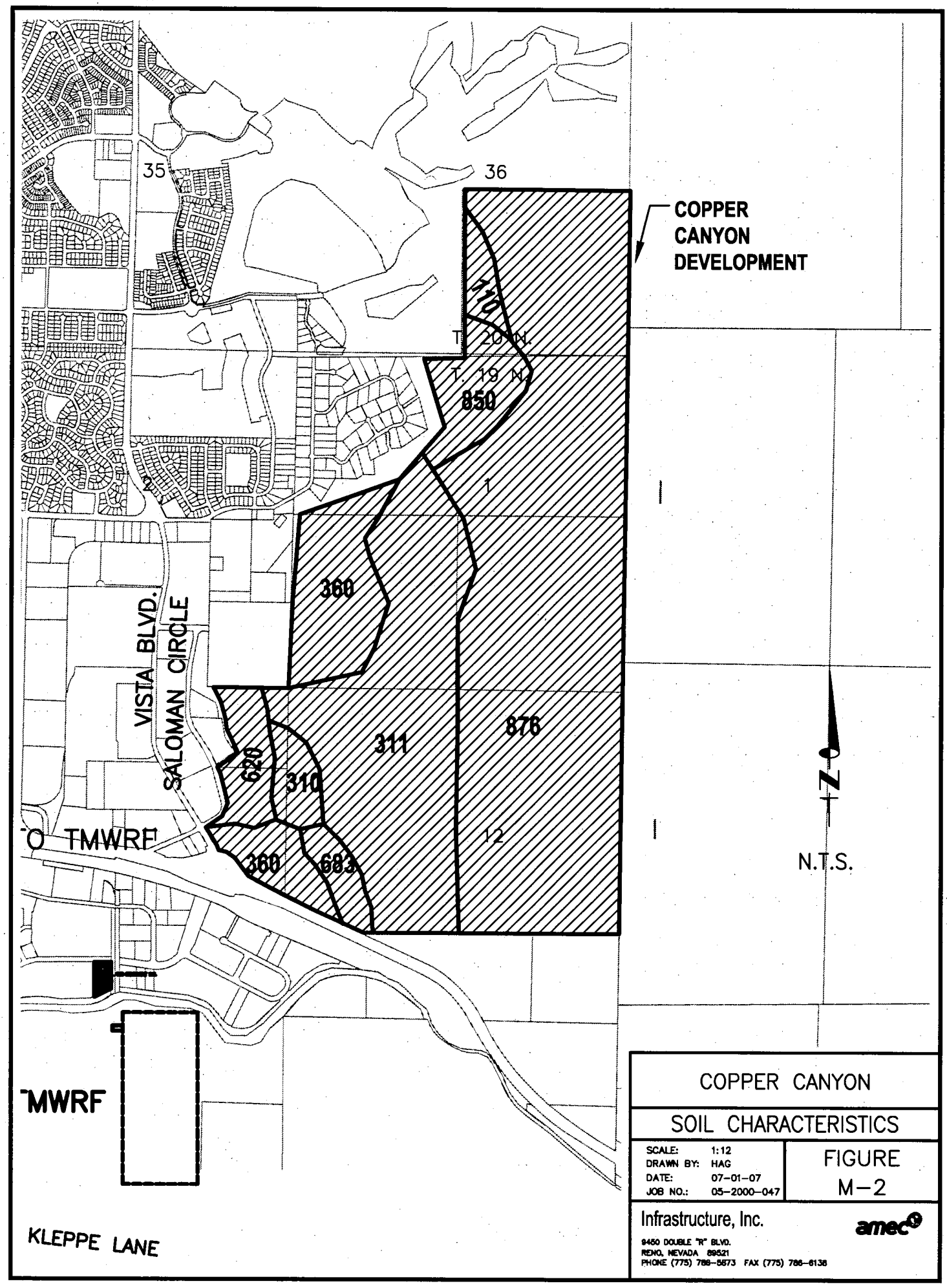
1.6 RUNOFF CONTROL PLAN

In the event of an emergency, the effluent irrigation system for TEC Equipment should be shut down by closing the gate valve located at the effluent meter vault.



COPPER CANYON DEVELOPMENT	
VICINITY MAP	
SCALE: N.T.S. DRAWN BY: HAG DATE: 7-1-07 JOB NO.: 05-2000-047	FIGURE M-1

Infrastructure, Inc.
amec
9450 DOUBLE "R" BLVD.
RENO, NEVADA 89521
PHONE (775) 788-5873 FAX (775) 788-6138



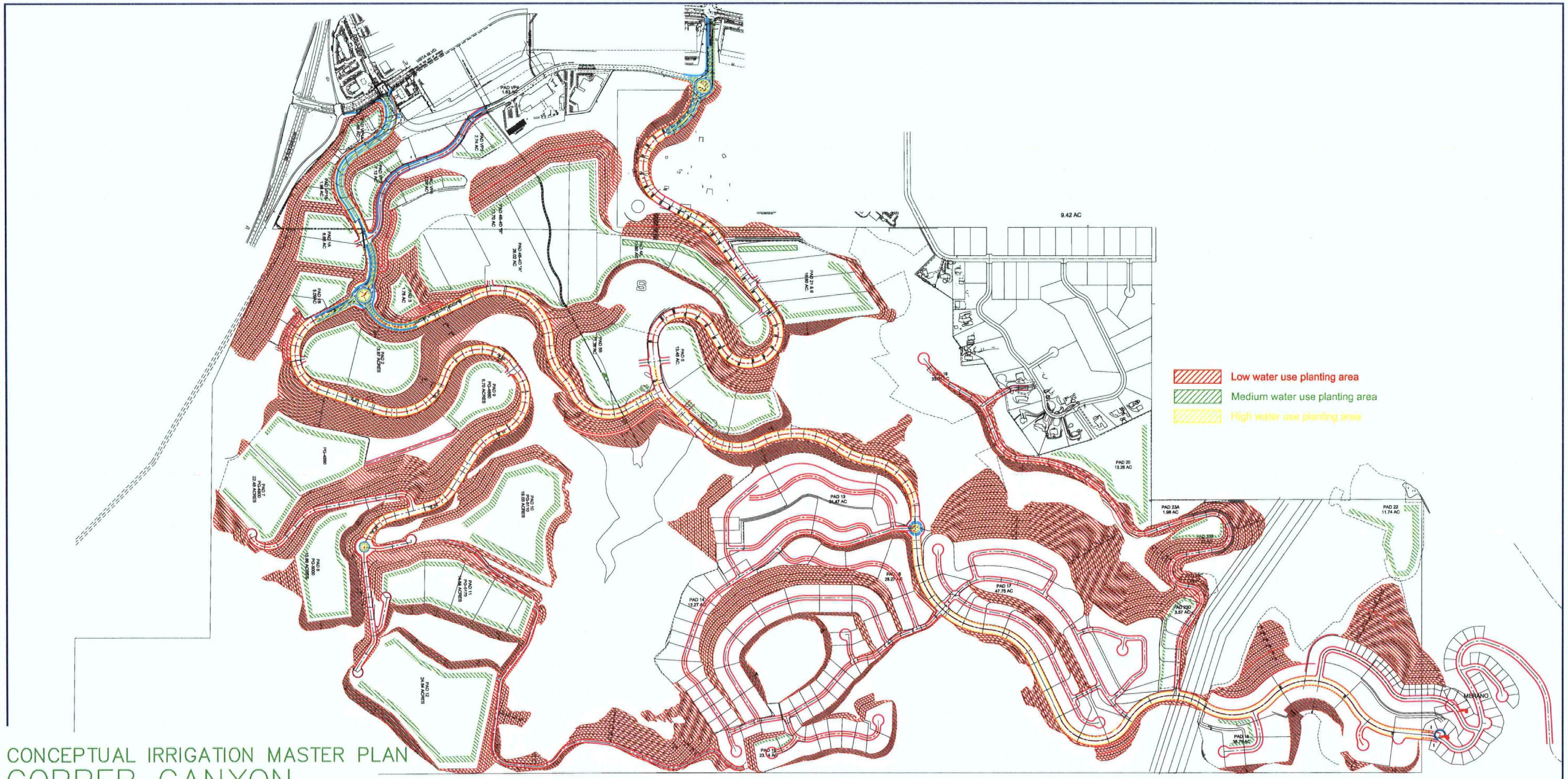
COPPER CANYON

SOIL CHARACTERISTICS

SCALE:	1:12
DRAWN BY:	HAG
DATE:	07-01-07
JOB NO.:	05-2000-047

FIGURE
M-2

Infrastructure, Inc.
amec
9450 DOUBLE "R" BLVD.
RENO, NEVADA 89521
PHONE (775) 786-5573 FAX (775) 786-6138



CONCEPTUAL IRRIGATION MASTER PLAN
COPPER CANYON

SPARKS, NEVADA
WASHOE COUNTY

SUNCAL COMPANIES
CLIENT ADRESS

SUMMERS/MURPHY & PARTNERS, INC.
LANDSCAPE ARCHITECTS

APPENDIX N-PELICAN PARK

1.1 PELICAN PARK AND WALKING PATH

Pelican Park is located off of Silverton Way near Media Ct. in Sparks, Nevada. The walking path extends from Vista Boulevard north to Arrow Smith Drive along the west side of Pelican Park. Refer to Figure **N-1**. Adjacent developments to Pelican Park include residential housing to the north and east, a future commercial site to the south, and the walking path to the west. Site location information for Pelican Park is given in Table **N-1** below.

Table N-1 – Pelican Park Site Information

Property	Physical Address	Latitude/ Longitude	Section/Township/ Range
Pelican Park	Silverton Way	39°36'31"N 119°41'39"W	S12. T20N. R20E

Pelican Park and walking path is identified in the Flood Insurance Rate Map as both Zone X (areas of 500-year flood, areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile, and areas protected by levees from 100-year flood) and AO (Flood depths of 1 to 3 feet, average depths determined).

1.2 SOILS

The Soil Conservation Service describes several native soils for the Pelican Park and walking path site. A brief description of each of the soil types is listed below. Figure N-2 shows the soil distribution at this location.

230 - **Cradlebaugh loam.** The Cradlebaugh component makes up 85 percent of the map unit. Slopes are 0 to 2 percent. This component is on flood plains, semi-bolsons. The parent material consists of mixed alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is high. Shrink-swell potential is moderate. This soil is occasionally flooded. It is not ponded. Permeability of this Cradlebaugh soil is moderately slow. The present vegetation located in most areas in mainly black greasewood, basin wildrye, and saltgrass.

420 - **Godecke loamy sand.** The Godecke component makes up 85 percent of the map unit. Slopes are 0 to 2 percent. This component is on semi-bolsons, stream terraces. The parent material consists of mixed alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is moderately low. Permeability of this Godecke soil is slow. Runoff is very slow, and the hazard of water erosion is slight. The main vegetation for this soil is mainly black greasewood and saltgrass.

910 - **Vamp fine sandy loam, slightly saline-alkali**. The Vamp, slightly saline-alkali component makes up 85 percent of the map unit. Slopes are 0 to 2 percent. This component is on flood plains, semi-bolsons. The parent material consists of mixed alluvium. Depth to a root restrictive layer, duripan, is 20 to 40 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. Permeability of this Vamp soil is moderate. The hazard to blowing is slight. The present vegetation in most areas is grass.

993 - **Endoaquolls, nearly level.** The Endoaquolls component makes up 100 percent of the map unit. Slopes are 0 to 2 percent. This component is on flood plains, semi-bolsons. The parent material consists of mixed alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is very poorly drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. The vegetation varies from sparse to lush stands of sedges and rushes.

1191 - **Spasprey sandy loam, 2 to 4 percent slopes.** The Spasprey component makes up 85 percent of the map unit. Slopes are 2 to 4 percent. This component is on piedmonts, fan remnants. The parent material consists of mixed alluvium. Depth to a root restrictive layer, duripan, is 20 to 30 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. Permeability of this Spasprey soil is moderately slow. Runoff is slow, and the hazard of water erosion is slight. The present vegetation in most areas is mainly big sagebrush, spiny hopsage, and Douglas Rabbitbrush.

The soils listed above are the natural soils in the area. During the construction of the Pelican Park, there was disruption of this soil and possibly the importation of other material. It is difficult to predict the conditions of the soil that may influence ponding, runoff and infiltration.

1.3 IRRIGATION PLAN

Pelican Park is a 4.5-acre park. The park will use effluent for spray and drip irrigation of the park and walking path landscaping. Refer to Figures **N-3** for park irrigation plans. Irrigation plans for the walking path are not available at this time.

