1791-00033

EFFLUENT MANAGEMENT PLAN

WOLF RUN GOLF COURSE

RENO, NEVADA

Prepared For

Wolf Run Golf Course
1400 Wolf Run Road
Reno, Nevada 89511

Job No. 2281.17B

Revision 2
August 5, 2002

Pezonella Associates, Inc.
Consulting Engineers and Geologists
520 EDISON WAY • RENO, NEVADA 89502 • (775) 856-5566

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August 5, 2002
Job No. 2281.17-B

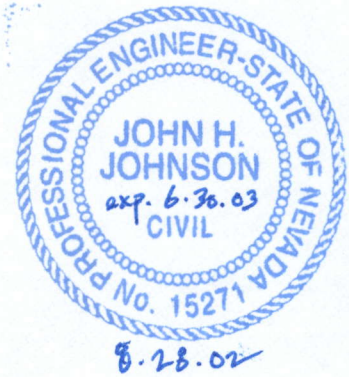
Wolf Run Golf Course
1400 Wolf Run Road
Reno, Nevada 89511

Attn: Mr. Tim Davis

Effluent Management Plan
Wolf Run Golf Course
1400 Wolf Run Road
Reno, Nevada

Dear Mr. Davis:

Please find attached an *Effluent Management Plan* for the use of treated effluent for irrigation purposes at the Wolf Run Golf Course. We appreciate having been selected to prepare this application and trust that the results meet your needs at this time. If you have any questions or require further information, please do not hesitate to contact us.



Respectfully,

PEZONELLA ASSOCIATES, INC.

John H. Johnson, P.E.
Senior Geologist

Raymond M. Pezonella
Civil Engineer - 4186

Pezonella Associates, Inc.

EFFLUENT MANAGEMENT PLAN

WOLF RUN GOLF COURSE

RENO, NEVADA

Prepared For

Wolf Run Golf Course
1400 Wolf Run Road
Reno, Nevada 89511

By

John H. Johnson, P.E.
Senior Geologist

Raymond M. Pezonella
Civil Engineer - 4186

Pezonella Associates, Inc.
520 Edison Way
Reno, Nevada 89502
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Revision 2
August 5, 2002

Job No. 2281.17-B

EFFLUENT MANAGEMENT PLAN

WOLF RUN GOLF COURSE

RENO, NEVADA

Prepared For

Wolf Run Golf Course
1400 Wolf Run Road
Reno, Nevada 89511

Job No. 2281.17B

Revision 1
October 5, 2001

Pezonella Associates, Inc.
Consulting Engineers and Geologists

520 EDISON WAY • RENO, NEVADA 89502 • (775) 856-5566

EFFLUENT MANAGEMENT PLAN

WOLF RUN GOLF COURSE

RENO, NEVADA

Prepared For

Wolf Run Golf Course
1400 Wolf Run Road
Reno, Nevada 89511

Job No. 2281.17B

Revision 1
October 5, 2001

Pezonella Associates, Inc.
Geotechnical & Environmental Engineers & Geologists
520 EDISON WAY • RENO, NEVADA 89502 • (775) 856-5566
FAX • (775) 856-6042

October 5, 2001
Job No. 2281.17-B

Wolf Run Golf Course
1400 Wolf Run Road
Reno, Nevada 89511

Attn: Mr. Ron Gribble

Effluent Management Plan
Wolf Run Golf Course
1400 Wolf Run Road
Reno, Nevada

Dear Mr. Gribble:

Please find attached an *Effluent Management Plan* for the use of treated effluent for irrigation purposes at the Wolf Run Golf Course. We appreciate having been selected to prepare this application and trust that the results meet your needs at this time. If you have any questions or require further information, please do not hesitate to contact us.

Respectfully,

PEZONELLA ASSOCIATES, INC.

John H. Johnson
Senior Geologist, EM-1507

10-5-01

Raymond M. Pezonella
Professional Engineer - 4186

Pezonella Associates, Inc.

EFFLUENT MANAGEMENT PLAN

WOLF RUN GOLF COURSE

RENO, NEVADA

Prepared For

Wolf Run Golf Course
1400 Wolf Run Road
Reno, Nevada 89511

By

John H. Johnson
Senior Geologist, EM - 1507

Raymond M. Pezonella
Professional Engineer - 4186

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Revision 1
October 5, 2001

Job No. 2281.17-B

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CONTACTS

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Attn: Mr. Richard Reviglio

Operator:
Wolf Run Golf Course
1400 Wolf Run Road
Reno, Nevada 89511
(775) 851-3301
Attn: Mr. Tim Davis

Water Supplier:
South Truckee Meadows Sewage Treatment Plant
8500 Mira Loma Drive
Reno, Nevada 89502
(775) 954-4600

Washoe County:
Washoe County Department of Water Resources
Utilities Services Division
P.O. Box 11130
Reno, Nevada 89502
(775) 954-4600

State of Nevada:
Nevada Division of Environmental Protection
333 West Nye Lane
Carson City, Nevada 89706
(775) 687-4670 ext 3023 or 3024
Nights and weekends (775) 687-5300

C O N T A C T S

Owner:

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I Introduction

Wolf Run Golf Course is located at 1400 Wolf Run Road, Reno, Washoe County, Nevada (Property). The golf course was built in 1996 and includes approximately 81 acres of irrigated turf. Water for culinary and irrigative uses is currently supplied through Washoe County. Irrigative water is supplemented from the Steamboat Ditch and White's Creek, both of which flow through the Property. It is the intention of Washoe County Utility Services Division to conserve the potable water supply for domestic use, and see reclaimed water used on the golf course for irrigation. The source of the reclaimed water is the Washoe County Utility Services Division, South Truckee Meadows Water Treatment Facility (STMWTF) currently in operation on Arrowcreek Parkway, a few hundred yards southeast of the golf course. The use of reclaimed water for irrigation is addressed in the Nevada Administrative Code (NAC) 445A.275 to 445A.280 inclusive. General requirements and restrictions for reclaimed water use include acquisition of a discharge permit in compliance with NAC 445A.228 to 445A.263, inclusive, and approval of an effluent management plan.

A *Nevada Groundwater Discharge Permit Application Form* for the project was submitted in the June 23, 2000 Pezonella Associates, Inc. document *Effluent Discharge Report to Accompany Nevada Groundwater Discharge Permit Application, Wolf Run Golf Course, Reno, Nevada* (Appendix A). A letter from the Nevada Division of Environmental Protection, Bureau of Water Pollution Control (NDEP) dated November 20, 2000, requested additional information concerning the project. This information was included in *Supplemental Document to Accompany Nevada Groundwater Discharge Permit Application, Wolf Run Golf Course, Reno, Nevada*, which was submitted to NDEP on January 9, 2001. At a February 15, 2001 site meeting, NDEP requested information concerning the effect of a 25-year, 24-hour storm event on White's Creek flow adjacent to the effluent storage pond at the golf course. The document *Estimate of White's Creek flow volume at Wolf Run Golf Course resulting from a 25-year 24-hour precipitation event, Wolf Run Golf Course, Reno, Nevada* was submitted to NDEP on March 28, 2001 (Appendix B).

This document is presented as an *Effluent Management Plan* (EMP) in an attempt to satisfy the requirements of the Nevada Administrative Code for effluent water use at Wolf Run Golf Course. It draws from information previously presented to NDEP in the above-referenced documents. Public notice of the proposed discharge permit was included in the March 2, 2001 edition of the Reno Gazette-Journal. The permit (NEV98018) became effective on April 4, 2001. A copy of the permit is included as Appendix C. A copy of the water service agreement between Washoe County and Wolf Run Golf Course is attached as Appendix D.

II Site Evaluation

A. Topography and Site Plan

Wolf Run Golf Course is located in the southwestern part of the Truckee Meadows in Reno, Nevada. It lies between Zolezzi Lane to the north and Arrowcreek Parkway to the south approximately one mile west of South Virginia Street. The Property is entirely within Section 19, Township 18 North, Range 20 East, Mount Diablo Baseline & Meridian, and is on the *Mount Rose NE Quadrangle*, of the United States Geological Survey (USGS) 7.5-minute topographic map series.

Wolf Run is an 18-hole championship golf course that includes approximately 3.5 acres of bent grass (*Argrostis capillaris*); 18 acres of rye grass (*Lolium perenne*), and 59.5 acres of a blue grass (*Poa pratensis*) and rye grass blend. Approximately 4,500 feet of White's Creek flows through the eastern portion of the course from south to north. Approximately 4,200 feet of the Steamboat Ditch flows through the north half of the Property from west to east. The ditch carries water only part of each year, typically May through October. White's Creek crosses the Steamboat Ditch through a corrugated steel culvert near the center of the golf course. A pond used to store irrigation water is also located in this area, near the center of the golf course. The location of the Property is depicted on Plate 1. Topography and details of the Property are depicted on Plate 2.

B. Groundwater

Wolf Run Golf Course is located on alluvial material on the east flank of the Carson Range. On and adjacent to the golf course are three water supply wells operated by the South Truckee Meadows General Improvement District (STMGID). One of the wells (STMGID #3) is located on the golf course property north of the irrigation pond near the crossing of White's Creek and the Steamboat Ditch. The other two wells are located off the golf course property, slightly to the east. Well STMGID #1 is located immediately south of Zolezzi Lane, approximately 500 feet east of the 11th green. Well STMGID #2 is located approximately 2,000 feet south of Zolezzi Lane, and approximately 600 feet east of the 13th tee.

An investigation into the lithology and construction of the STMGID wells was conducted at the Nevada Division of Water Resources office in Carson City, Nevada. According to records at that office, the three STMGID wells were drilled and installed by Charles Sargent Irrigation, Inc. in 1984. Lithologic and well construction details are included below.

The boring for well STMGID #1 was installed in March, 1984 and was drilled to a total depth of 620 feet. The well was installed to a total depth of 530 feet. It is 12-inches in diameter, and is screened from 260 to 520 feet below land surface. It was tested to 600 gallons per minute with a drawdown of 110 feet after 48 hours. The lithology is consistent with the expected fan-type deposit – a mixture of material sizes from silts and sands to boulders. The

well driller's log notes water-bearing strata from approximately 200 to 540 feet below land surface. The well has a surface seal of 54 feet.

The boring for well STMGID #2 was installed in April, 1984 and was drilled to a total depth of 715 feet. The well was installed to a total depth of 515 feet. It is 22-inches in diameter, and is screened from 255 to 505 feet below land surface. It was tested to 179 gallons per minute with a drawdown of 92½ feet after 23½ hours. The lithology is similar to that from STMGID #1. The well driller's log notes water-bearing strata from approximately 135 to 680 feet below land surface. The well has a surface seal of 88 feet.

The boring for well STMGID #3 was installed in August and September, 1984 and was drilled to a total depth of 590 feet. The well was installed to a total depth of 580 feet. It is 14-inches in diameter, and is screened from 240 to 580 feet below land surface. It was tested to 385 gallons per minute, and had a drawdown of 73 feet after 43½ hours at 300 gallons per minute. The lithology of the materials encountered in STMGID #3 includes finer material than that from STMGID #1 and #2. The well driller's log notes water-bearing strata from approximately 135 to 680 feet below land surface. The well has a surface seal of 88 feet.

Information from a records search, previous investigations, municipal wells, and contact with Washoe County Department of Water Resources indicates that depth to groundwater varies at the golf course from approximately 60 to 100 feet below ground surface. Groundwater movement at the facility is generally to the north-east, parallel to surface water movement toward the Truckee River in the northern Truckee Meadows.

C. Surface Water

Surface water present on the golf course includes White's Creek, the Steamboat Ditch, the pond which is used for irrigation water storage, and two small detention ponds used as stilling basins for stormwater outfalls from the Fieldcreek subdivision west of the Property. White's Creek rises from White's Canyon on the north flank of Mt. Rose in the Carson Range. There are also contributions from drainages on the east flank of Alpine Walk Peak immediately north of Mt. Rose. The creek debouches onto the Pre-Lake Lahontan alluvial fan approximately ½-mile north of the Mt. Rose Highway (Nevada 431), and flows slightly north of east in a single channel for approximately 3 miles. The natural channel divides into four smaller channels at this point in the eastern portion of Section 30, Township 18 North, Range 20 East at White's Creek Park. However, a concrete flow control structure restricts creek flow into just two of the channels. One of these flows north-northeast along the base of a small bluff for approximately ½ mile before passing through culverts under Arrowcreek Parkway and onto the Wolf Run Golf Course.

White's Creek is designated as Class B waters from below the east line of Section 33, Township 18 North, Range 19 East, Mount Diablo Baseline & Meridian. This designation includes the portions of the creek present on the Wolf Run Golf Course. The NAC defines *Class B waters* in NAC 445A.125 as "waters or portions of waters which are located in areas

of light or moderate human habitation, little industrial development, light-to-moderate agricultural development and where the watershed is only moderately influenced by man's activity." Class B waters include standards for floating and settleable solids, sludge deposits, sewage, industrial wastes, odor-producing substances, toxic materials, pH, dissolved oxygen, temperature, fecal coliform, phosphates, and total dissolved solids.

Steamboat Ditch carries water from the Truckee River near Gold Ranch along the west side of the Truckee Meadows to Steamboat Creek, south of Reno. The ditch provides irrigation for those with water rights along the route. White's Creek crosses over Steamboat Ditch on the golf course through a corrugated metal pipe.

Near the center of the golf course property and the crossing of Steamboat Ditch by White's Creek is a storage reservoir used as a distribution point for irrigation water. Information provided by Wolf Run Golf Course personnel indicates the reservoir has a usable capacity of approximately 2 million gallons. Water has historically been introduced to the reservoir through either a gate from Steamboat Ditch or through a diversion from White's Creek. The reservoir is now used for effluent storage, with the effluent supplied through a pipeline from the STMWTF.

The storage reservoir has an areal extent of approximately ½-acre. The elevation of the bottom of the pond is approximately 4758 feet above mean sea level (AMSL). The normal pool elevation is approximately 4765 feet AMSL. The elevation of the top of the berm protecting the reservoir on the downslope side is approximately 4768 feet AMSL; leaving approximately 3 feet of freeboard between normal pool elevation and an overflow condition. An overflow channel is set into the berm southeast of the reservoir, between the reservoir and White's Creek.

The reservoir was lined after construction with a 40 mil lining manufactured by Barber-Webb of Los Angeles, California. The lining is approximately 91,000 square feet in area and was installed on April 1, 1997. The purpose of the lining is to make the reservoir impervious to prevent leakage. The lining extends above normal pool elevation to the top of the berm. It was completely inspected and re-sealed in 1998. It was re-inspected by National Seal in early 2001. The lining was in good condition and no maintenance was required. The inspection is performed every 3 years, and will next occur during the winter months of 2004.

As indicated above, the reservoir is located very near the crossing of Steamboat Ditch and White's Creek. It is our understanding that the threat of release of effluent from the reservoir to White's Creek or Steamboat Ditch during flood events can be minimized by maintaining a low volume of effluent in the reservoir during the flood-prone winter and early spring seasons. It is also our understanding that irrigation is not generally required during these months, which will allow the reservoir level to be lowered without an adverse effect on the golf course. The irrigation intensive months are March through October. During these months the storage reservoir will be in use and at or near capacity. During the winter and early spring the storage reservoir will be drawn down to approximately half its capacity. On

an annual basis during the spring draw down, before the reservoir volume is brought up to capacity, the pumps, piping, and appurtenances associated with the reservoir will be inspected by the superintendent.

D. Soils

The Property lies in the eastern foothills of the Carson Range, near the boundary between the Sierra Nevada and the Basin Ranges. Regionally, the geology is composed of regionally and thermally metamorphosed and eroded basement rocks overlain by Cenozoic age volcanic and sedimentary rocks. Basement rocks are most likely Mesozoic in age. Regional Cenozoic igneous rocks are present in the form of the Hartford Hill rhyolite tuff, the Alta Formation, the Davidson Granodiorite, and the Kate Peak Formation. The sedimentary, Pliocene age Truckee Formation was deposited in structural basins in and around the volcanic hills. The later volcanic events including the Lousetown Formation were probably completed by late Pliocene or early Pleistocene time. At least four glaciation events occurred in the Carson Range, depositing along the range front the alluvium and landslide debris on which the golf course now rests (Thompson and White 1964).

The *Mt. Rose NE Quadrangle Geologic Map* (Bonham and Rogers 1983) indicates the Property is located on Quaternary period fan sediments. The vast majority of the Property is located on *Donner Lake Outwash – Mount Rose Fan Complex* (Qdm). This unit is composed of "pediment and thin fan deposits from major streams draining alpine glaciers on Mount Rose; brown to brownish-gray, sandy, muddy, poorly sorted large pebble gravel; cobbles and small boulders common. Clasts dominantly volcanic (porphyritic andesite and latite); surface granitic clasts rare. Deeply weathered, strongly developed soil profile...well cemented and/or hydrothermally altered in Steamboat Hills area."

A thin strip of Quaternary age *alluvial bajada deposit* (Qa) is present on the Property along the bed of White's Creek. Bonham and Rogers describe this deposit as "thin sheet-like aprons of fine- to medium-grained clayey sand and intercalated muddy, medium pebble gravel; deposits of low gradient streams that reworked older gravelly outwash and alluvial fan deposits; weakly weathered and largely undissected. Little or no soil development (entisols)."

At the south boundary of the Property, where White's Creek enters the golf course, is a wedge of *Tahoe Outwash – Mount Rose Fan Complex* (Qtm). This unit is described as "glacial outwash stream deposits of volcanic and granitic composition; light yellowish- to orange-brown; sandy large cobble to boulder gravel containing characteristically fresh granitic lag gravel. Strongly developed 1 m (3 ft) thick soil profile; dark yellowish-brown, prismatic argillic B-horizon; typically no siliceous or calcic duripan development; granitic boulders partly to thoroughly decomposed where buried in soil. Deposits locally only thin veneers; some undifferentiated areas."