Majority of irrigation will occur at night to minimize the possibility of public contact with effluent. All irrigation will be done with automatic sprinklers. The length of time each zone will be irrigated will be adjusted according to seasonal temperature and precipitation data. Spray irrigators will discharge near ground surface and away from areas of frequent public use. Adjustments will be made to the sprinklers heads as required to prevent ponding and runoff. If ponding or line breaks should occur they will be quickly identified and repaired.

Potable water line will be identified and necessary adjustments made to provide the required separation between effluent and potable water lines. Any component of the irrigation system that is exposed will be posted and painted purple to clearly identify the component as effluent fixture. All areas of the site shall be posted to notify the public that the landscaping is irrigated with effluent.

The irrigation control system will control the time and duration of the effluent application. Each system controls a set of valves independent of the master valve at the service connection. In case of emergency the system should be shut down at the gate valve that connects the system to the main water supply.

1.4 IRRIGATION SYSTEM

Pelican Park has a 2 ½ inch water line that runs through the park. It is from this access point that the drip and spray irrigation operate off of this can been seen in Figure N-4.

1.5 EFFLUENT DEMAND

The estimated effluent demand for Pelican Park is shown in Table N-2.

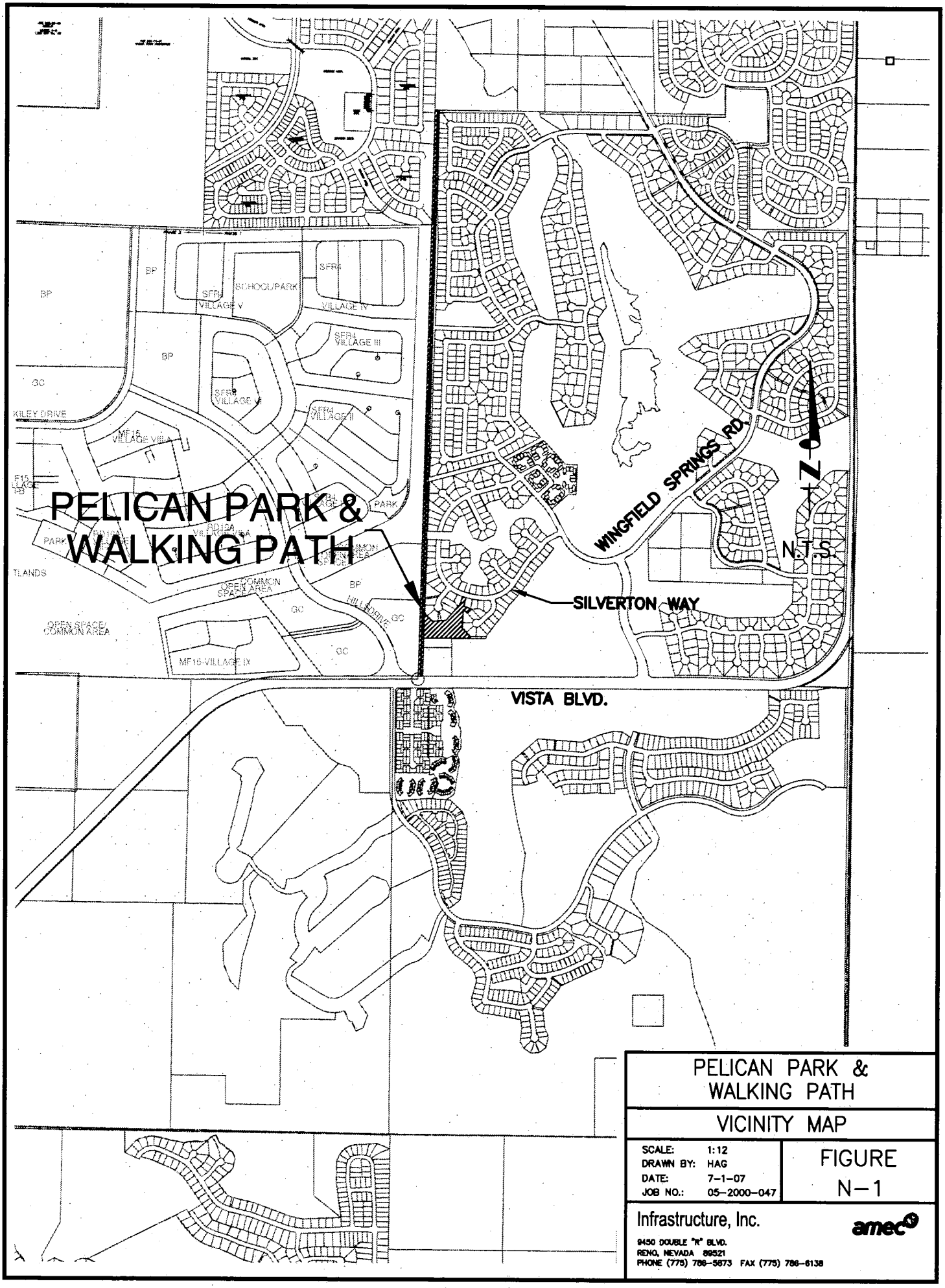
Table N-2 – Pelican Park & Walking Path Effluent Demands

Property	Total Area (Acres)	Irrigated Area (Acres)	Acre-Feet per Year	Peak Demand (gpm)	Maximum Daily Flow (mgd)	30-Day Average (mgd)
Pelican Park	4.5	4.0	16	60	.029	.025
Walking Path	1.5	0.75	10	25	.012	.010
Total	**6.0**	**4.75**	**26**	**85**	**.041**	**0.035**

Estimated irrigation peak flow for Pelican Park was obtained from the Reclaimed Irrigation Plan.

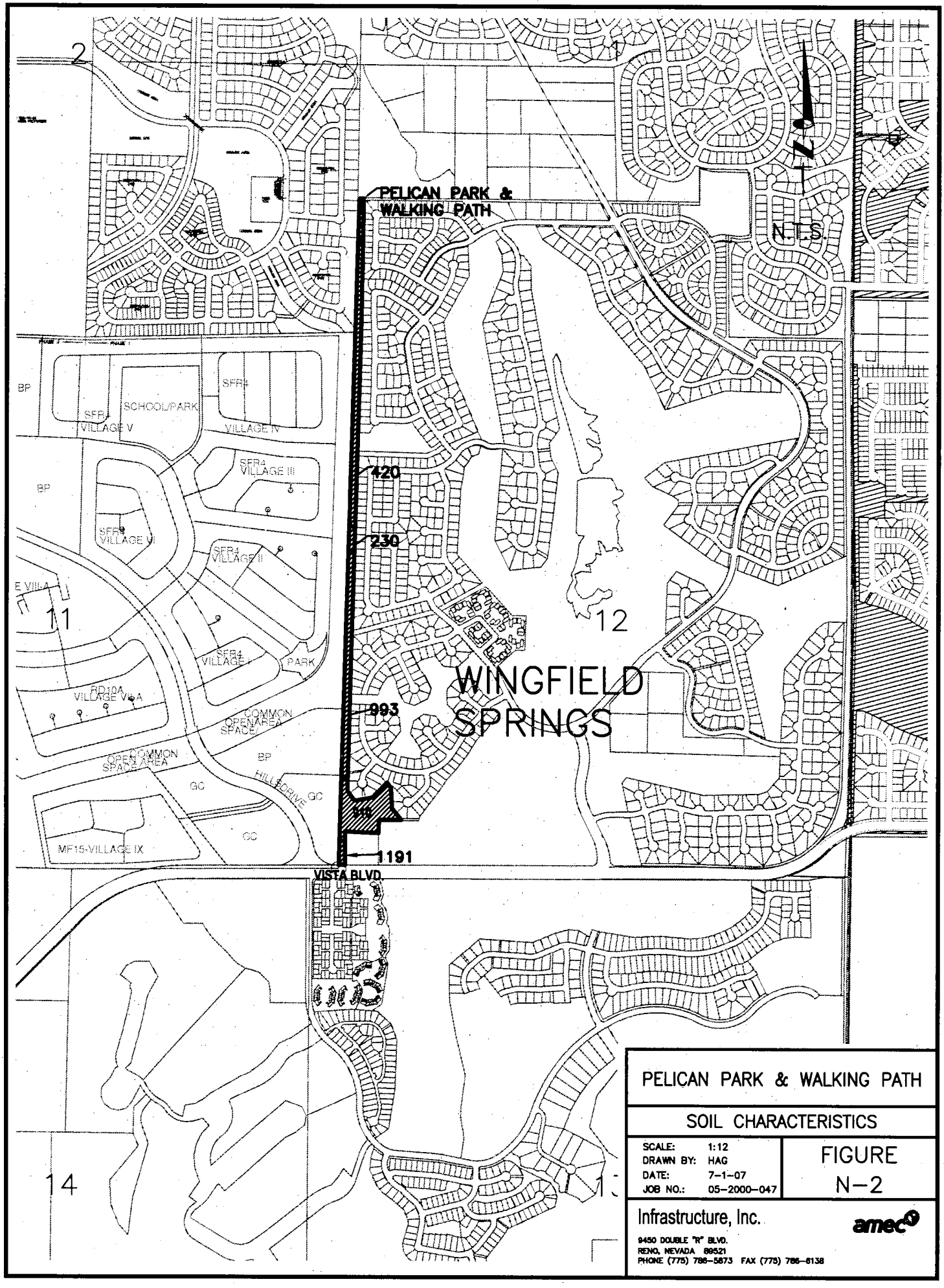
1.6 RUNOFF CONTROL PLAN

In the event of an emergency the effluent irrigation system for Pelican Park should be shut down by closing the gate valve located at the effluent meter vault this shown on Figure N-4.



PELICAN PARK & WALKING PATH	
VICINITY MAP	
SCALE: 1:12 DRAWN BY: HAG DATE: 7-1-07 JOB NO.: 05-2000-047	FIGURE N-1

Infrastructure, Inc.
amec
9450 DOUBLE "R" BLVD.
RENO, NEVADA 89521
PHONE (775) 786-5873 FAX (775) 786-6138



PELICAN PARK & WALKING PATH

SOIL CHARACTERISTICS

SCALE:	1:12
DRAWN BY:	HAG
DATE:	7-1-07
JOB NO.:	05-2000-047

FIGURE
N-2

Infrastructure, Inc.
amec
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RENO, NEVADA 89521
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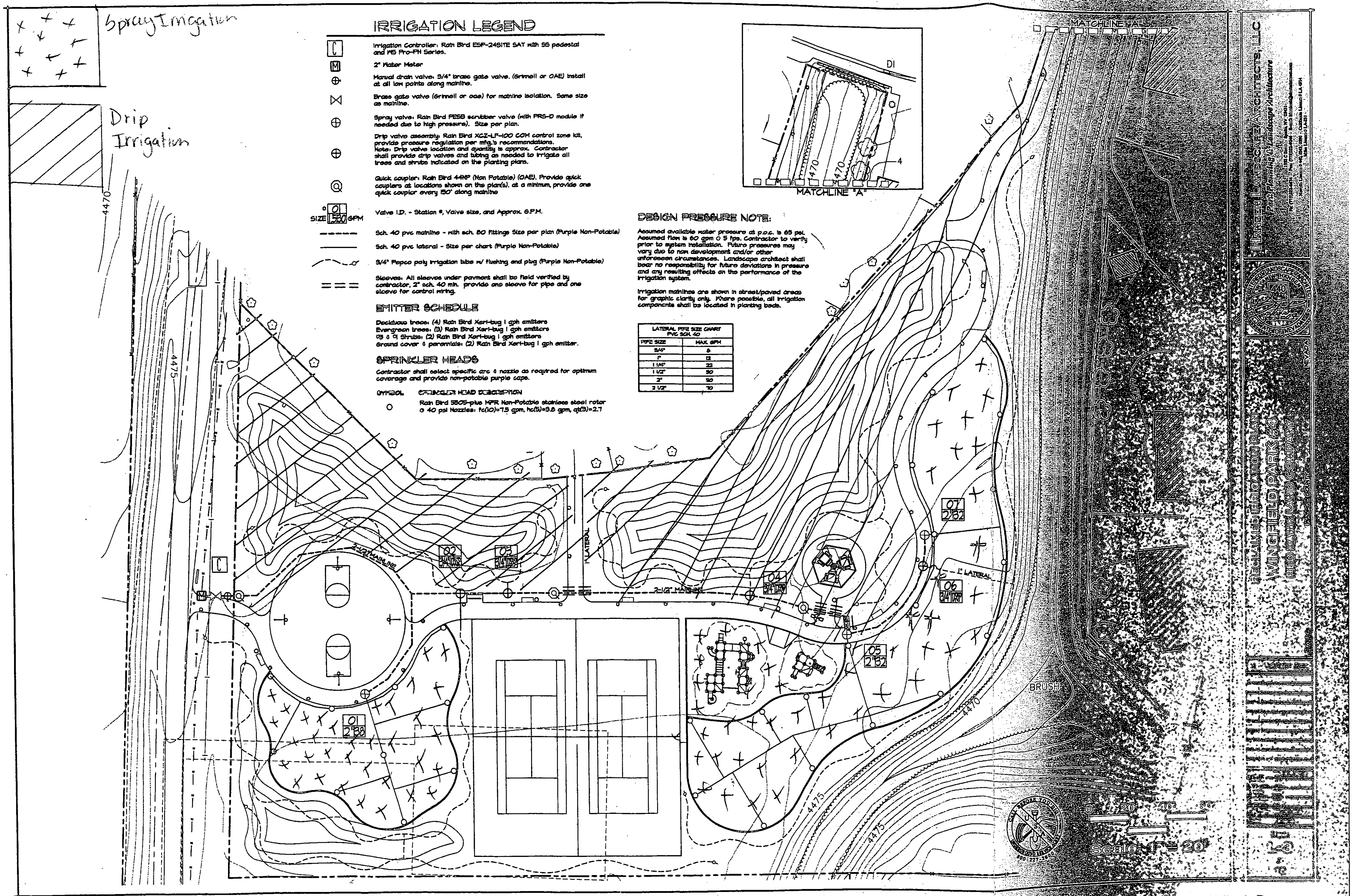


IRRIGATION LEGEND

Irrigation Controller: Rain Bird ESP-24SITE SAT with SS pedestal and WS Pro-PH Series.