Studies completed by the U.S. Department of Agriculture Soil Conservation Service, indicate that the native soils at the Property are predominantly of the Oest Series. This is a deep, well-drained soil on terraces, alluvial fans, and escarpments formed in alluvium derived from mixed rock sources. Oest Series soil on the golf course prior to construction would typically have had 15 to 50 percent of the surface covered with stones. The surface layer is a grayish-brown extremely stony to very bouldery sandy loam 8 to 15 inches thick. The subsoil is a brown very gravelly sandy loam approximately 25 to 32 inches thick. The substratum is a pale brown very gravelly loamy sand that extends to approximately 60 inches (Soil Conservation Service, 1983).

III Design Items

A. Nitrogen and Water Budgets

Nitrogen and water use at the golf course during the 1999 season were presented in the June, 2000 *Application* based on information supplied by Wolf Run Golf Course personnel. Approximately 131,000,000 (one hundred thirty-one million) gallons of water were used during the 1999 irrigation season. Approximately 27,000 (twenty-seven thousand) pounds of nitrogen were applied through the use of fertilizers during the same period.

The original *Application* submitted in June, 2000 included analytical results for effluent from the STMWTF from March 1997 through April 1998. During that period, the average nitrogen concentration in the effluent was 2.47 mg/l. The maximum nitrogen concentration during that period was 6.4 mg/l. Based on the volume of irrigation water used in the previous season, treated effluent would deliver 2,700 pounds of nitrogen based on the average nitrogen concentration in the effluent, and 7,000 pounds of nitrogen based on the maximum nitrogen concentration in the effluent.

Attached to the November, 2000 NDEP letter were the *Plant Consumptive Use Worksheet* and the *Nitrogen Loading Limit Worksheet*. These worksheets calculate water use based on crop water and nitrogen requirements. The worksheets take into account such factors as evapotranspiration rate, precipitation rate, leaching requirement, irrigation system efficiency, salinity tolerance of crop, salinity of effluent, crop nitrogen uptake rate, nitrogen concentration in effluent, and fraction of nitrogen removed by denitrification and volatilization.

Data used in the calculations were gathered from a number of sources. Base evapotranspiration rates for the Reno area were obtained from Nevada Bureau of Mines & Geology Report 48, *Statewide Potential Evapotranspiration Maps for Nevada* (Shevenell, 1996). Crop coefficients for turfgrass were estimated from information provided by representatives of the University of Nevada Cooperative Extension. The precipitation rate is from the Western Regional Climate Center with a period of record from March 1937 to July, 2000. Irrigation system efficiency, nitrogen uptake rates, estimates of nitrogen concentration in percolating water, and denitrification/volatilization rates are from *Wastewater Engineering* (Metcalf & Eddy, 1992). Salinity tolerances for turfgrass are from *Wastewater Reuse for Golf Course*

Irrigation (United States Golf Association, 1994). Washoe County Department of Water Resources supplied the estimate for salinity of applied effluent.

Based on information from the above sources, the *Plant Consumptive Use Worksheet* (Worksheet 1-A) indicates water use to be approximately 124,000,000 (one hundred twenty-four million) gallons of water per year. The *Nitrogen Loading Limit Worksheet* (Worksheet 2-A) indicates water use to be approximately 1,500,000,000 (1.5 billion) gallons of water per year. Consequently, the *Consumptive Use Requirement Worksheet* (Worksheet 1-B) was used to re-calculate the maximum loading rate based on plant water use requirements. Using monthly evapotranspiration rates based on a yearly total of 60 inches and a crop coefficient of 0.8, the *Consumptive Use Requirement Worksheet* indicated yearly water consumption to be approximately 126,000,000 (one hundred twenty-six million) gallons. Calculation sheets are included as Appendix E.

As mentioned above, the golf course consists of approximately 81 irrigated acres. These acres are planted with three types of grass. Greens (3.5 acres) are bent grass; tee boxes (18 acres) are rye grass; fairways (59.5 acres) are a blue grass/rye grass blend. Each of these grass types is fertilized at different rates. The fertilizing season at Wolf Run Golf Course normally starts in March and extends through October. Greens are fertilized on a two-week interval from March through October for a total of sixteen fertilizing episodes. Tees are fertilized every three weeks from April through October for a total of approximately ten fertilizing episodes. Fairways are fertilized monthly from April through October for a total of seven fertilizing episodes. Fertilizers include a wide variety of brands and nitrogen sources. Both organic and synthetic fertilizers are consistently used.

Wolf Run is currently applying nitrogen to greens at a rate of 6 to 8 pounds per 1000 square feet per year. This is equivalent to an application rate of approximately 260 to 350 pounds per acre-year (lbs/ac-yr). Nitrogen is being applied to tees and fairways at a rate of 4 to 6 pounds per 1000 square feet per year. This is equivalent to an application rate of 175 to 260 lbs/ac-yr.

Worksheet 2-C was completed for each of the three grass types using effluent application rates calculated in the *Consumptive Use Requirement Worksheet* (Worksheet 1-B). The nitrogen concentration in the effluent was taken to be 6.4 mg/l, the maximum concentration from the STMWTF data presented in the June, 2000 *Application*. Based on these values, effluent supplies approximately 68 pounds per acre-year (lbs/ac-yr) to the bent grass greens, approximately 66 lbs/ac-yr to the rye grass tees, and approximately 67 lbs/ac-yr to the bent/rye grass blend fairways. The nitrogen uptake rate for the greens is approximately 450 lbs/ac-yr, while the uptake rate for tees and fairways is approximately 180 lbs/ac-yr. Consequently, it appears that 20% to 25% of the nitrogen uptake rate is supplied to greens through effluent application, and one-quarter to slightly over one-third of the nitrogen uptake rate is supplied to tees and fairways through the same process. It should be noted, however, that this is based on the maximum nitrogen concentration recorded in the effluent water. Monthly or quarterly average nitrogen concentrations in the effluent should be used

henceforth in the calculations associated with Worksheet 2-C. Given the effluent concentration and application rates, the rate of fertilizer application can be adjusted monthly to the nitrogen uptake rates of the various grasses. The Worksheets and blank Worksheet 2-Cs for greens, tees, and fairways are included in Appendix E for use by the superintendent and golf course staff. A conversion for pounds of nitrogen per 1000 square feet to pounds of nitrogen per acre is included on the bottom of the blank worksheets.

B. Pumps and Piping

The Nevada Administrative Code (NAC) 445A.276 provides requirements for bacteriological quality and buffer zone limitations for use with spray irrigation systems such as are in use at Wolf Run Golf Course. Effluent water for irrigation is provided by the Washoe County Department of Water Resources Utility Services Division from the STMWTP. The plant operates under NDEP Discharge Permit NEV40024. It is our understanding that the conditions of that permit are such that the effluent water is of category "C" from NAC 445A.276, and no buffer zone is required. In addition, irrigation and routine maintenance can be performed during regular working hours, provided the public is excluded from the area.

Treated effluent is supplied to the golf course through the irrigation system that was installed at the time of original construction. Cross-connection controls are in place, and have been inspected and approved by the water purveyor (Washoe County Utility Services Division). A letter to that effect is attached as Appendix F.

The irrigation season at Wolf Run Golf Course generally runs from March through October each year. Irrigation cycles are from 9:00 PM to 7:00 AM seven days per week. Additional daytime watering may be done on an as-needed basis as determined by course management. The watering may be done by hand, by hydro-jet, or through the in-ground sprinkler system provided it is under supervision, and not allowed to strike golfers or maintenance personnel. A sufficient amount of drying time shall be given to the hole(s) that have been irrigated during the day before allowing golfers back on the holes(s). This drying time should be sufficient to allow for the majority of the reclaimed water to have evapotranspirated. The in-ground sprinkler system may not be used during any significant wind event that would cause aerosols to drift to adjacent homes or to adjacent course holes that are in use.

The irrigation system currently consists of approximately 1,700 valve-in-head sprinklers using 67 controllers separated into 32 groups. Sprinkler times range from 3 to 25 minutes per station depending on evapotranspiration rates. White's Creek is downslope from the majority of the golf course and will therefore receive run-off from the golf course during storm or flood events.

A variety of sprinklers are in use at the golf course. Communication with representatives of Wolf Run indicate that the majority are manufactured by Toro Irrigation Products, and are the 650/670 Series or equivalent. Based on information published by the manufacturer and

provided by Wolf Run Golf Course personnel, the sprinklers distribute water at approximately 40 gallons per minute (gpm).

At the time of submittal of the initial *Application*, approximately 100 of the sprinkler heads were within a water distribution radius of White's Creek, and irrigation water could be introduced directly to the creek during watering cycles. Communication with Wolf Run personnel indicates these sprinklers have been changed by the golf course to half- and quarter-circles to prevent irrigation water discharge to the creek. A plan of the irrigation system at Wolf Run is included as Plate 3.

C. Flow Monitoring & Communication

A Washoe County flow meter is installed on the pipeline that supplies effluent to the golf course. Readings are collected from the meter on a monthly basis. Water use records are submitted quarterly as part of the Discharge Monitoring Reports (DMRs) submitted to NDEP.

Effluent delivery from the Washoe County facility to the Wolf Run Golf Course is substantially automated. High- and low- water level transducers are installed in the wet well at the pump station near the effluent reservoir. The transducers are connected via telemetry to a monitoring system at Washoe County Utility Services Division. A motor control valve at the County pump station is actuated based on water levels received from the transducers in the golf course wet well. The valve opens and closes at set water surface elevations. There is a high-water alarm at the County facility. The valve controlling effluent flow to the golf course can also be operated manually by County personnel.

Emergency reporting will vary depending on the incident. Malfunctions that do not result in the release of effluent will be reported to the maintenance supervisor. Unauthorized releases of effluent will be stopped as quickly as practicable by maintenance personnel. The release will be reported to the maintenance supervisor, who will then notify the proper authorities if applicable. Notification numbers are listed at the front of this document.

D. System Management

Effluent water is distributed through the system depicted on Plate 3 by both spray and drip irrigation. The vast majority of the water distribution is through spray irrigation, but four small drip systems were required when the full-circle sprinkler heads were exchanged for half- and quarter-circle heads. The drip systems are in place at the 10th tee, 11th green, 12th tee, and 15th tee. In addition, a number of quick-connects are present on the main irrigation lines for the use of hoses in hand watering. The quick-connects are locked when not in use.

As indicated above, irrigation generally runs from 9:00 PM to 7:00 AM during the irrigation season in order to prevent the public from coming into contact with treated wastewater. A wind monitoring system to automatically shut down watering when winds exceed 20 miles per hour continuously for more than 5 minutes is also being planned, but has not yet been

implemented. Discussions with Wolf Run personnel indicate that new controllers are being purchased, and a high-wind shut-off provision will be built into the system at that time.

Both spray and drip irrigation systems are set and operated to prevent ponding and run-off. No flood irrigation is used. Maintenance personnel are aware that ponding is an undesirable condition, and will report it to the superintendent if it is encountered. Sprinkler heads, lines, and nozzles are inspected on a regular basis to ensure the system is in proper adjustment. Should ponding occur, it is remedied through either sprinkler station timing or sprinkler head adjustment. There are no drinking fountains on the golf course, but water coolers in individual shelters are covered during irrigation.

Public notification of the use of treated effluent at the Property is accomplished through the use of signs. They are located near the entrance to Wolf Run Golf Course and in visible locations throughout the course. The warning will also be printed on scorecards. An example of the text is below:

CONSERVING FOR THE FUTURE

WE IRRIGATE WITH EFFLUENT WATER

DO NOT DRINK

In addition, a worker hygiene fact sheet containing information about treated effluent is posted in landscaping and maintenance areas. The sheet is intended to notify workers of the hazards of working with treated effluent, and provide general guidelines for worker protection. An example of the sheet is included in Appendix G.

IV Reporting

The Wolf Run Discharge permit (NEV98018) requires DMRs to present information concerning flow (in million gallons per month) and annual application volume (acre-feet). The permit states that fecal coliform is reported as a condition of discharge permit NEV40024 (STMWTF), and that fecal coliform reporting is not required in Wolf Run Golf Course DMRs. DMRs are submitted to the NDEP Bureau of Water Pollution Control on a quarterly basis.

Information concerning effluent and fertilizer usage can be obtained from Worksheet 2-C, included in Appendix E.

V References

Bonham, H. F. *Geology and Mineral Deposits of Washoe and Storey Counties, Nevada.* Reno: Nevada Bureau of Mines & Geology, University of Nevada, Reno, 1969.

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United States Geological Survey. *Mount Rose NE Quadrangle.* 7.5 Minute Series Map (Topographic). 1:24,000. Denver: USGS, 1994.

United States Golf Association. *Wastewater Reuse for Golf Course Irrigation.* Boca Raton: Lewis Publishers. 1994.

VI Distribution

2 originals:
Mr. Tim Davis
Wolf Run Golf Course
1400 Wolf Run Road
Reno, Nevada 89511
TEL (775) 851-7720
FAX (775) 851-4403

1 original:
Mr. Darrell Rasner
Nevada Division of Environmental Protection
Bureau of Water Pollution Control
333 West Nye Lane
Carson City, Nevada 89706-0851
TEL (775) 687-4670, Ext. 3141
FAX (775) 687-5856

1 original:
Mr. Joe Howard
Washoe County Department of Water Resources
Utility Services Division
P.O. Box 11130
Reno, Nevada 89520
TEL (775) 954-4623
FAX (775) 687-4610

VII Appendices

Appendix A: *Effluent Discharge Report to Accompany Nevada Groundwater Discharge Permit Application, Wolf Run Golf Course, Reno, Nevada* (June 23, 2000)

Appendix B: *Estimate of White's Creek flow volume at Wolf Run Golf Course resulting from a 25-year 24-hour precipitation event, Wolf Run Golf Course, Reno, Nevada* (March 28, 2001)

Appendix C: Nevada Division of Environmental Protection *Authorization to Discharge*, Permit No. NEV98018

Appendix D: *Agreement for Reclaimed Water Service by Washoe County to Wolf Run Golf Course* (March, 2000)

Appendix E: *Plant Consumptive Use Worksheet* (Worksheet 1-A), *Nitrogen Loading Limit Worksheet* (Worksheet 2-A), *Consumptive Use Requirement Worksheet* (Worksheet 1-B), and Worksheet 2-C

Appendix F: Washoe County Utility Services Division cross-connection control letter

Appendix G: Example *Worker Hygiene Fact Sheet*

Appendix H: Document Revision History

VIII Plates

Plate 1: Property Location Map
Plate 2: Wolf Run Golf Course
Plate 3: Wolf Run Golf Course Irrigation System

I Introduction

Wolf Run Golf Course is located at 1400 Wolf Run Road, Reno, Washoe County, Nevada (Property). The golf course was built in 1996 and includes approximately 81 acres of irrigated turf. Water for culinary and irrigative uses is currently supplied through Washoe County. Irrigative water is supplemented from the Steamboat Ditch and White's Creek, both of which flow through the Property. It is the intention of Washoe County Utility Services Division to conserve the potable water supply for domestic use, and see reclaimed water used on the golf course for irrigation. The source of the reclaimed water is the Washoe County Utility Services Division, South Truckee Meadows Water Treatment Facility (STMWTF) currently in operation on Arrowcreek Parkway, a few hundred yards southeast of the golf course. The use of reclaimed water for irrigation is addressed in the Nevada Administrative Code (NAC) 445A.275 to 445A.280 inclusive. General requirements and restrictions for reclaimed water use include acquisition of a discharge permit in compliance with NAC 445A.228 to 445A.263, inclusive, and approval of an effluent management plan.

A *Nevada Groundwater Discharge Permit Application Form* for the project was submitted in the June 23, 2000 Pezonella Associates, Inc. document *Effluent Discharge Report to Accompany Nevada Groundwater Discharge Permit Application, Wolf Run Golf Course, Reno, Nevada* (Appendix A). A letter from the Nevada Division of Environmental Protection, Bureau of Water Pollution Control (NDEP) dated November 20, 2000, requested additional information concerning the project. This information was included in *Supplemental Document to Accompany Nevada Groundwater Discharge Permit Application, Wolf Run Golf Course, Reno, Nevada*, which was submitted to NDEP on January 9, 2001. At a February 15, 2001 site meeting, NDEP requested information concerning the effect of a 25-year, 24-hour storm event on White's Creek flow adjacent to the effluent storage pond at the golf course. The document *Estimate of White's Creek flow volume at Wolf Run Golf Course resulting from a 25-year 24-hour precipitation event, Wolf Run Golf Course, Reno, Nevada* was submitted to NDEP on March 28, 2001 (Appendix B).

This document is presented as an *Effluent Management Plan* (EMP) in an attempt to satisfy the requirements of the Nevada Administrative Code for effluent water use at Wolf Run Golf Course. It draws from information previously presented to NDEP in the above-referenced documents. Public notice of the proposed discharge permit was included in the March 2, 2001 edition of the Reno Gazette-Journal. The permit (NEV98018) became effective on April 4, 2001. A copy of the permit is included as Appendix C. A copy of the water service agreement between Washoe County and Wolf Run Golf Course is attached as Appendix D.

II Site Evaluation

A. Topography and Site Plan

Wolf Run Golf Course is located in the southwestern part of the Truckee Meadows in Reno, Nevada. It lies between Zolezzi Lane to the north and Arrowcreek Parkway to the south approximately one mile west of South Virginia Street. The Property is entirely within Section 19, Township 18 North, Range 20 East, Mount Diablo Baseline & Meridian, and is on the *Mount Rose NE Quadrangle*, of the United States Geological Survey (USGS) 7.5-minute topographic map series.