2" Water Meter

Manual drain valve: 3/4" brass gate valve. (Grinnell or OAE) install at all low points along mainline.

Brass gate valve (Grinnell or oae) for mainline isolation. Same size as mainline.

Spray valve: Rain Bird PESB scrubber valve (with PRS-D module if needed due to high pressure). Size per plan.

Drip valve assembly: Rain Bird XCZ-LF-100 COM control zone kit, provide pressure regulation per mfg.'s recommendations.
Note: Drip valve location and quantity is approx. Contractor shall provide drip valves and tubing as needed to irrigate all trees and shrubs indicated on the planting plans.

Quick coupler: Rain Bird 44NP (Non Potable) (OAE). Provide quick couplers at locations shown on the plan(s). at a minimum, provide one quick coupler every 150' along mainline

01 SIZE 1.530 GPM — Valve I.D. - Station #, Valve size, and Approx. G.P.M.

Sch. 40 pvc mainline - with sch. 80 fittings Size per plan (Purple Non-Potable)

Sch. 40 pvc lateral - Size per chart (Purple Non-Potable)

3/4" Pepco poly irrigation tube w/ flushing end plug (Purple Non-Potable)

Sleeves: All sleeves under pavment shall be field verified by contractor, 2" sch. 40 min. provide one sleeve for pipe and one sleeve for control wiring.

EMITTER SCHEDULE

Deciduous trees: (4) Rain Bird Xeri-bug 1 gph emitters
Evergreen trees: (3) Rain Bird Xeri-bug 1 gph emitters
05 & 01 Shrubs: (2) Rain Bird Xeri-bug 1 gph emitters
Ground cover & perennials: (2) Rain Bird Xeri-bug 1 gph emitter.

SPRINKLER HEADS

Contractor shall select specific arc & nozzle as required for optimum coverage and provide non-potable purple caps.

SYMBOL — SPRINKLER HEAD DESCRIPTION

Rain Bird 5505-plus MPR Non-Potable stainless steel rotor @ 40 psi Nozzles: fc(10)=7.5 gpm, hc(5)=3.8 gpm, qt(3)=2.7

DESIGN PRESSURE NOTE:

Assumed available water pressure at p.o.c. is 65 psi. Assumed flow is 60 gpm @ 5 fps. Contractor to verify prior to system installation. Future pressures may vary due to new development and/or other unforeseen circumstances. Landscape architect shall bear no responsibility for future deviations in pressure and any resulting effects on the performance of the irrigation system.

Irrigation mainlines are shown in street/paved areas for graphic clarity only. Where possible, all irrigation components shall be located in planting beds.

LATERAL PIPE SIZE CHART PVC SCH. 40	
PIPE SIZE	MAX. GPM
3/4"	8
1"	12
1 1/4"	22
1 1/2"	30
2"	50
2 1/2"	70

APPENDIX O-STONEBROOK

Stonebrook

1.1 SITE LOCATION AND DESCIPTION

Stonebrook is located south of La Posada, east of the intersection of La Posada Drive and Pyramid Highway in Sparks, Nevada. Refer to Figure O-1. Adjacent developments to the Stonebrook include undeveloped land to the west, La Posada Drive to the north, residential housing to the east, and undeveloped land to the south. Site location information for Stonebrook is given in Table O-1 below.

Table O-1 – Stonebrook Site Information

Property	Physical Address	Latitude/ Longitude	Section/Township/ Range
Stonebrook	South of La Posada, east of intersection of La Posada Dr. and Pyramid Highway	39°37'44"N 119°42'14"W	S2. T20N. R20E

Stonebrook is identified in the Flood Insurance Rate Map as Zone X (Areas of 500 year floods) and as Zone AO (Flood depths of 1 to 3 feet, average depths determined).

1.2 SOILS

The Soil Conservation Service describes several native soils for the Stonebrook development site. A brief description of each of the soil types is listed below. Figure O-2 shows the soils distribution at this location.

370 - **Lemm very gravelly coarse sandy loam, 4 to 8 percent slopes.** This very deep, well drained soil is on alluvial fans. It formed in alluvium derived dominantly from granodiorite. Elevation is 4,700 to 5,500 feet. Typically, 40 to 50 percent of the surface is covered with gravel. The surface layer is grayish brown very gravelly coarse sandy loam about 19 inches thick. The subsoil is pale brown very gravelly coarse sandy loam about 21 inches thick. The substratum to a depth of 60 inches or more is very pale brown very gravelly loamy coarse sand. Included in this unit are Indian Creek soils on higher terrace remnants, Cassiro soils on higher alluvial fan remnants, and Greenbrae soils on toe slopes of alluvial fans. The unit is about 5 percent Indian Creek soils, 5 percent Cassiro soils, and 5 percent Greenbrae soils.

Permeability of this Lemm soil is moderately rapid. Available water capacity of the soil is low. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is slight. The soil is subject to flash flooding during storms of unusually high intensity. Channeling and deposition are common along stream banks.

The present vegetation in most areas is mainly big sagebrush and antelope bitterbrush.

420 - **Godecke loamy sand.** This very deep, somewhat poorly drained soil is on slightly concave to smooth terraces. It formed in alluvium derived from mixed rock surfaces. Typically, the surface layer is pale brown loamy sand about 5 inches thick. The subsoil is pale brown sandy clay loam about 10 inches thick. The substratum to a depth of 60 inches or more is stratified sandy loam through clay. Included in this unit are Voltaire soils on flood plains; Dalzell soils on higher terrace remnants; Sagouspe Variant soils, which occur as narrow stringers near stream channels; and Incy soils on sand dunes. The unit is about 5 percent Voltaire soils, 5 percent Dalzell soils, 3 percent Sagouspe Variant soils and 2 percent Incy soils.

Permeability of this Gedecke soil is slow. Available water capacity is high. Effective rooting depth is 60 inches for water-tolerant plants but is limited to 36 to 60 inches for water-sensitive plants. Runoff is very slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate. A seasonal high water table is at a depth of 30 to 40 inches in late winter and spring. The soil is slightly too moderately affected by sodium salts.

The present vegetation in most areas is mainly black greasewood and saltgrass.

470 - **Dalzell loamy fine sand**. The Dalzell component makes up 85 percent of the map unit. Slopes are 0 to 2 percent. This component is on lake terraces, lake plains. The parent material consists of mixed alluvium. Depth to a root restrictive layer, duripan, is 20 to 40 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is moderate. Permeability of this Dalzell soil is moderately slow. The present vegetation in most areas is mainly big sagebrush, black greasewood, and saltgrass.

805 - **Truckee sandy loam, gravelly substratum.** This very deep, somewhat poorly drained soil is on flood plains. Drainage has been altered. This soil formed in alluvium derived from mixed rock sources. Typically, the surface layer is gray sandy loam about 12 inches thick. The upper 18 inches of the underlying material is gray, stratified sandy loam through silty clay loam. The lower part to a depth of 60 inches is pale brown, stratified gravelly sand through very gravelly sandy loam. Depth to gravelly material ranges from 30 to 40 inches. Included in this unit are Rose Creek soils that occur as stringer channels on flood plains, Washoe soils on alluvial fan remnants, and Fettic soils on low terrace remnants. The unit is about 4 percent Rose Creek soils, 5 percent Washoe soils, and 6 percent Fettic soils.

Permeability of the Truckee soil is moderately slow in the upper part of the underlying material and rapid in the lower part. Available water capacity is

moderate. Effective rooting depth is 60 inches. Runoff is very slow, and the hazard of water erosion is slight. The soil is subject to flooding during storms of prolonged high intensity. Channeling and deposition are common along stream banks. The soil is moderately saline and alkali affected.

830 - **Fettic silty clay loam.** This very deep, poorly drained soil is on low terraces. It formed in alluvium derived from mixed rock sources. Typically, the surface layer is dark grayish brown silty clay loam about 1 inch thick. The subsoil is grayish brown clay loam about 20 inches thick. The substratum to a depth of 60 inches or more is light brownish gray stratified fine sandy loam through clay. Included in this unit are Voltaire soils on flood plains and Truckee soils on flood plains. The unit is about 8 percent Voltaire soils and 7 percent Truckee soils.

Permeability of this Fettic soil is very slow. Available water capacity is high. Effective rooting depth is 60 inches for water-tolerant plants but is limited to 20 to 40 inches for water-sensitive plants. Runoff is very slow, and the hazard of soil blowing is slight. A seasonal high water table is at a depth of 20 to 40 inches in spring and early summer. This soil is subject to flooding during storms of prolonged high intensity. This soil is moderately saline and alkali affected.

The present vegetation in most areas is mainly saltgrass and basin wildrye.

1210 - **Linhart stony coarse sand, 4 to 8 percent.** This very deep, somewhat excessively drained soil is on alluvial fns. It formed in alluvium derived dominantly from granitic rocks. Typically, 1 to 3 percent of the surface is covered with stones. The surface layer is dark grayish brown stony coarse sand about 14 inches thick. The underlying material to a depth of 60 inches is grayish brown to light brownish gray stratified very gravelly coarse sand to very gravelly loamy coarse sand. Included in this unit are Bedell soils on higher alluvial fans and Holbrook soils, which occur at lower elevations along drainage ways and are subject to flooding for short periods in most years. The unit is about 8 percent Bedell soils and 7 percent Holbrook soils.

Permeability of this Linhart soil is rapid. Available water capacity is very low. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is slight. This soil is subject to occasional flash flooding during storms of high intensity, usually during summer.

The present vegetation in most areas is mainly big sagebrush, Anderson peacebrush, and bottlebrush squirreltail.

The soils listed above are the natural soil in the area. During the construction of the sports complex, there was disruption of this soil and possibly the importation of other material. Because of this, it is difficult to predict the conditions of the soil that may influence ponding, runoff and infiltration

1141 - **Bedell loamy sand, 2 to 4 percent slopes.** This very deep, somewhat excessively drained soil is on alluvial fans. It formed in alluvium derived mainly form granitic rock. Typically, the surface layer is brown loamy sand about 15 inches thick. The subsoil is yellowish brown sandy loam about 39 inches thick. The substratum to a depth of 60 inches is yellowish brown loamy coarse sand. Included in this unit are Linhart soils on inset alluvial fans, Orr soils on higher terrace remnants, and Wedertz soils on toe slopes of alluvial fans. The unit is about 5 percent Linhart soils, 5 percent Orr soils, and 5 percent Wedertz soils.

Permeability of this Bedell soil is moderately rapid in the subsoil and rapid in the substratum. Available water capacity of the soil is low. Effective rooting depth is more than 60 inches. Runoff is slow, and the hazard of soil blowing is moderate. This soil is subject to flash flooding during storms of unusually high intensity.

The present vegetation in most areas is mainly big sagebrush, antelope bitterbrush, Anderson peachbrush, and Indian ricegrass.