Wolf Run is an 18-hole championship golf course that includes approximately 3.5 acres of bent grass (*Argrostis capillaris*); 18 acres of rye grass (*Lolium perenne*), and 59.5 acres of a blue grass (*Poa pratensis*) and rye grass blend. Approximately 4,500 feet of White's Creek flows through the eastern portion of the course from south to north. Approximately 4,200 feet of the Steamboat Ditch flows through the north half of the Property from west to east. The ditch carries water only part of each year, typically May through October. White's Creek crosses the Steamboat Ditch through a corrugated steel culvert near the center of the golf course. A pond used to store irrigation water is also located in this area, near the center of the golf course. The location of the Property is depicted on Plate 1. Topography and details of the Property are depicted on Plate 2.

B. Groundwater

Wolf Run Golf Course is located on alluvial material on the east flank of the Carson Range. On and adjacent to the golf course are three water supply wells operated by the South Truckee Meadows General Improvement District (STMGID). One of the wells (STMGID #3) is located on the golf course property north of the irrigation pond near the crossing of White's Creek and the Steamboat Ditch. The other two wells are located off the golf course property, slightly to the east. Well STMGID #1 is located immediately south of Zolezzi Lane, approximately 500 feet east of the 11th green. Well STMGID #2 is located approximately 2,000 feet south of Zolezzi Lane, and approximately 600 feet east of the 13th tee.

An investigation into the lithology and construction of the STMGID wells was conducted at the Nevada Division of Water Resources office in Carson City, Nevada. According to records at that office, the three STMGID wells were drilled and installed by Charles Sargent Irrigation, Inc. in 1984. Lithologic and well construction details are included below.

The boring for well STMGID #1 was installed in March, 1984 and was drilled to a total depth of 620 feet. The well was installed to a total depth of 530 feet. It is 12-inches in diameter, and is screened from 260 to 520 feet below land surface. It was tested to 600 gallons per minute with a drawdown of 110 feet after 48 hours. The lithology is consistent with the expected fan-type deposit – a mixture of material sizes from silts and sands to boulders. The

well driller's log notes water-bearing strata from approximately 200 to 540 feet below land surface. The well has a surface seal of 54 feet.

The boring for well STMGID #2 was installed in April, 1984 and was drilled to a total depth of 715 feet. The well was installed to a total depth of 515 feet. It is 22-inches in diameter, and is screened from 255 to 505 feet below land surface. It was tested to 179 gallons per minute with a drawdown of 92½ feet after 23½ hours. The lithology is similar to that from STMGID #1. The well driller's log notes water-bearing strata from approximately 135 to 680 feet below land surface. The well has a surface seal of 88 feet.

The boring for well STMGID #3 was installed in August and September, 1984 and was drilled to a total depth of 590 feet. The well was installed to a total depth of 580 feet. It is 14-inches in diameter, and is screened from 240 to 580 feet below land surface. It was tested to 385 gallons per minute, and had a drawdown of 73 feet after 43½ hours at 300 gallons per minute. The lithology of the materials encountered in STMGID #3 includes finer material than that from STMGID #1 and #2. The well driller's log notes water-bearing strata from approximately 135 to 680 feet below land surface. The well has a surface seal of 88 feet.

Information from a records search, previous investigations, municipal wells, and contact with Washoe County Department of Water Resources indicates that depth to groundwater varies at the golf course from approximately 60 to 100 feet below ground surface. Groundwater movement at the facility is generally to the north-east, parallel to surface water movement toward the Truckee River in the northern Truckee Meadows.

C. Surface Water

Surface water present on the golf course includes White's Creek, the Steamboat Ditch, the pond which is used for irrigation water storage, and two small detention ponds used as stilling basins for stormwater outfalls from the Fieldcreek subdivision west of the Property. White's Creek rises from White's Canyon on the north flank of Mt. Rose in the Carson Range. There are also contributions from drainages on the east flank of Alpine Walk Peak immediately north of Mt. Rose. The creek debouches onto the Pre-Lake Lahontan alluvial fan approximately ½-mile north of the Mt. Rose Highway (Nevada 431), and flows slightly north of east in a single channel for approximately 3 miles. The natural channel divides into four smaller channels at this point in the eastern portion of Section 30, Township 18 North, Range 20 East at White's Creek Park. However, a concrete flow control structure restricts creek flow into just two of the channels. One of these flows north-northeast along the base of a small bluff for approximately ½ mile before passing through culverts under Arrowcreek Parkway and onto the Wolf Run Golf Course.

White's Creek is designated as Class B waters from below the east line of Section 33, Township 18 North, Range 19 East, Mount Diablo Baseline & Meridian. This designation includes the portions of the creek present on the Wolf Run Golf Course. The NAC defines *Class B waters* in NAC 445A.125 as "waters or portions of waters which are located in areas

of light or moderate human habitation, little industrial development, light-to-moderate agricultural development and where the watershed is only moderately influenced by man's activity." Class B waters include standards for floating and settleable solids, sludge deposits, sewage, industrial wastes, odor-producing substances, toxic materials, pH, dissolved oxygen, temperature, fecal coliform, phosphates, and total dissolved solids.

Steamboat Ditch carries water from the Truckee River near Gold Ranch along the west side of the Truckee Meadows to Steamboat Creek, south of Reno. The ditch provides irrigation for those with water rights along the route. White's Creek crosses over Steamboat Ditch on the golf course through a corrugated metal pipe.

Near the center of the golf course property and the crossing of Steamboat Ditch by White's Creek is a storage reservoir used as a distribution point for irrigation water. Information provided by Wolf Run Golf Course personnel indicates the reservoir has a usable capacity of approximately 2 million gallons. Water has historically been introduced to the reservoir through either a gate from Steamboat Ditch or through a diversion from White's Creek. The reservoir is now used for effluent storage, with the effluent supplied through a pipeline from the STMWTF.

The storage reservoir has an areal extent of approximately ½-acre. The elevation of the bottom of the pond is approximately 4758 feet above mean sea level (AMSL). The normal pool elevation is approximately 4765 feet AMSL. The elevation of the top of the berm protecting the reservoir on the downslope side is approximately 4768 feet AMSL; leaving approximately 3 feet of freeboard between normal pool elevation and an overflow condition. An overflow channel is set into the berm southeast of the reservoir, between the reservoir and White's Creek.

The reservoir was lined after construction with a 40 mil lining manufactured by Barber-Webb of Los Angeles, California. The lining is approximately 91,000 square feet in area and was installed on April 1, 1997. The purpose of the lining is to make the reservoir impervious to prevent leakage. The lining extends above normal pool elevation to the top of the berm. It was completely inspected and re-sealed in 1998. It was re-inspected by National Seal in early 2001. The lining was in good condition and no maintenance was required. The inspection is performed every 3 years, and will next occur during the winter months of 2004.

As indicated above, the reservoir is located very near the crossing of Steamboat Ditch and White's Creek. It is our understanding that the threat of release of effluent from the reservoir to White's Creek or Steamboat Ditch during flood events can be minimized by maintaining a low volume of effluent in the reservoir during the flood-prone winter and early spring seasons. It is also our understanding that irrigation is not generally required during these months, which will allow the reservoir level to be lowered without an adverse effect on the golf course. The irrigation intensive months are March through October. During these months the storage reservoir will be in use and at or near capacity. During the winter and early spring the storage reservoir will be drawn down to approximately half its capacity. On

an annual basis during the spring draw down, before the reservoir volume is brought up to capacity, the pumps, piping, and appurtenances associated with the reservoir will be inspected by the superintendent.

D. Soils

The Property lies in the eastern foothills of the Carson Range, near the boundary between the Sierra Nevada and the Basin Ranges. Regionally, the geology is composed of regionally and thermally metamorphosed and eroded basement rocks overlain by Cenozoic age volcanic and sedimentary rocks. Basement rocks are most likely Mesozoic in age. Regional Cenozoic igneous rocks are present in the form of the Hartford Hill rhyolite tuff, the Alta Formation, the Davidson Granodiorite, and the Kate Peak Formation. The sedimentary, Pliocene age Truckee Formation was deposited in structural basins in and around the volcanic hills. The later volcanic events including the Lousetown Formation were probably completed by late Pliocene or early Pleistocene time. At least four glaciation events occurred in the Carson Range, depositing along the range front the alluvium and landslide debris on which the golf course now rests (Thompson and White 1964).

The *Mt. Rose NE Quadrangle Geologic Map* (Bonham and Rogers 1983) indicates the Property is located on Quaternary period fan sediments. The vast majority of the Property is located on *Donner Lake Outwash – Mount Rose Fan Complex* (Qdm). This unit is composed of "pediment and thin fan deposits from major streams draining alpine glaciers on Mount Rose; brown to brownish-gray, sandy, muddy, poorly sorted large pebble gravel; cobbles and small boulders common. Clasts dominantly volcanic (porphyritic andesite and latite); surface granitic clasts rare. Deeply weathered, strongly developed soil profile...well cemented and/or hydrothermally altered in Steamboat Hills area."

A thin strip of Quaternary age *alluvial bajada deposit* (Qa) is present on the Property along the bed of White's Creek. Bonham and Rogers describe this deposit as "thin sheet-like aprons of fine- to medium-grained clayey sand and intercalated muddy, medium pebble gravel; deposits of low gradient streams that reworked older gravelly outwash and alluvial fan deposits; weakly weathered and largely undissected. Little or no soil development (entisols)."

At the south boundary of the Property, where White's Creek enters the golf course, is a wedge of *Tahoe Outwash – Mount Rose Fan Complex* (Qtm). This unit is described as "glacial outwash stream deposits of volcanic and granitic composition; light yellowish- to orange-brown; sandy large cobble to boulder gravel containing characteristically fresh granitic lag gravel. Strongly developed 1 m (3 ft) thick soil profile; dark yellowish-brown, prismatic argillic B-horizon; typically no siliceous or calcic duripan development; granitic boulders partly to thoroughly decomposed where buried in soil. Deposits locally only thin veneers; some undifferentiated areas."

Studies completed by the U.S. Department of Agriculture Soil Conservation Service, indicate that the native soils at the Property are predominantly of the Oest Series. This is a deep, well-drained soil on terraces, alluvial fans, and escarpments formed in alluvium derived from mixed rock sources. Oest Series soil on the golf course prior to construction would typically have had 15 to 50 percent of the surface covered with stones. The surface layer is a grayish-brown extremely stony to very bouldery sandy loam 8 to 15 inches thick. The subsoil is a brown very gravelly sandy loam approximately 25 to 32 inches thick. The substratum is a pale brown very gravelly loamy sand that extends to approximately 60 inches (Soil Conservation Service, 1983).

III Design Items

A. Nitrogen and Water Budgets

Nitrogen and water use at the golf course during the 1999 season were presented in the June, 2000 *Application* based on information supplied by Wolf Run Golf Course personnel. Approximately 131,000,000 (one hundred thirty-one million) gallons of water were used during the 1999 irrigation season. Approximately 27,000 (twenty-seven thousand) pounds of nitrogen were applied through the use of fertilizers during the same period.

The original *Application* submitted in June, 2000 included analytical results for effluent from the STMWTF from March 1997 through April 1998. During that period, the average nitrogen concentration in the effluent was 2.47 mg/l. The maximum nitrogen concentration during that period was 6.4 mg/l. Based on the volume of irrigation water used in the previous season, treated effluent would deliver 2,700 pounds of nitrogen based on the average nitrogen concentration in the effluent, and 7,000 pounds of nitrogen based on the maximum nitrogen concentration in the effluent.

Attached to the November, 2000 NDEP letter were the *Plant Consumptive Use Worksheet* and the *Nitrogen Loading Limit Worksheet*. These worksheets calculate water use based on crop water and nitrogen requirements. The worksheets take into account such factors as evapotranspiration rate, precipitation rate, leaching requirement, irrigation system efficiency, salinity tolerance of crop, salinity of effluent, crop nitrogen uptake rate, nitrogen concentration in effluent, and fraction of nitrogen removed by denitrification and volatilization.

Data used in the calculations were gathered from a number of sources. Base evapotranspiration rates for the Reno area were obtained from Nevada Bureau of Mines & Geology Report 48, *Statewide Potential Evapotranspiration Maps for Nevada* (Shevenell, 1996). Crop coefficients for turfgrass were estimated from information provided by representatives of the University of Nevada Cooperative Extension. The precipitation rate is from the Western Regional Climate Center with a period of record from March 1937 to July, 2000. Irrigation system efficiency, nitrogen uptake rates, estimates of nitrogen concentration in percolating water, and denitrification/volatilization rates are from *Wastewater Engineering* (Metcalf & Eddy, 1992). Salinity tolerances for turfgrass are from *Wastewater Reuse for Golf Course*

Irrigation (United States Golf Association, 1994). Washoe County Department of Water Resources supplied the estimate for salinity of applied effluent.

Based on information from the above sources, the *Plant Consumptive Use Worksheet* (Worksheet 1-A) indicates water use to be approximately 124,000,000 (one hundred twenty-four million) gallons of water per year. The *Nitrogen Loading Limit Worksheet* (Worksheet 2-A) indicates water use to be approximately 1,500,000,000 (1.5 billion) gallons of water per year. Consequently, the *Consumptive Use Requirement Worksheet* (Worksheet 1-B) was used to re-calculate the maximum loading rate based on plant water use requirements. Using monthly evapotranspiration rates based on a yearly total of 60 inches and a crop coefficient of 0.8, the *Consumptive Use Requirement Worksheet* indicated yearly water consumption to be approximately 126,000,000 (one hundred twenty-six million) gallons. Calculation sheets are included as Appendix E.

As mentioned above, the golf course consists of approximately 81 irrigated acres. These acres are planted with three types of grass. Greens (3.5 acres) are bent grass; tee boxes (18 acres) are rye grass; fairways (59.5 acres) are a blue grass/rye grass blend. Each of these grass types is fertilized at different rates. The fertilizing season at Wolf Run Golf Course normally starts in March and extends through October. Greens are fertilized on a two-week interval from March through October for a total of sixteen fertilizing episodes. Tees are fertilized every three weeks from April through October for a total of approximately ten fertilizing episodes. Fairways are fertilized monthly from April through October for a total of seven fertilizing episodes. Fertilizers include a wide variety of brands and nitrogen sources. Both organic and synthetic fertilizers are consistently used.

Wolf Run is currently applying nitrogen to greens at a rate of 6 to 8 pounds per 1000 square feet per year. This is equivalent to an application rate of approximately 260 to 350 pounds per acre-year (lbs/ac-yr). Nitrogen is being applied to tees and fairways at a rate of 4 to 6 pounds per 1000 square feet per year. This is equivalent to an application rate of 175 to 260 lbs/ac-yr.

Worksheet 2-C was completed for each of the three grass types using effluent application rates calculated in the *Consumptive Use Requirement Worksheet* (Worksheet 1-B). The nitrogen concentration in the effluent was taken to be 6.4 mg/l, the maximum concentration from the STMWTF data presented in the June, 2000 *Application*. Based on these values, effluent supplies approximately 68 pounds per acre-year (lbs/ac-yr) to the bent grass greens, approximately 66 lbs/ac-yr to the rye grass tees, and approximately 67 lbs/ac-yr to the bent/rye grass blend fairways. The nitrogen uptake rate for the greens is approximately 450 lbs/ac-yr, while the uptake rate for tees and fairways is approximately 180 lbs/ac-yr. Consequently, it appears that 20% to 25% of the nitrogen uptake rate is supplied to greens through effluent application, and one-quarter to slightly over one-third of the nitrogen uptake rate is supplied to tees and fairways through the same process. It should be noted, however, that this is based on the maximum nitrogen concentration recorded in the effluent water. Monthly or quarterly average nitrogen concentrations in the effluent should be used

henceforth in the calculations associated with Worksheet 2-C. Given the effluent concentration and application rates, the rate of fertilizer application can be adjusted monthly to the nitrogen uptake rates of the various grasses. The Worksheets and blank Worksheet 2-Cs for greens, tees, and fairways are included in Appendix E for use by the superintendent and golf course staff. A conversion for pounds of nitrogen per 1000 square feet to pounds of nitrogen per acre is included on the bottom of the blank worksheets.

B. Pumps and Piping

The Nevada Administrative Code (NAC) 445A.276 provides requirements for bacteriological quality and buffer zone limitations for use with spray irrigation systems such as are in use at Wolf Run Golf Course. Effluent water for irrigation is provided by the Washoe County Department of Water Resources Utility Services Division from the STMWTP. The plant operates under NDEP Discharge Permit NEV40024. It is our understanding that the conditions of that permit are such that the effluent water is of category "C" from NAC 445A.276, and no buffer zone is required. In addition, irrigation and routine maintenance can be performed during regular working hours, provided the public is excluded from the area.

Treated effluent is supplied to the golf course through the irrigation system that was installed at the time of original construction. Cross-connection controls are in place, and have been inspected and approved by the water purveyor (Washoe County Utility Services Division). A letter to that effect is attached as Appendix F.

The irrigation season at Wolf Run Golf Course generally runs from March through October each year. Irrigation cycles are from 9:00 PM to 7:00 AM seven days per week. Hand watering is done during the day on an as-needed basis. The irrigation system currently consists of approximately 1,700 valve-in-head sprinklers using 67 controllers separated into 32 groups. Sprinkler times range from 3 to 25 minutes per station depending on evapotranspiration rates. White's Creek is downslope from the majority of the golf course and will therefore receive run-off from the golf course during storm or flood events.

A variety of sprinklers are in use at the golf course. Communication with representatives of Wolf Run indicate that the majority are manufactured by Toro Irrigation Products, and are the 650/670 Series or equivalent. Based on information published by the manufacturer and provided by Wolf Run Golf Course personnel, the sprinklers distribute water at approximately 40 gallons per minute (gpm).

At the time of submittal of the initial *Application*, approximately 100 of the sprinkler heads were within a water distribution radius of White's Creek, and irrigation water could be introduced directly to the creek during watering cycles. Communication with Wolf Run personnel indicates these sprinklers have been changed by the golf course to half- and quarter-circles to prevent irrigation water discharge to the creek. A plan of the irrigation system at Wolf Run is included as Plate 3.