1200 - **Mellor silt loam**. The Mellor component makes up 85 percent of the map unit. Slopes are 0 to 2 percent. This component is on lake terraces, lake plains.
The parent material consists of mixed alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is high. Shrink-swell potential is moderate. Permeability of this Mellor soil is slow. Runoff is slow, and the hazard of water erosion is slight. The present vegetation in most areas is mainly black greasewood and Douglas Rabbitbrush.

1170 - **Wedertz sandy loam, 2 to 4 percent slopes**. The Wedertz component makes up 85 percent of the map unit. Slopes are 2 to 4 percent. This component is on piedmonts, fan remnants. The parent material consists of mixed alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. Permeability of this Wedertz soil is moderately slow in the subsoil and upper part of the substratum. The present vegetation in most areas is mainly big sagebrush, littleleaf horsebrush, and Indian ricegrass.

1172 - **Wedertz sand, 2 to 4 percent slopes.** The Wedertz component makes up 85 percent of the map unit. Slopes are 2 to 4 percent. This component is on fan remnants, Piedmonts. The parent material consists of mixed alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. Permeability of this Wedertz soil is moderately slow in the subsoil and upper part of the substratum and rapid in the lower part. The present vegetation in most areas is mainly big sagebrush, littleleaf horsebrush, and Indian ricegrass.

1610 – **Water.** Generated brief soil descriptions are created for major soil components. The Water is a miscellaneous area.

1190 - **Spasprey sandy loam, 0 to 2 percent slopes.** The Spasprey component makes up 85 percent of the map unit. Slopes are 0 to 2 percent. This component is on piedmonts, fan remnants. The parent material consists of mixed alluvium. Depth to a root restrictive layer, duripan, is 20 to 30 inches. Drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. Permeability of this Spasprey soil is moderately slow. The present vegetation in most areas is mainly big sagebrush, spiny hopsage, and Douglas Rabbitbrush.

1191 - **Spasprey sandy loam, 2 to 4 percent slopes**. The Spasprey component makes up 85 percent of the map unit. Slopes are 2 to 4 percent. This component is on piedmonts, fan remnants. The parent material consists of mixed alluvium. Depth to a root restrictive layer, duripan, is 20 to 30 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. Permeability of this Spasprey soil is moderately slow. Runoff is slow, and the hazard of water erosion is slight. The present vegetation in most areas is mainly big sagebrush, spiny hopsage, and Douglas Rabbitbrush.

The soils listed above are the natural soils for the area. When Woodtrail Park was constructed there was a disruption of the soil and possibly other important material. It is difficult to predict the current soil conditions of the soil that may exist such as ponding, runoff, and infiltration.

1.3 IRRIGATION PLAN

Stonebrook consists of approximately 600 acres of multi-use development. Stonebrook proposes spray and drip effluent irrigation of landscaping along streets, in common areas, in parks, and green belts as well as temporary irrigation of re-vegetation and for dust control. Stonebrook will be served effluent from an existing 18" effluent line which is located along the west side of the proposed development. Irrigation drawings are not available at this time. Refer to Figures **O-3** and **O-4** for a master irrigation plan and effluent main layout.

Majority of irrigation will occur at night to minimize the possibility of public contact with effluent. All irrigation will be done with automatic sprinklers. The length of time each zone will be irrigated will be adjusted according to seasonal temperature and precipitation data. Spray irrigators will discharge near ground surface and away from areas of frequent public use. Adjustments will be made to the sprinklers heads as required to prevent ponding and runoff. If ponding or line breaks should occur they will be quickly identified and repaired.

Potable water line will be identified and necessary adjustments made to provide the required separation between effluent and potable water lines. Any component of the irrigation system that is exposed will be posted and painted purple to clearly identify the component as effluent fixture. All areas of the site shall be posted to notify the public that the landscaping is irrigated with effluent.

The irrigation control system will control the time and duration of the effluent application. Each system controls a set of valves independent of the master valve at the service connection. In case of emergency the system should be shut down at the gate valve that connects the system to the main water supply.

1.4 IRRIAGATION SYSTEM

The Stonebrook has a 6 inch effluent pipe which runs through the development. There have been no irrigations provided at this time only a layout for the development.

1.5 EFFLUENT DEMAND

The estimated effluent demand for the Stonebrook is shown in Table O-2.

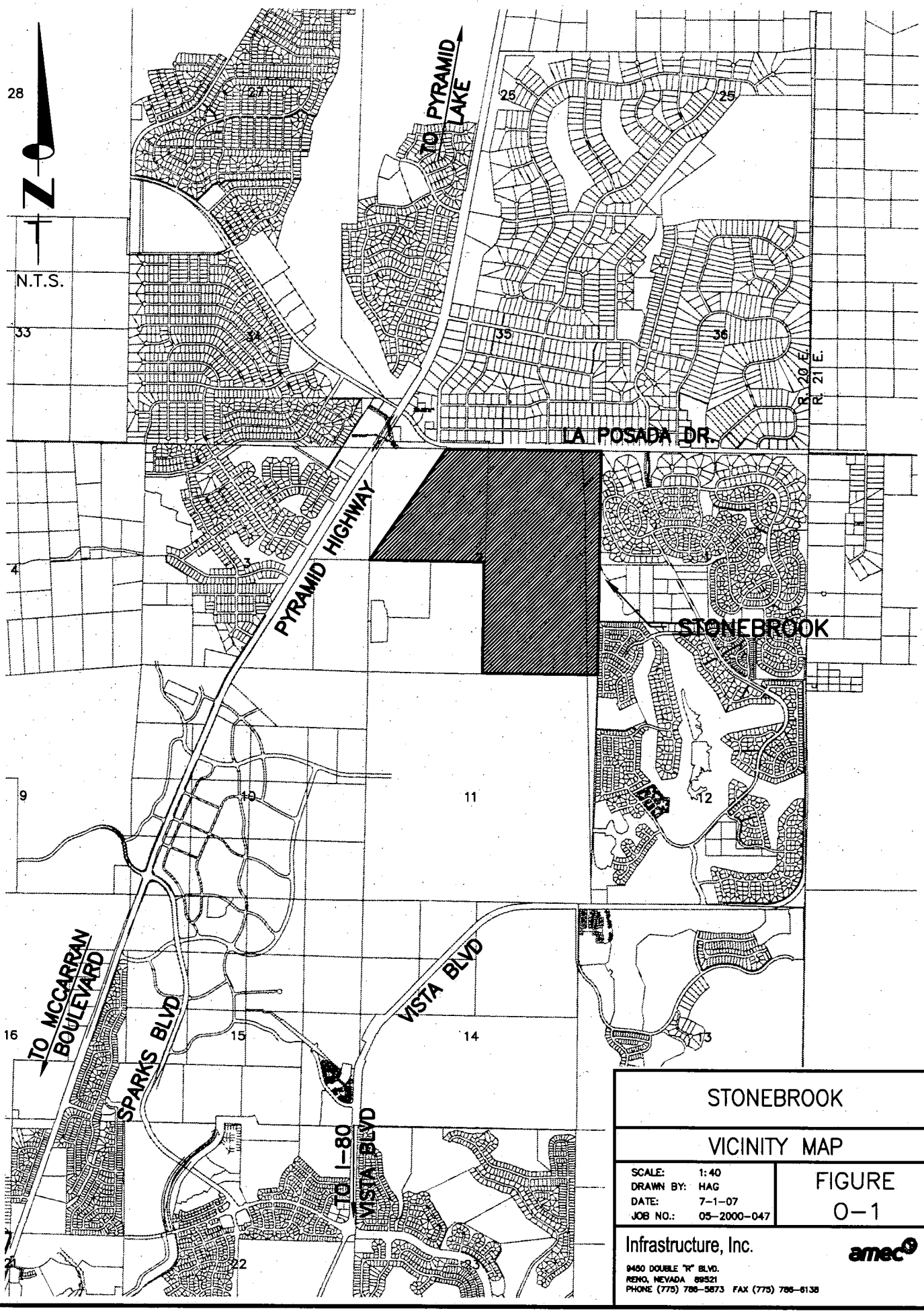
Table O-2 – Stonebrook Effluent Demands

Property	Total Area (Acres)	Irrigated Area (Acres)	Acre-Feet per Year	Peak Demand (gpm)	Maximum Daily Flow (mgd)	30-Day Average (mgd)
Stonebrook	440	25	90	1542	0.74	0.63

Estimated irrigation peak flow was obtained from the master landscape irrigation plan.

1.6 RUNOFF CONTROL PLAN

In the event of an emergency the effluent irrigation system for Stonebrook should be shut down by closing the gate valve located at the effluent meter vault.



STONEBROOK

VICINITY MAP

SCALE:	1:40
DRAWN BY:	HAG
DATE:	7-1-07
JOB NO.:	05-2000-047

FIGURE O-1

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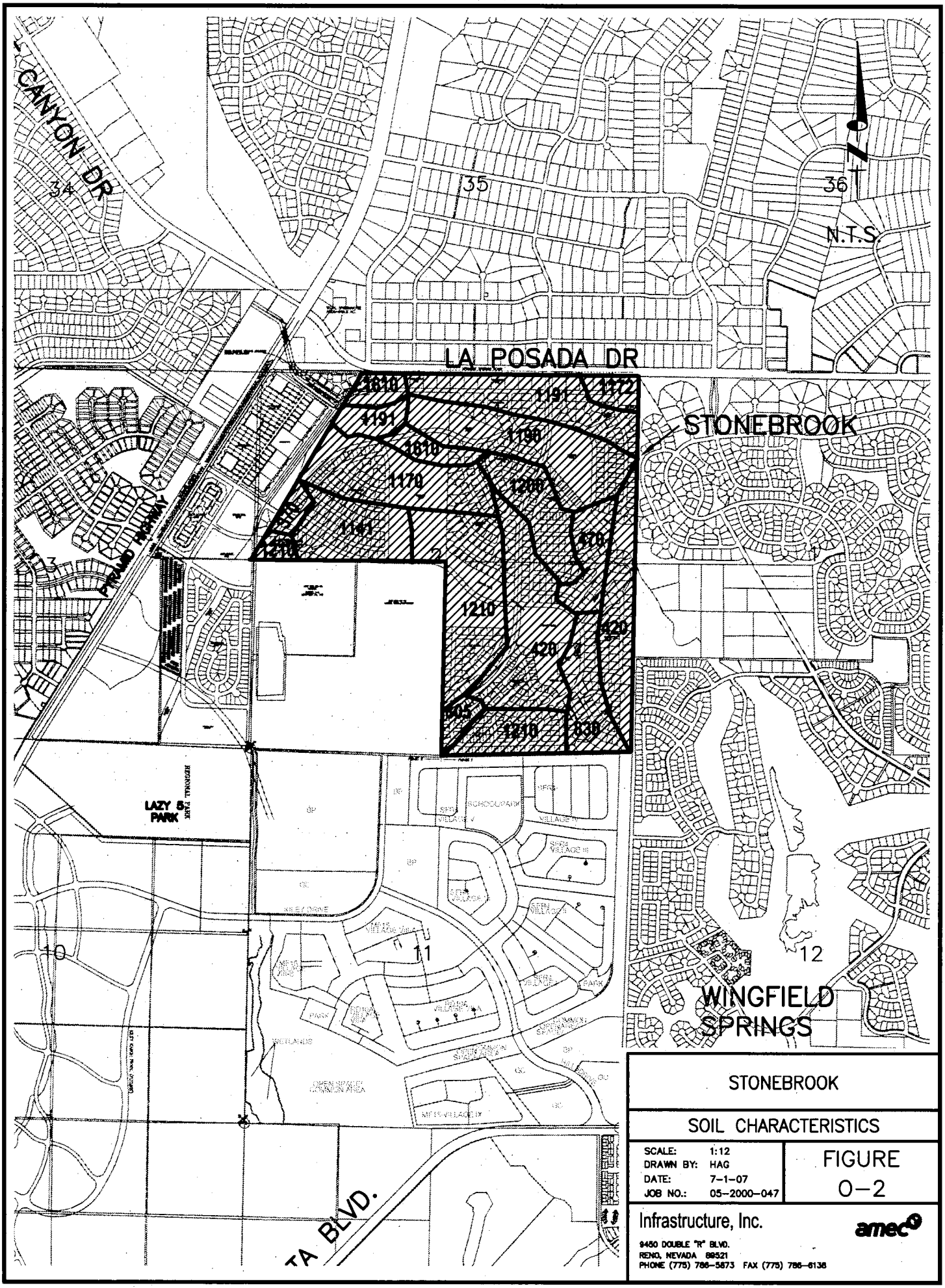
amec
9460 DOUBLE "R" BLVD.
RENO, NEVADA 89521
PHONE (775) 786-5873 FAX (775) 786-6138



STONEBROOK

SOIL CHARACTERISTICS

SCALE:	1:12
DRAWN BY:	HAG
DATE:	7-1-07
JOB NO.:	05-2000-047

FIGURE
O-2

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amec
9450 DOUBLE "R" BLVD.
RENO, NEVADA 89521
PHONE (775) 786-5873 FAX (775) 786-6136

APPENDIX O-STONEBROOK

Stonebrook

1.1 SITE LOCATION AND DESCIPTION

Stonebrook is located south of La Posada, east of the intersection of La Posada Drive and Pyramid Highway in Sparks, Nevada. Refer to Figure O-1. Adjacent developments to the Stonebrook include undeveloped land to the west, La Posada Drive to the north, residential housing to the east, and undeveloped land to the south. Site location information for Stonebrook is given in Table O-1 below.