C. Flow Monitoring & Communication

A Washoe County flow meter is installed on the pipeline that supplies effluent to the golf course. Readings are collected from the meter on a monthly basis. Water use records are submitted quarterly as part of the Discharge Monitoring Reports (DMRs) submitted to NDEP.

Effluent delivery from the Washoe County facility to the Wolf Run Golf Course is substantially automated. High- and low- water level transducers are installed in the wet well at the pump station near the effluent reservoir. The transducers are connected via telemetry to a monitoring system at Washoe County Utility Services Division. A motor control valve at the County pump station is actuated based on water levels received from the transducers in the golf course wet well. The valve opens and closes at set water surface elevations. There is a high-water alarm at the County facility. The valve controlling effluent flow to the golf course can also be operated manually by County personnel.

Emergency reporting will vary depending on the incident. Malfunctions that do not result in the release of effluent will be reported to the maintenance supervisor. Unauthorized releases of effluent will be stopped as quickly as practicable by maintenance personnel. The release will be reported to the maintenance supervisor, who will then notify the proper authorities if applicable. Notification numbers are listed at the front of this document.

D. System Management

Effluent water is distributed through the system depicted on Plate 3 by both spray and drip irrigation. The vast majority of the water distribution is through spray irrigation, but four small drip systems were required when the full-circle sprinkler heads were exchanged for half- and quarter-circle heads. The drip systems are in place at the 10th tee, 11th green, 12th tee, and 15th tee. In addition, a number of quick-connects are present on the main irrigation lines for the use of hoses in hand watering. The quick-connects are locked when not in use.

As indicated above, irrigation generally runs from 9:00 PM to 7:00 AM during the irrigation season in order to prevent the public from coming into contact with treated wastewater. A wind monitoring system to automatically shut down watering when winds exceed 20 miles per hour continuously for more than 5 minutes is also being planned, but has not yet been implemented. Discussions with Wolf Run personnel indicate that new controllers are being purchased, and a high-wind shut-off provision will be built into the system at that time.

Both spray and drip irrigation systems are set and operated to prevent ponding and run-off. No flood irrigation is used. Maintenance personnel are aware that ponding is an undesirable condition, and will report it to the superintendent if it is encountered. Sprinkler heads, lines, and nozzles are inspected on a regular basis to ensure the system is in proper adjustment. Should ponding occur, it is remedied through either sprinkler station timing or sprinkler head adjustment. There are no drinking fountains on the golf course, but water coolers in individual shelters are covered during irrigation.

Public notification of the use of treated effluent at the Property is accomplished through the use of signs. They are located near the entrance to Wolf Run Golf Course and in visible locations throughout the course. The warning will also be printed on scorecards. An example of the text is below:

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In addition, a worker hygiene fact sheet containing information about treated effluent is posted in landscaping and maintenance areas. The sheet is intended to notify workers of the hazards of working with treated effluent, and provide general guidelines for worker protection. An example of the sheet is included in Appendix G.

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Information concerning effluent and fertilizer usage can be obtained from Worksheet 2-C, included in Appendix E.

V References

Bonham, H. F. *Geology and Mineral Deposits of Washoe and Storey Counties, Nevada.* Reno: Nevada Bureau of Mines & Geology, University of Nevada, Reno, 1969.

Bonham Jr., H.F. and David K. Rogers. *Mt. Rose NE Quadrangle Geologic Map.* Reno: Nevada Bureau of Mines & Geology, University of Nevada, Reno, 1983.

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United States Golf Association. *Wastewater Reuse for Golf Course Irrigation.* Boca Raton: Lewis Publishers. 1994.

VI Distribution

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VII Appendices

Appendix A: *Effluent Discharge Report to Accompany Nevada Groundwater Discharge Permit Application, Wolf Run Golf Course, Reno, Nevada* (June 23, 2000)

Appendix B: *Estimate of White's Creek flow volume at Wolf Run Golf Course resulting from a 25-year 24-hour precipitation event, Wolf Run Golf Course, Reno, Nevada* (March 28, 2001)

Appendix C: Nevada Division of Environmental Protection *Authorization to Discharge*, Permit No. NEV98018

Appendix D: *Agreement for Reclaimed Water Service by Washoe County to Wolf Run Golf Course* (March, 2000)

Appendix E: *Plant Consumptive Use Worksheet* (Worksheet 1-A), *Nitrogen Loading Limit Worksheet* (Worksheet 2-A), *Consumptive Use Requirement Worksheet* (Worksheet 1-B), and Worksheet 2-C

Appendix F: Washoe County Utility Services Division cross-connection control letter

Appendix G: Example *Worker Hygiene Fact Sheet*

VIII Plates

Plate 1: Property Location Map
Plate 2: Wolf Run Golf Course
Plate 3: Wolf Run Golf Course Irrigation System

EFFLUENT DISCHARGE REPORT TO ACCOMPANY

NEVADA GROUNDWATER DISCHARGE PERMIT APPLICATION

WOLF RUN GOLF COURSE

RENO, NEVADA

Prepared For

Golf Vision
1400 Wolf Run Road
Reno, Nevada 89511

Job No. 2281.17-B

June 23, 2000

Pezonella Associates, Inc.
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June 23, 2000
Job No. 2281.17-B

Golf Vision
1400 Wolf Run Road
Reno, Nevada 89511

Attn: Mr. Ron Gribble

Nevada Groundwater Discharge Permit Application and Attachments
Wolf Run Golf Course
1400 Wolf Run Road
Reno, Nevada

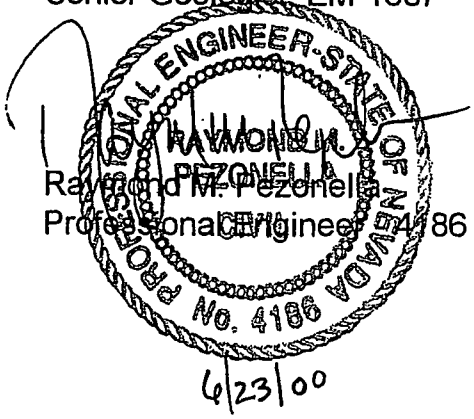
Please find attached a *Nevada Groundwater Discharge Permit Application* for the use of treated effluent for irrigation at the Wolf Run Golf Course. In addition to the *Application*, this packet includes attachments concerning site-specific issues raised during the investigation phase of the project. The *Application* and attachments should be forwarded to the Nevada Division of Environmental Protection for review.

We appreciate having been selected to prepare this application and trust that the results meet your needs at this time. If you have any questions or require further information, please do not hesitate to contact us.

Respectfully,

PEZONELLA ASSOCIATES, INC.

John H. Johnson
Senior Geologist, EM-1507



Raymond M. Pezonella
Professional Engineer 4186

6/23/00

EFFLUENT DISCHARGE REPORT TO ACCOMPANY

NEVADA GROUNDWATER DISCHARGE PERMIT APPLICATION

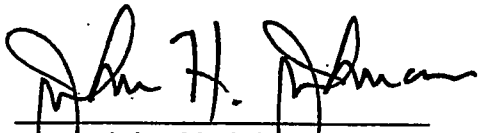
WOLF RUN GOLF COURSE

RENO, NEVADA

Prepared For

Golf Vision
1400 Wolf Run Road
Reno, Nevada 89511

By



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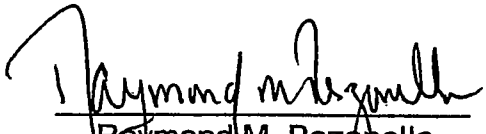

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June 23, 2000

Job No. 2281.17-B

CONTENTS

TABLES

I. Introduction:

Wolf Run Golf Course is located at 1400 Wolf Run Road, Reno, Washoe County, Nevada (Property). The Property lies between Zolezzi Lane to the north and Arrowcreek Parkway to the south. It is approximately one mile west of South Virginia Street. The Property lies entirely within Section 19, Township 18 North, Range 20 East, Mount Diablo Baseline & Meridian, and is on the *Mount Rose NE Quadrangle*, of the United States Geological Survey (USGS) 7.5-minute topographic map series.

The Property lies in the eastern foothills of the Carson Range, near the boundary between the Sierra Nevada and the Basin Ranges. Regionally, the geology is composed of regionally and thermally metamorphosed and eroded basement rocks overlain by Cenozoic age volcanic and sedimentary rocks. Basement rocks are most likely Mesozoic in age. Regional Cenozoic igneous rocks are present in the form of the Hartford Hill rhyolite tuff, the Alta Formation, the Davidson Granodiorite, and the Kate Peak Formation. The sedimentary, Pliocene age Truckee Formation was deposited in structural basins in and around the volcanic hills. The later volcanic events including the Lousetown Formation were probably completed by late Pliocene or early Pleistocene time. At least four glaciation events occurred in the Carson Range, depositing along the range front the alluvium and landslide debris on which the golf course now rests (Thompson & White, 1964).