Table O-1 – Stonebrook Site Information

Property	Physical Address	Latitude/ Longitude	Section/Township/ Range
Stonebrook	South of La Posada, east of intersection of La Posada Dr. and Pyramid Highway	39°37'44"N 119°42'14"W	S2. T20N. R20E

Stonebrook is identified in the Flood Insurance Rate Map as Zone X (Areas of 500 year floods) and as Zone AO (Flood depths of 1 to 3 feet, average depths determined).

1.2 SOILS

The Soil Conservation Service describes several native soils for the Stonebrook development site. A brief description of each of the soil types is listed below. Figure O-2 shows the soils distribution at this location.

370 - **Lemm very gravelly coarse sandy loam, 4 to 8 percent slopes.** This very deep, well drained soil is on alluvial fans. It formed in alluvium derived dominantly from granodiorite. Elevation is 4,700 to 5,500 feet. Typically, 40 to 50 percent of the surface is covered with gravel. The surface layer is grayish brown very gravelly coarse sandy loam about 19 inches thick. The subsoil is pale brown very gravelly coarse sandy loam about 21 inches thick. The substratum to a depth of 60 inches or more is very pale brown very gravelly loamy coarse sand. Included in this unit are Indian Creek soils on higher terrace remnants, Cassiro soils on higher alluvial fan remnants, and Greenbrae soils on toe slopes of alluvial fans. The unit is about 5 percent Indian Creek soils, 5 percent Cassiro soils, and 5 percent Greenbrae soils.

Permeability of this Lemm soil is moderately rapid. Available water capacity of the soil is low. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is slight. The soil is subject to flash flooding during storms of unusually high intensity. Channeling and deposition are common along stream banks.

The present vegetation in most areas is mainly big sagebrush and antelope bitterbrush.

420 - **Godecke loamy sand.** This very deep, somewhat poorly drained soil is on slightly concave to smooth terraces. It formed in alluvium derived from mixed rock surfaces. Typically, the surface layer is pale brown loamy sand about 5 inches thick. The subsoil is pale brown sandy clay loam about 10 inches thick. The substratum to a depth of 60 inches or more is stratified sandy loam through clay. Included in this unit are Voltaire soils on flood plains; Dalzell soils on higher terrace remnants; Sagouspe Variant soils, which occur as narrow stringers near stream channels; and Incy soils on sand dunes. The unit is about 5 percent Voltaire soils, 5 percent Dalzell soils, 3 percent Sagouspe Variant soils and 2 percent Incy soils.

Permeability of this Gedecke soil is slow. Available water capacity is high. Effective rooting depth is 60 inches for water-tolerant plants but is limited to 36 to 60 inches for water-sensitive plants. Runoff is very slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate. A seasonal high water table is at a depth of 30 to 40 inches in late winter and spring. The soil is slightly too moderately affected by sodium salts.

The present vegetation in most areas is mainly black greasewood and saltgrass.

470 - **Dalzell loamy fine sand**. The Dalzell component makes up 85 percent of the map unit. Slopes are 0 to 2 percent. This component is on lake terraces, lake plains. The parent material consists of mixed alluvium. Depth to a root restrictive layer, duripan, is 20 to 40 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is moderate. Permeability of this Dalzell soil is moderately slow. The present vegetation in most areas is mainly big sagebrush, black greasewood, and saltgrass.

805 - **Truckee sandy loam, gravelly substratum.** This very deep, somewhat poorly drained soil is on flood plains. Drainage has been altered. This soil formed in alluvium derived from mixed rock sources. Typically, the surface layer is gray sandy loam about 12 inches thick. The upper 18 inches of the underlying material is gray, stratified sandy loam through silty clay loam. The lower part to a depth of 60 inches is pale brown, stratified gravelly sand through very gravelly sandy loam. Depth to gravelly material ranges from 30 to 40 inches. Included in this unit are Rose Creek soils that occur as stringer channels on flood plains, Washoe soils on alluvial fan remnants, and Fettic soils on low terrace remnants. The unit is about 4 percent Rose Creek soils, 5 percent Washoe soils, and 6 percent Fettic soils.

Permeability of the Truckee soil is moderately slow in the upper part of the underlying material and rapid in the lower part. Available water capacity is

moderate. Effective rooting depth is 60 inches. Runoff is very slow, and the hazard of water erosion is slight. The soil is subject to flooding during storms of prolonged high intensity. Channeling and deposition are common along stream banks. The soil is moderately saline and alkali affected.

830 - **Fettic silty clay loam.** This very deep, poorly drained soil is on low terraces. It formed in alluvium derived from mixed rock sources. Typically, the surface layer is dark grayish brown silty clay loam about 1 inch thick. The subsoil is grayish brown clay loam about 20 inches thick. The substratum to a depth of 60 inches or more is light brownish gray stratified fine sandy loam through clay. Included in this unit are Voltaire soils on flood plains and Truckee soils on flood plains. The unit is about 8 percent Voltaire soils and 7 percent Truckee soils.

Permeability of this Fettic soil is very slow. Available water capacity is high. Effective rooting depth is 60 inches for water-tolerant plants but is limited to 20 to 40 inches for water-sensitive plants. Runoff is very slow, and the hazard of soil blowing is slight. A seasonal high water table is at a depth of 20 to 40 inches in spring and early summer. This soil is subject to flooding during storms of prolonged high intensity. This soil is moderately saline and alkali affected.

The present vegetation in most areas is mainly saltgrass and basin wildrye.

1210 - **Linhart stony coarse sand, 4 to 8 percent.** This very deep, somewhat excessively drained soil is on alluvial fns. It formed in alluvium derived dominantly from granitic rocks. Typically, 1 to 3 percent of the surface is covered with stones. The surface layer is dark grayish brown stony coarse sand about 14 inches thick. The underlying material to a depth of 60 inches is grayish brown to light brownish gray stratified very gravelly coarse sand to very gravelly loamy coarse sand. Included in this unit are Bedell soils on higher alluvial fans and Holbrook soils, which occur at lower elevations along drainage ways and are subject to flooding for short periods in most years. The unit is about 8 percent Bedell soils and 7 percent Holbrook soils.

Permeability of this Linhart soil is rapid. Available water capacity is very low. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is slight. This soil is subject to occasional flash flooding during storms of high intensity, usually during summer.

The present vegetation in most areas is mainly big sagebrush, Anderson peacebrush, and bottlebrush squirreltail.

The soils listed above are the natural soil in the area. During the construction of the sports complex, there was disruption of this soil and possibly the importation of other material. Because of this, it is difficult to predict the conditions of the soil that may influence ponding, runoff and infiltration

1141 - **Bedell loamy sand, 2 to 4 percent slopes.** This very deep, somewhat excessively drained soil is on alluvial fans. It formed in alluvium derived mainly form granitic rock. Typically, the surface layer is brown loamy sand about 15 inches thick. The subsoil is yellowish brown sandy loam about 39 inches thick. The substratum to a depth of 60 inches is yellowish brown loamy coarse sand. Included in this unit are Linhart soils on inset alluvial fans, Orr soils on higher terrace remnants, and Wedertz soils on toe slopes of alluvial fans. The unit is about 5 percent Linhart soils, 5 percent Orr soils, and 5 percent Wedertz soils.

Permeability of this Bedell soil is moderately rapid in the subsoil and rapid in the substratum. Available water capacity of the soil is low. Effective rooting depth is more than 60 inches. Runoff is slow, and the hazard of soil blowing is moderate. This soil is subject to flash flooding during storms of unusually high intensity.

The present vegetation in most areas is mainly big sagebrush, antelope bitterbrush, Anderson peachbrush, and Indian ricegrass.

1200 - **Mellor silt loam**. The Mellor component makes up 85 percent of the map unit. Slopes are 0 to 2 percent. This component is on lake terraces, lake plains.
The parent material consists of mixed alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is high. Shrink-swell potential is moderate. Permeability of this Mellor soil is slow. Runoff is slow, and the hazard of water erosion is slight. The present vegetation in most areas is mainly black greasewood and Douglas Rabbitbrush.

1170 - **Wedertz sandy loam, 2 to 4 percent slopes**. The Wedertz component makes up 85 percent of the map unit. Slopes are 2 to 4 percent. This component is on piedmonts, fan remnants. The parent material consists of mixed alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. Permeability of this Wedertz soil is moderately slow in the subsoil and upper part of the substratum. The present vegetation in most areas is mainly big sagebrush, littleleaf horsebrush, and Indian ricegrass.

1172 - **Wedertz sand, 2 to 4 percent slopes.** The Wedertz component makes up 85 percent of the map unit. Slopes are 2 to 4 percent. This component is on fan remnants, Piedmonts. The parent material consists of mixed alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. Permeability of this Wedertz soil is moderately slow in the subsoil and upper part of the substratum and rapid in the lower part. The present vegetation in most areas is mainly big sagebrush, littleleaf horsebrush, and Indian ricegrass.

1610 – **Water.** Generated brief soil descriptions are created for major soil components. The Water is a miscellaneous area.

1190 - **Spasprey sandy loam, 0 to 2 percent slopes.** The Spasprey component makes up 85 percent of the map unit. Slopes are 0 to 2 percent. This component is on piedmonts, fan remnants. The parent material consists of mixed alluvium. Depth to a root restrictive layer, duripan, is 20 to 30 inches. Drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. Permeability of this Spasprey soil is moderately slow. The present vegetation in most areas is mainly big sagebrush, spiny hopsage, and Douglas Rabbitbrush.

1191 - **Spasprey sandy loam, 2 to 4 percent slopes**. The Spasprey component makes up 85 percent of the map unit. Slopes are 2 to 4 percent. This component is on piedmonts, fan remnants. The parent material consists of mixed alluvium. Depth to a root restrictive layer, duripan, is 20 to 30 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. Permeability of this Spasprey soil is moderately slow. Runoff is slow, and the hazard of water erosion is slight. The present vegetation in most areas is mainly big sagebrush, spiny hopsage, and Douglas Rabbitbrush.

The soils listed above are the natural soils for the area. When Woodtrail Park was constructed there was a disruption of the soil and possibly other important material. It is difficult to predict the current soil conditions of the soil that may exist such as ponding, runoff, and infiltration.

1.3 IRRIGATION PLAN

Stonebrook consists of approximately 600 acres of multi-use development. Stonebrook proposes spray and drip effluent irrigation of landscaping along streets, in common areas, in parks, and green belts as well as temporary irrigation of re-vegetation and for dust control. Stonebrook will be served effluent from an existing 18" effluent line which is located along the west side of the proposed development. Irrigation drawings are not available at this time. Refer to Figures **O-3** and **O-4** for a master irrigation plan and effluent main layout.

Majority of irrigation will occur at night to minimize the possibility of public contact with effluent. All irrigation will be done with automatic sprinklers. The length of time each zone will be irrigated will be adjusted according to seasonal temperature and precipitation data. Spray irrigators will discharge near ground surface and away from areas of frequent public use. Adjustments will be made to the sprinklers heads as required to prevent ponding and runoff. If ponding or line breaks should occur they will be quickly identified and repaired.

Potable water line will be identified and necessary adjustments made to provide the required separation between effluent and potable water lines. Any component of the irrigation system that is exposed will be posted and painted purple to clearly identify the component as effluent fixture. All areas of the site shall be posted to notify the public that the landscaping is irrigated with effluent.

The irrigation control system will control the time and duration of the effluent application. Each system controls a set of valves independent of the master valve at the service connection. In case of emergency the system should be shut down at the gate valve that connects the system to the main water supply.

1.4 IRRIAGATION SYSTEM

The Stonebrook has a 6 inch effluent pipe which runs through the development. There have been no irrigations provided at this time only a layout for the development.

1.5 EFFLUENT DEMAND

The estimated effluent demand for the Stonebrook is shown in Table O-2.

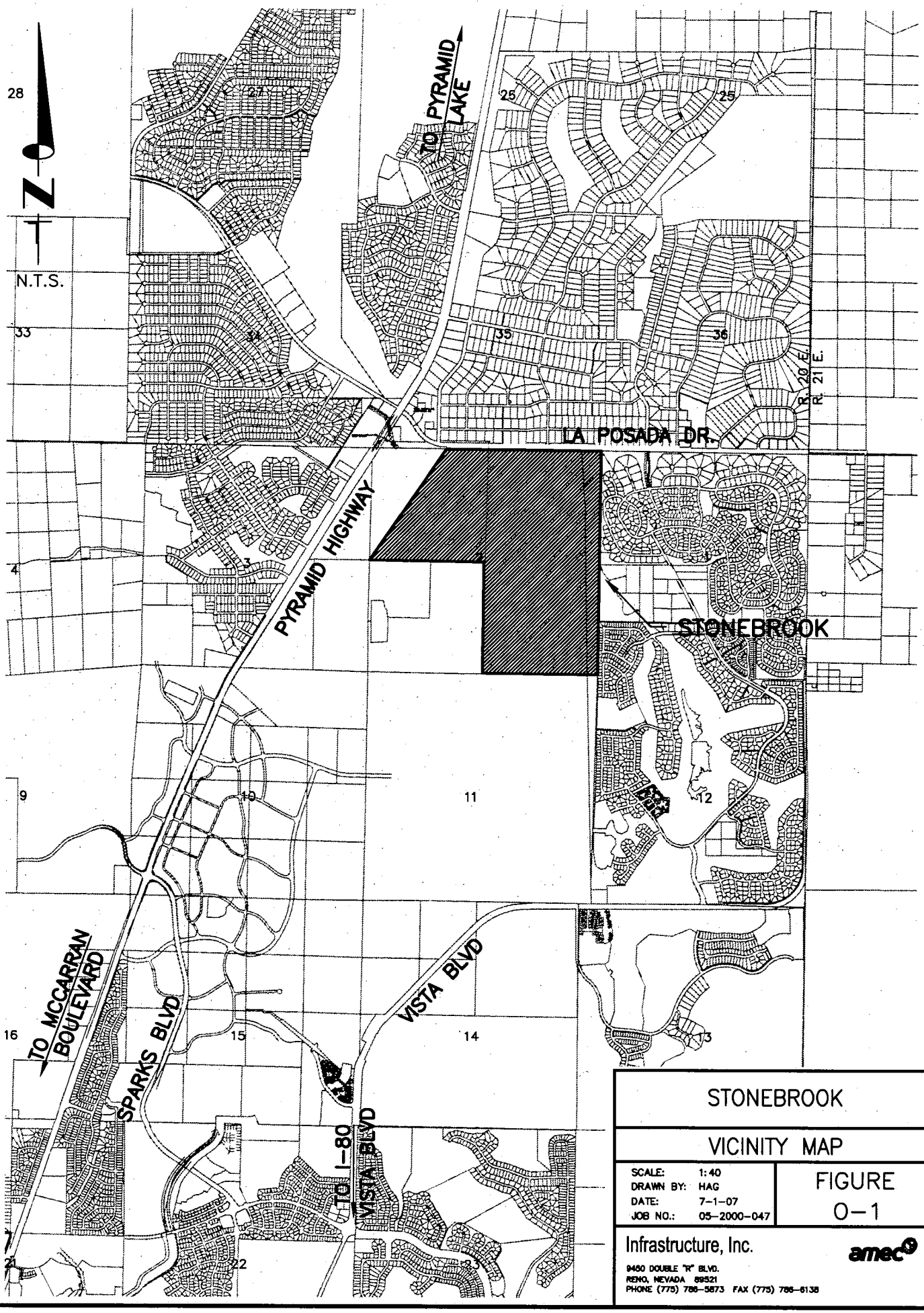
Table O-2 – Stonebrook Effluent Demands

Property	Total Area (Acres)	Irrigated Area (Acres)	Acre-Feet per Year	Peak Demand (gpm)	Maximum Daily Flow (mgd)	30-Day Average (mgd)
Stonebrook	440	25	90	1542	0.74	0.63

Estimated irrigation peak flow was obtained from the master landscape irrigation plan.

1.6 RUNOFF CONTROL PLAN

In the event of an emergency the effluent irrigation system for Stonebrook should be shut down by closing the gate valve located at the effluent meter vault.



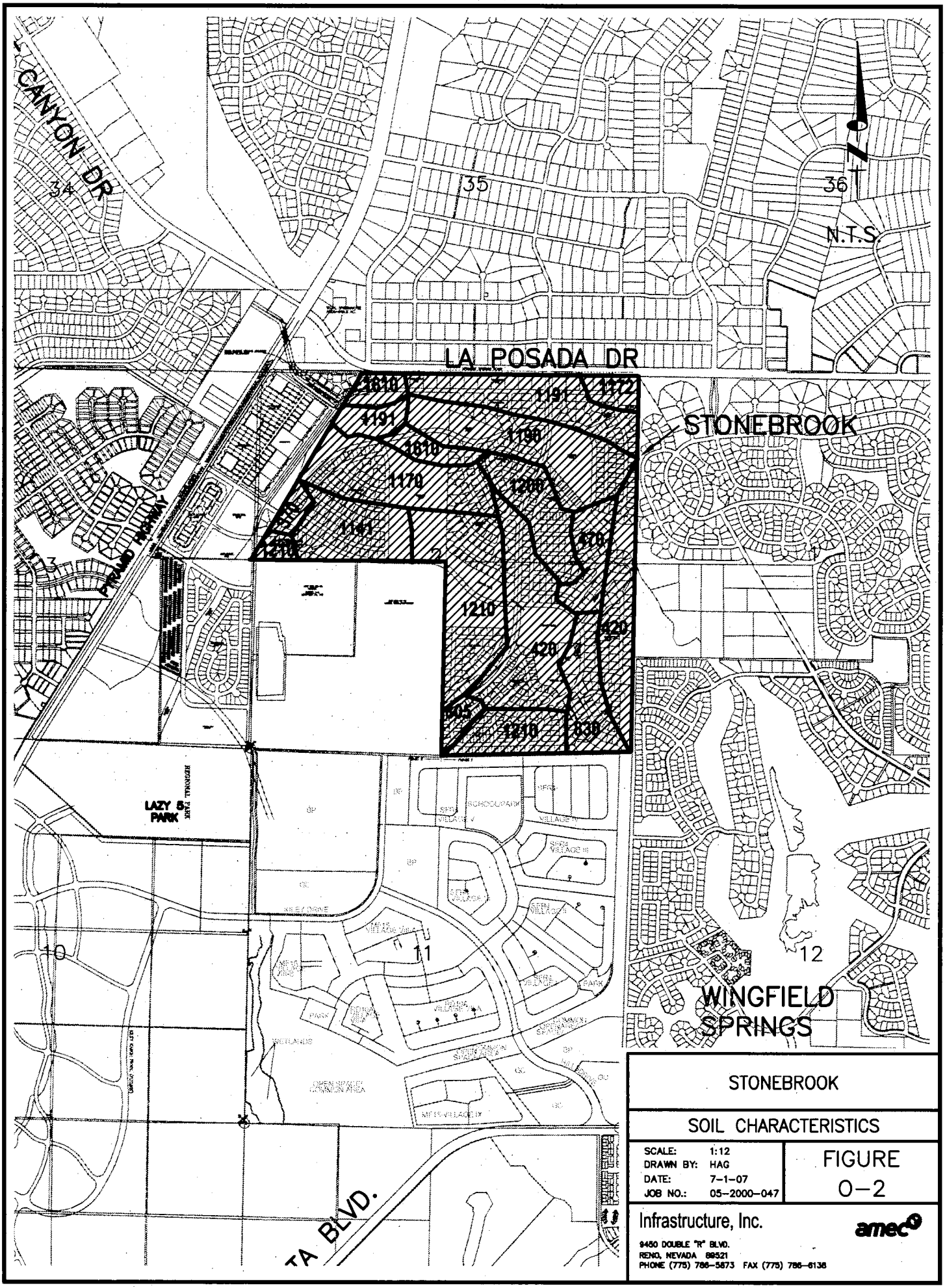
STONEBROOK

VICINITY MAP

SCALE:	1:40
DRAWN BY:	HAG
DATE:	7-1-07
JOB NO.:	05-2000-047

FIGURE O-1

Infrastructure, Inc.
amec
9460 DOUBLE "R" BLVD.
RENO, NEVADA 89521
PHONE (775) 786-5873 FAX (775) 786-6138



STONEBROOK

SOIL CHARACTERISTICS

SCALE:	1:12
DRAWN BY:	HAG
DATE:	7-1-07
JOB NO.:	05-2000-047

FIGURE
O-2

Infrastructure, Inc.
amec
9450 DOUBLE "R" BLVD.
RENO, NEVADA 89521
PHONE (775) 786-5873 FAX (775) 786-6136

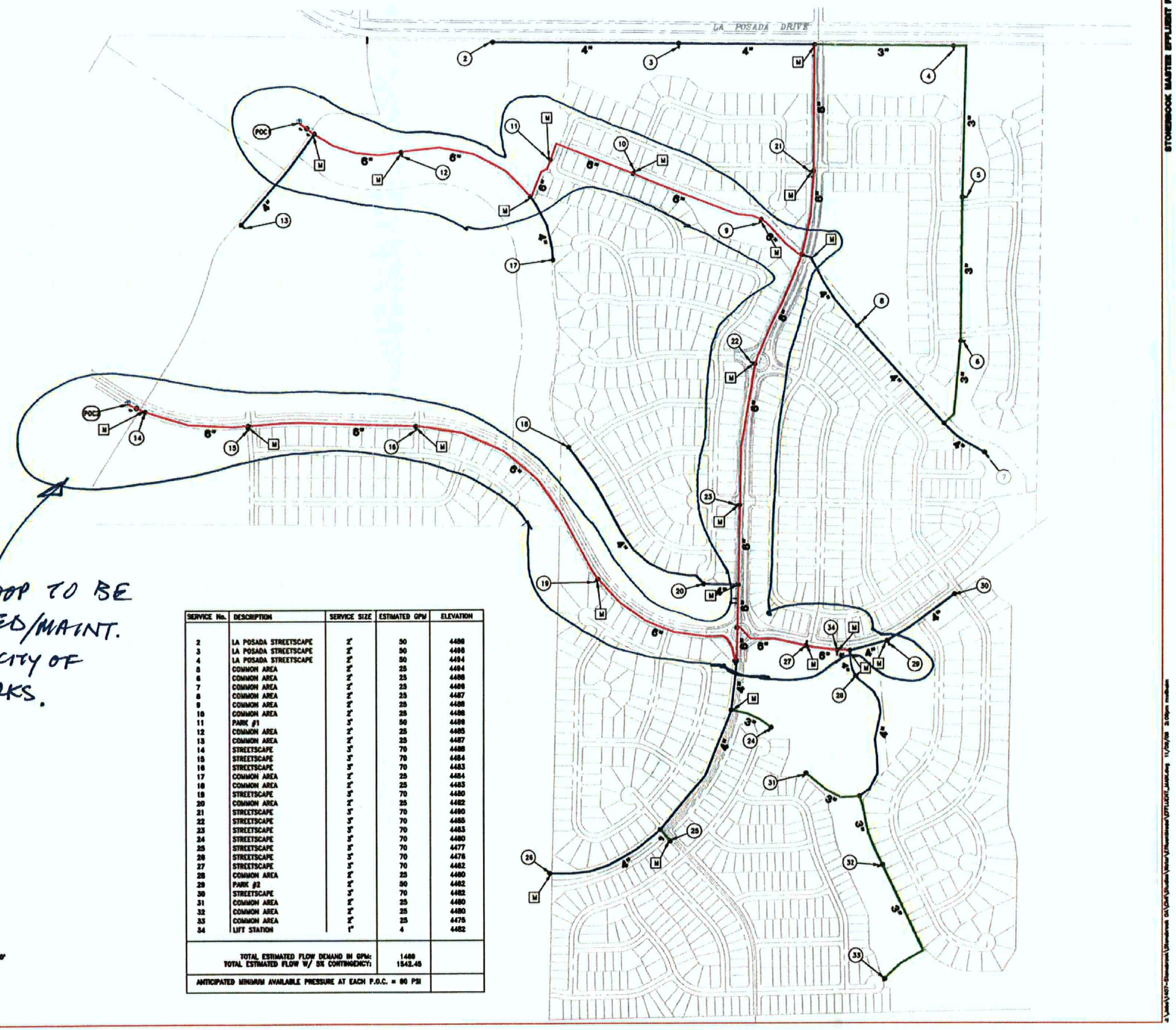
FIGURE 2
EFFLUENT MAIN LAYOUT - BUILDOUT

STONEBROOK

REYNEN & BARDIS

SPARKS NEVADA

NOVEMBER 2006



6" LOOP TO BE OWNED/MAINT. BY CITY OF SPARKS.

PIPE DIAMETER LEGEND

3"
4"
6"

(X) IRRIGATION POINT OF CONNECTION

[M] INTERNAL METER LOCATION

(POC) EFFLUENT MAIN POINT OF CONNECTION AND CITY MASTER METER LOCATION

SERVICE No.	DESCRIPTION	SERVICE SIZE	ESTIMATED GPM	ELEVATION
2	LA POSADA STREETSCAPE	2"	50	4486
3	LA POSADA STREETSCAPE	2"	50	4486
4	LA POSADA STREETSCAPE	2"	50	4484
5	COMMON AREA	2"	25	4484
6	COMMON AREA	2"	25	4486
7	COMMON AREA	2"	25	4486
8	COMMON AREA	2"	25	4487
9	COMMON AREA	2"	25	4488
10	COMMON AREA	2"	25	4488
11	PARK #1	3"	50	4488
12	COMMON AREA	2"	25	4485
13	COMMON AREA	2"	25	4487
14	STREETSCAPE	3"	70	4488
15	STREETSCAPE	3"	70	4484
16	STREETSCAPE	3"	70	4483
17	COMMON AREA	2"	25	4484
18	COMMON AREA	2"	25	4483
19	STREETSCAPE	3"	70	4480
20	COMMON AREA	2"	25	4482
21	STREETSCAPE	3"	70	4490
22	STREETSCAPE	3"	70	4485
23	STREETSCAPE	3"	70	4483
24	STREETSCAPE	3"	70	4480
25	STREETSCAPE	3"	70	4477
26	STREETSCAPE	3"	70	4476
27	STREETSCAPE	3"	70	4482
28	COMMON AREA	2"	25	4480
29	PARK #2	3"	50	4482
30	STREETSCAPE	3"	70	4482
31	COMMON AREA	2"	25	4480
32	COMMON AREA	2"	25	4480
33	COMMON AREA	2"	25	4475
34	LIFT STATION	1"	4	4482
	TOTAL ESTIMATED FLOW DEMAND IN GPM:		1468	
	TOTAL ESTIMATED FLOW W/ 5% CONTINGENCY:		1542.45	
	ANTICIPATED MINIMUM AVAILABLE PRESSURE AT EACH P.O.C. = 60 PSI			

250' 125' 0 250' 500'

SCALE: 1" = 250'

WOOD RODGERS
DEVELOPED INNOVATIVE DESIGN SOLUTIONS
575 Double Eagle Court Tel 775.688.4088
Reno, NV. 89521 Fax 775.688.4088

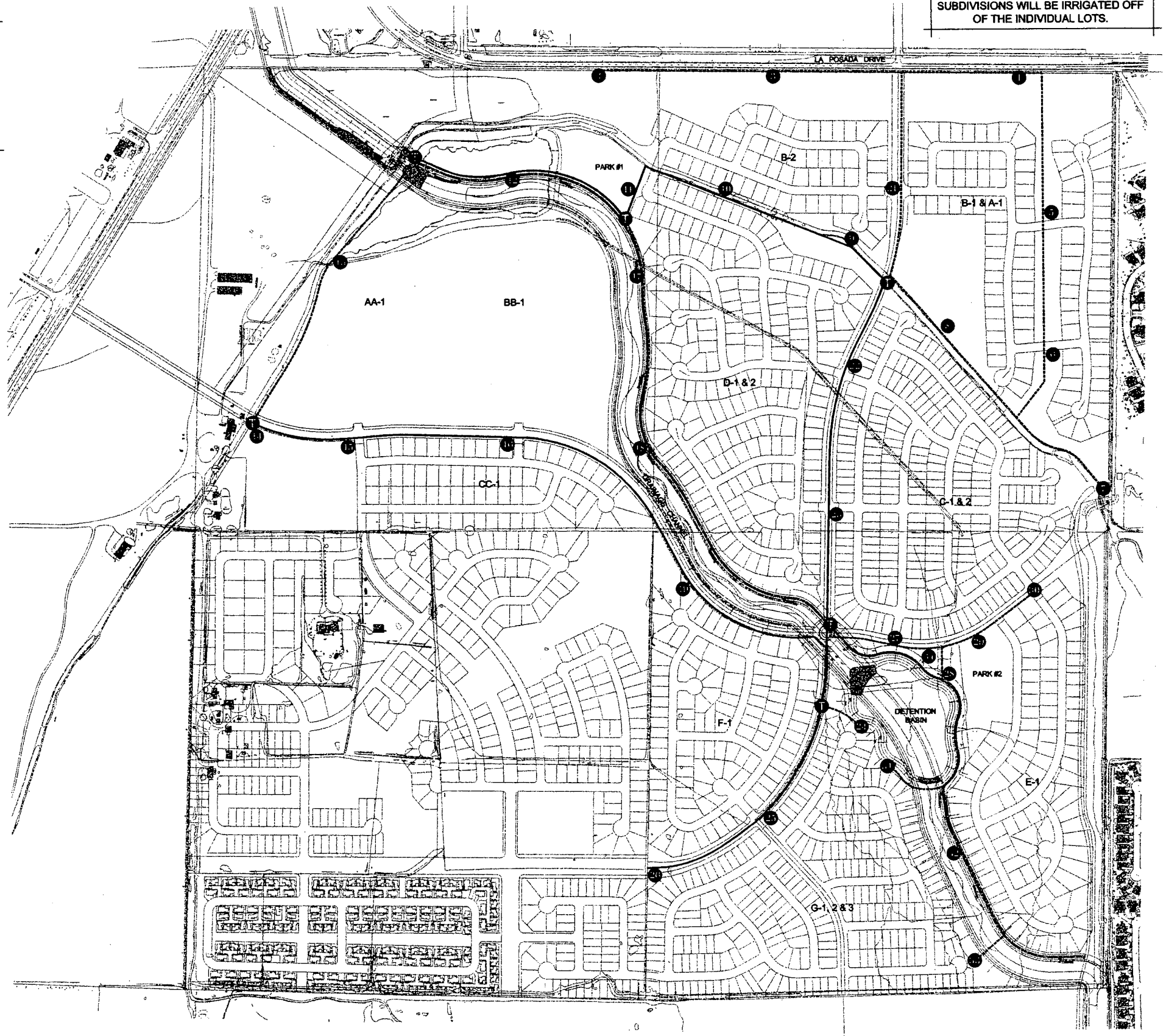
STONEBROOK MASTER EFFLUENT PLAN

GENERAL NOTE:

THIS DRAWING IS FOR PLANNING PURPOSES ONLY AND IS INTENDED AS A "BEST GUESS" ESTIMATE OF ANTICIPATED NON-POTABLE IRRIGATION FLOWS AT THE STONEBROOK PROJECT. SERVICE SIZE INDICATES PIPE SIZE ONLY. INDIVIDUAL METER SIZES AND FINAL SERVICE SIZING WILL BE DETERMINED DURING DEVELOPMENT OF FINAL IRRIGATION PLANS FOR THE VARIOUS PLANTING ZONES THROUGHOUT THE DEVELOPMENT.

Service No.	Description	Service Size	Estimated GPM
1	La Posada Streetscape	2"	0
2	La Posada Streetscape	2"	50
3	La Posada Streetscape	2"	50
4	La Posada Streetscape	2"	50
5	Common Area	2"	25
6	Common Area	2"	25
7	Common Area	2"	25
8	Common Area	2"	25
9	Common Area	2"	25
10	Common Area	2"	25
11	Park #1	3"	50
12	Common Area	2"	25
13	Common Area	2"	25
14	Streetscape	3"	70
15	Streetscape	3"	70
16	Streetscape	3"	70
17	Common Area	2"	25
18	Common Area	2"	25
19	Streetscape	3"	70
20	Common Area	2"	25
21	Streetscape	3"	70
22	Streetscape	3"	70
23	Streetscape	3"	70
24	Streetscape	3"	70
25	Streetscape	3"	70
26	Streetscape	3"	70
27	Streetscape	3"	70
28	Common Area	2"	25
29	Park #2	2"	50
30	Streetscape	3"	70
31	Common Area	2"	25
32	Common Area	2"	25
33	Common Area	2"	25
34	Pump Station	1"	4
	Total Estimated Flow Demand In GPM:		1469
	Total Estimated Flow With 5% Contingency:		1542.45
	Anticipated Minimum Available Pressure at Each P.O.C. = 80 PSI		

STREETSCAPES WITHIN THE INDIVIDUAL SUBDIVISIONS WILL BE IRRIGATED OFF OF THE INDIVIDUAL LOTS.



LEGEND

- CITY RECLAIMED IRRIGATION MAIN (RECLAIMED IRRIGATION MAIN OWNED BY THE CITY OF SPARKS)
- PROJECT RECLAIMED IRRIGATION MAIN (SUB-MAIN BRANCHING OFF OF CITY IRRIGATION MAIN)
- T — RECLAIMED IRRIGATION POINT-OF-CONNECTION (MASTER METER LOCATION BETWEEN CITY MAIN AND PROJECT SUB-MAIN)
- S — RECLAIMED IRRIGATION SERVICE LOCATION (WATER SERVICE LOCATION FROM PROJECT MAIN TO INDIVIDUAL IRRIGATION SYSTEMS, SEE TABLE FOR APPROXIMATE SERVICE SIZE)

0' 300' 600' 900'

Scale: 1" = 300'

CITY OF SPARKS APPROVAL

KAREN L. MELBY, AICP
Manager of Current Planning
Community Development

HANSEN LANDSCAPE ARCHITECTS, LLC
Park Planning & Landscape Architecture
1535 C Street, Sparks, NV 89431
Ph. (775)322-4474 - FAX (775)322-4561 - info@hansenlaw.com
Nevada License # 440, PLSL 0051 - California License # LA 4814
Idaho License # LA-251

REGISTERED LANDSCAPE ARCHITECT — RYAN W. HANSEN — 440 — EXP. DEC. 31 — STATE OF NEVADA

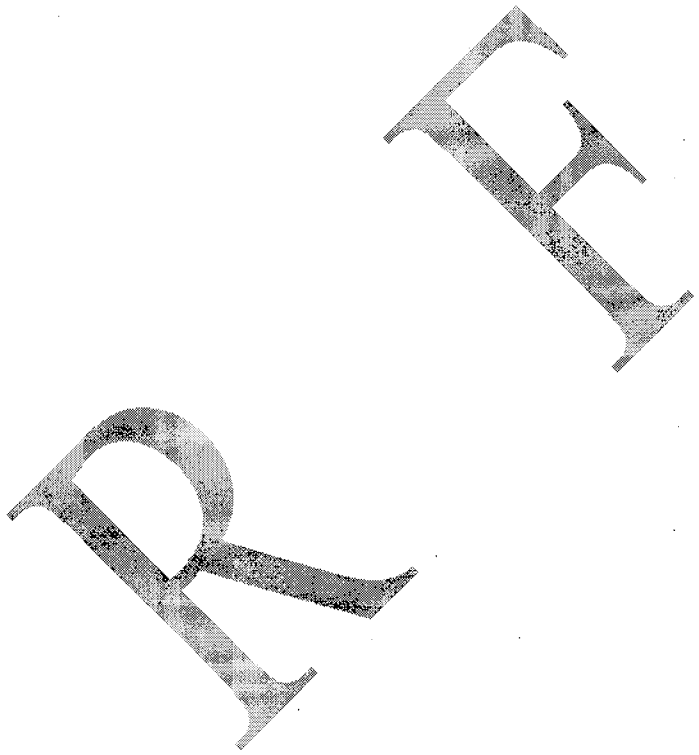
Master Landscape Irrigation Plan
STONEBROOK
Reynen & Bardis Communities
Washoe Co.
Nevada
Sparks

No.	Revision Date

HLA No: 105-04-08-08
Designed: RPH
Drawn: KHK
Checked: RPH
CAD File: 105-M-RR-01
Date: 10/11/06

Sheet
M-1
of
9

APPENDIX P-SPANISH SPRINGS NURSEY



Spanish Springs Nursery

1.1 SITE LOCATION AND DESCIPTION

Spanish Springs Nursery is located at 7655 Pyramid Highway Sparks, Nevada. Refer to Figure P-1. Adjacent developments to Spanish Springs Nursery include Pyramid Highway to the east, a drainage channel to the west and undeveloped land to the north and south. Site location information for Spanish Springs Nursery is given in Table P-1 below.

Table P-1 – Spanish Springs Nursery Site Information

Property	Physical Address	Latitude/ Longitude	Section/Township/ Range
Spanish Springs Nursery	7655 Pyramid Highway	39°38'05" N 119°42'58" W	S3. T20N. R20E & S35. T21N. R20E

Spanish Springs is identified in the Flood Insurance Rate Map as Zone X(Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood).

1.2 SOILS

The Soil Conservation Service describes several native soils for the Stonebrook development site. A brief description of each of the soil types is listed below. Figure P-2 shows the soils distribution at this location.

1170 - **Wedertz sandy loam, 2 to 4 percent slopes**. The Wedertz component makes up 85 percent of the map unit. Slopes are 2 to 4 percent. This component is on piedmonts, fan remnants. The parent material consists of mixed alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. Permeability of this Wedertz soil is moderately slow in the subsoil and upper part of the substratum. The present vegetation in most areas is mainly big sagebrush, littleleaf horsebrush, and Indian ricegrass.

1200 - **Mellor silt loam**. The Mellor component makes up 85 percent of the map unit. Slopes are 0 to 2 percent. This component is on lake terraces, lake plains.
The parent material consists of mixed alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is high. Shrink-swell potential is moderate. Permeability of this Mellor soil is slow. Runoff is slow, and the hazard of water erosion is slight. The present vegetation in most areas is mainly black greasewood and Douglas Rabbitbrush.

The soils listed above are the natural soil in the area. During the construction of the sports complex, there was disruption of this soil and possibly the importation of other material. Because of this, it is difficult to predict the conditions of the soil that may influence ponding, runoff and infiltration

1.3 IRRIGATION PLAN

Spanish Springs Nursery is a 5 acre commercial business site. Spanish Springs Nursery will use effluent for spray and drip irrigation of the site's landscaping and nursery. Irrigation drawings are not available at this time. Refer to Figure P-3 for a site plan.

Majority of irrigation will occur at night to minimize the possibility of public contact with effluent. All irrigation will be done with automatic sprinklers. The length of time each zone will be irrigated will be adjusted according to seasonal temperature and precipitation data. Spray irrigators will discharge near ground surface and away from areas of frequent public use. Adjustments will be made to the sprinklers heads as required to prevent ponding and runoff. If ponding or line breaks should occur they will be quickly identified and repaired.

Potable water line will be identified and necessary adjustments made to provide the required separation between effluent and potable water lines. Any component of the irrigation system that is exposed will be posted and painted purple to clearly identify the component as effluent fixture. All areas of the site shall be posted to notify the public that the landscaping is irrigated with effluent.

The irrigation control system will control the time and duration of the effluent application. Each system controls a set of valves independent of the master valve at the service connection. In case of emergency the system should be shut down at the gate valve that connects the system to the main water supply.

1.4 IRRIGATION PLAN

Currently there is not an irrigation plan available.

1.5 EFFLUENT DEMAND

The estimated effluent demand for the Spanish Springs Nursery is shown in Table P-2.

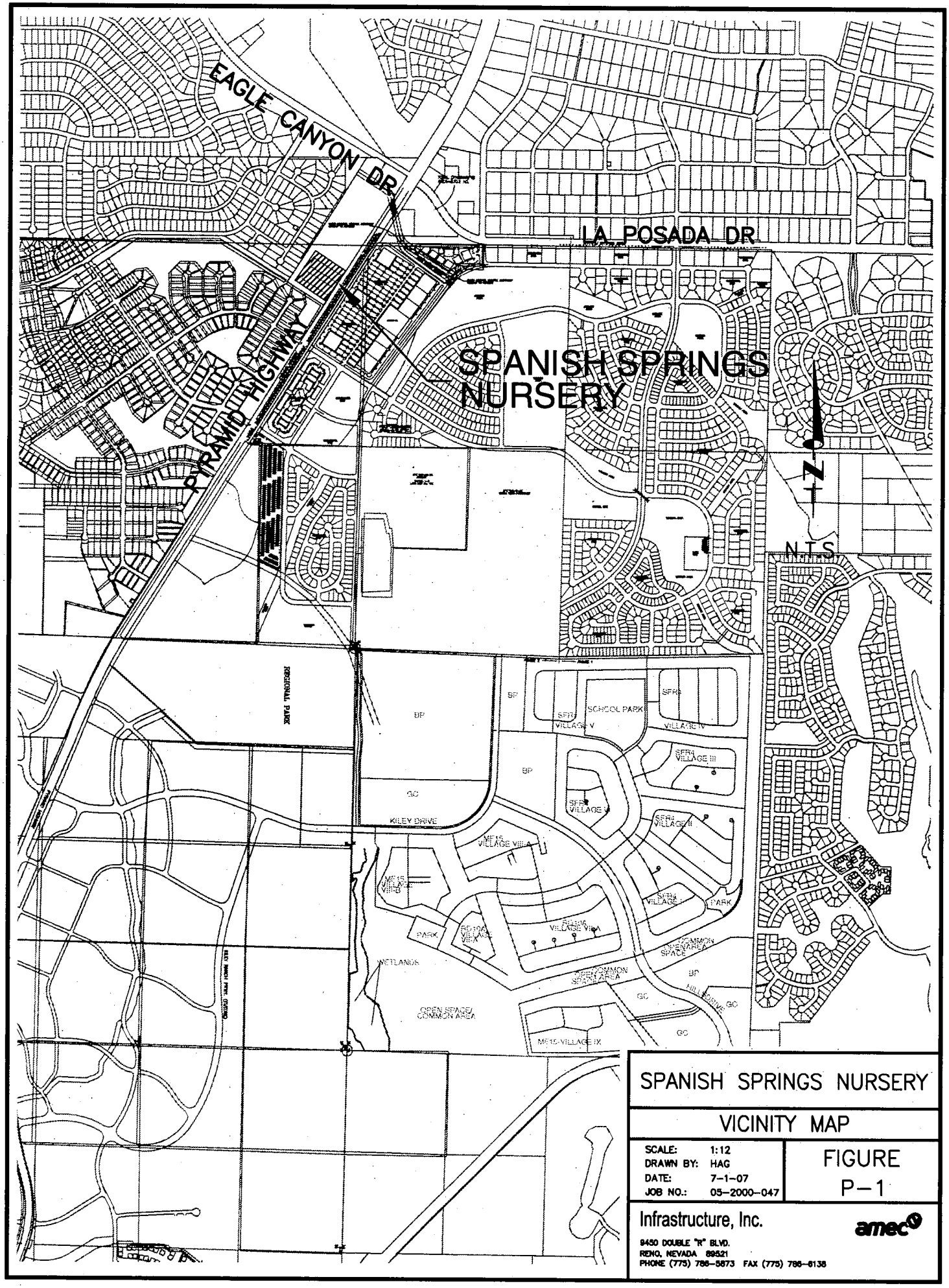
Table P-2 – Spanish Springs Nursery Effluent Demands

Property	Total Area (Acres)	Irrigated Area (Acres)	Acre-Feet per Year	Peak Demand (gpm)	Maximum Daily Flow (mgd)	30-Day Average (mgd)
Spanish Springs Nursery	5	1	7.95	68	0.10	0.08

Irrigation demands were obtained from the effluent management plan and discharge permits information form. Maximum daily flow is based on 24 hours a day irrigation.

1.6 RUNOFF CONTROL PLAN

In the event of an emergency the effluent irrigation system for Stonebrook should be shut down by closing the gate valve located at the effluent meter vault.



SPANISH SPRINGS NURSERY

VICINITY MAP

SCALE:	1:12
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DATE:	7-1-07
JOB NO.:	05-2000-047

FIGURE P-1

Infrastructure, Inc.
amec
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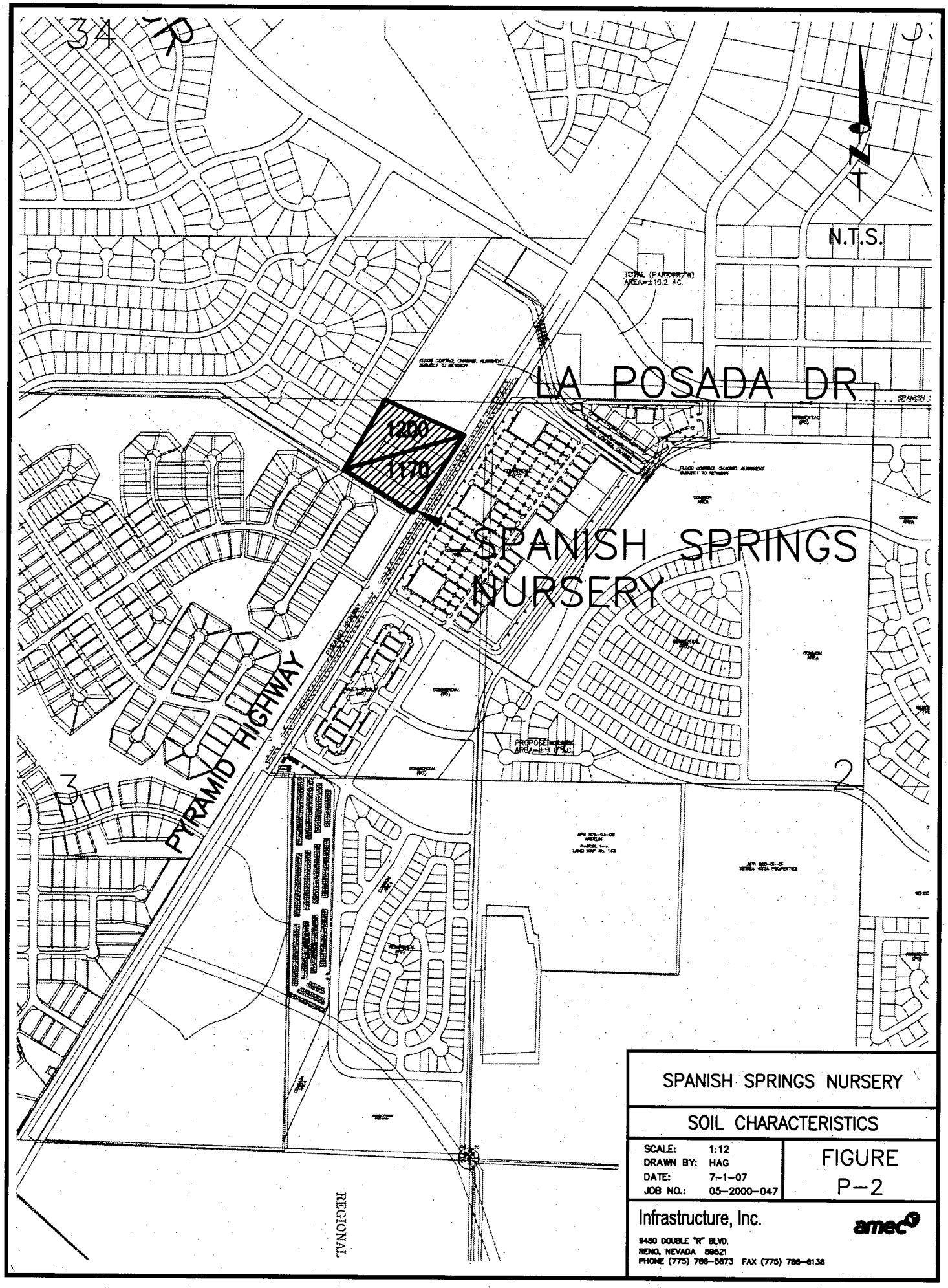
RENO, NEVADA 89521
PHONE (775) 786-5873 FAX (775) 786-6138



SPANISH SPRINGS NURSERY	
SOIL CHARACTERISTICS	
SCALE: 1:12 DRAWN BY: HAG DATE: 7-1-07 JOB NO.: 05-2000-047	FIGURE P-2

Infrastructure, Inc.
amec
9450 DOUBLE "R" BLVD.
RENO, NEVADA 89521
PHONE (775) 786-5873 FAX (775) 786-6138