The golf course was built in 1996 and includes approximately 81 acres of irrigated turf. Water for culinary and irrigative uses is currently supplied through Washoe County, and is supplemented with water from the Steamboat Ditch and White's Creek, both of which flow through the Property. It is, however, the intention of Washoe County Utility Services Division to conserve the potable water supply for domestic use, and see the golf course use reclaimed water for irrigation. The source of the reclaimed water will be the South Truckee Meadows Sewer Treatment Plant currently in operation on Arrowcreek Parkway, a few hundred yards southeast of the golf course. The use of reclaimed water for irrigation is addressed in the Nevada Administrative Code (NAC) 445A.275 to 445A.280 inclusive. General requirements and restrictions for reclaimed water use include the approval of an effluent management plan, and acquisition of a discharge permit in compliance with NAC 445A.228 to 445A.263, inclusive. This report presents information regarding issues concerning the use of treated effluent at Wolf Run Golf Course, and is submitted in support of the application for a discharge permit.

Wolf Run is an 18-hole championship golf course that includes approximately 3.5 acres of bent grass (*Argrostis capillaris*); 18 acres of rye grass (*Lolium perenne*), and 59.5 acres of a blue grass (*Poa pratensis*) and rye grass blend. Approximately 4,500 feet of White's Creek flows through the eastern portion course from south to north. Approximately 4,200 feet of the Steamboat Ditch flows through the north half of the Property from west to east. The ditch carries water only part of each year, typically May through October. White's Creek crosses the Steamboat Ditch through a corrugated steel culvert near the center of the golf course. A

pond used to store irrigation water is also located in this area, near the center of the golf course. The location of the Property is depicted on Plate 1. Details of the Property are depicted on Plates 2 & 3. An aerial photograph of the golf course is attached.

II. Issues of Concern:

A *Nevada Groundwater Discharge Permit Application Form* and fee in the name of the Wolf Run Golf Club at Fieldcreek Ranch were submitted to the Nevada Division of Environmental Protection, Bureau of Water Pollution Control on September 3, 1998. Review and assessment of the *Application* raised a number of issues related to the use of reclaimed water at the Property. These issues include: the proximity of culinary water supply wells and White's Creek to areas of proposed reclaimed water use; the location of the irrigation storage reservoir within the 100-year floodplain; and the differentiation of stormwater discharge to White's Creek between runoff from Fieldcreek Ranch and Wolf Run Golf Course. It is the purpose of this document to address these issues in a manner sufficient to satisfy the requirements of the Bureau of Water Pollution Control and allow the discharge permit to be issued.

A. Water Supply Wells

According to documentation available from the NDEP Bureau of Water Quality Planning, the State Wellhead Protection Program "...is a voluntary program that encourages local governments, communities, and utility companies to take systematic preventative measures to protect their underground drinking water sources. The basic idea of wellhead protection is to reduce the risk of ground water contamination by managing potential sources of contamination. A community must determine the land surface area around a water supply well, called the wellhead protection area (WHPA), that should be protected. Before a plan or program can be developed, it is important to identify the existing and potential threats to the ground water. Then the WHPA should be managed to protect the ground water."

On and adjacent to the golf course are three water supply wells operated by the South Truckee Meadows General Improvement District (STMGID). One of the wells (STMGID #3) is located on the golf course property north of the irrigation pond near the crossing of White's Creek and the Steamboat Ditch. The other two wells are located off the golf course property, slightly to the east. Well STMGID #1 is located immediately south of Zolezzi Lane, approximately 500 feet east of the 11th green. Well STMGID #2 is located approximately 2,000 feet south of Zolezzi Lane, and approximately 600 feet east of the 13th tee.

It is our understanding that the lead agency for the State Wellhead Protection Program as it may relate to the STMGID wells and the Wolf Run Golf Course is the Washoe County Department of Water Resources (WCDWR). As part of this investigation, that agency was contacted concerning possible WHPA issues arising from the proposed use of treated

effluent at the Property. WCDWR personnel indicated that the presence of the STMGID wells on and adjacent to the golf course does not preclude the use of treated effluent. WCDWR requested an accounting of fertilizers regularly used at the golf course that they can be identified and monitored at the Property and its environs.

STMGID #3 is on golf course property. Both STMGID #1 and STMGID #2 are hydraulically downgradient of portions of the golf course. A map prepared by WCDWR indicating approximate 2-year, 5-year, and 10-year capture zones for the STMGID wells is attached as Plate 4. In addition to golf course property, the capture zones indicated on the WCDWR map also include approximately 150 residential lots and 1½ miles of streets in the Fieldcreek development.

An investigation into the lithology and construction of the STMGID wells was recently conducted at the Nevada Division of Water Resources office in Carson City, Nevada. According to records at that office, the three STMGID wells were drilled and installed by Charles Sargent Irrigation, Inc. in 1984. Lithologic and well construction details are included below. Copies of the well logs obtained from the Office of the State Engineer in Carson City are attached.

Records concerning fertilizer use on the golf course during the past year were obtained from Wolf Run Golf Course personnel. That information is also detailed below.

1. Lithology and Well Construction

The boring for well STMGID #1 was installed in March, 1984 and was drilled to a total depth of 620 feet. The well was installed to a total depth of 530 feet. It is 12-inches in diameter, and is screened from 260 to 520 feet below land surface. It was tested to 600 gallons per minute with a drawdown of 110 feet after 48 hours. The lithology is consistent with the expected fan-type deposit – a mixture of material sizes from silts and sands to boulders. The well driller's log notes water-bearing strata from approximately 200 to 540 feet below land surface. The well has a surface seal of 54 feet.

The boring for well STMGID #2 was installed in April, 1984 and was drilled to a total depth of 715 feet. The well was installed to a total depth of 515 feet. It is 22-inches in diameter, and is screened from 255 to 505 feet below land surface. It was tested to 179 gallons per minute with a drawdown of 92½ feet after 23½ hours. The lithology is similar to that from STMGID #1. The well driller's log notes water-bearing strata from approximately 135 to 680 feet below land surface. The well has a surface seal of 88 feet.

The boring for well STMGID #3 was installed in August and September, 1984 and was drilled to a total depth of 590 feet. The well was installed to a total depth of 580 feet. It is 14-inches in diameter, and is screened from 240 to 580 feet below land surface. It was tested to 385 gallons per minute, and had a drawdown of 73 feet after 43½ hours at 300 gallons per

minute. The lithology of the materials encountered in STMGID #3 includes finer material than that from STMGID #1 and #2. similar to that from STMGID #1. The well driller's log notes water-bearing strata from approximately 135 to 680 feet below land surface. The well has a surface seal of 88 feet.

The *Mt. Rose NE Quadrangle Geologic Map* (Bonham & Rogers, 1983) indicates the Property is located on Quaternary period fan sediments. The vast majority of the Property, including the three STMGID wells, is located on *Qdm*, or Donner Lake Outwash – Mount Rose Fan Complex. This unit is composed of "pediment and thin fan deposits from major streams draining alpine glaciers on Mount Rose; brown to brownish-gray, sandy, muddy, poorly sorted large pebble gravel; cobbles and small boulders common. Clasts dominantly volcanic (porphyritiic andesite and latite); surface granitic clasts rare. Deeply weathered, strongly developed soil profile...well cemented and/or hydrothermally altered in Steamboat Hills area."

A thin strip of alluvial bajada deposit (*Qa*) is present on the Property along the bed of White's Creek. Bonham & Rogers describe this deposit as "thin sheet-like aprons of fine- to medium-grained clayey sand and intercalated muddy, medium pebble gravel; deposits of low gradient streams that reworked older gravelly outwash and alluvial fan deposits; weakly weathered and largely undissected. Little or no soil development (entisols)."

At the south boundary of the Property, where White's Creek enters the golf course, is a wedge of *Qtm*, or Tahoe Outwash – Mount Rose Fan Complex. This unit is described as "glacial outwash stream deposits of volcanic and granitic composition; light yellowish- to orange-brown; sandy large cobble to boulder gravel containing characteristically fresh granitic lag gravel. Strongly developed 1 m (3 ft) thick soil profile; dark yellowish-brown, prismatic argillic B-horizon; typically no siliceous or calcic duripan development; granitic boulders partly to thoroughly decomposed where buried in soil. Deposits locally only thin veneers; some undifferentiated areas."

Studies completed by the U.S. Department of Agriculture Soil Conservation Service, indicate that the native soils at the Property are predominantly of the Oest Series. This is a deep, well-drained soil on terraces, alluvial fans, and escarpments formed in alluvium derived from mixed rock sources. Oest Series soil on the golf course prior to construction would typically have had 15 to 50 percent of the surface covered with stones. The surface layer is a grayish-brown extremely stony to very bouldery sandy loam 8 to 15 inches thick. The subsoil is a brown very gravelly sandy loam approximately 25 to 32 inches thick. The substratum is a pale brown very gravelly loamy sand that extends to approximately 60 inches (Soil Conservation Service, 1983).

2. Fertilizer Use

As mentioned above, the golf course consists of approximately 81 irrigated acres. These acres are planted with three types of grass. Greens (3.5 acres) are bent grass; tee boxes (18 acres) are rye grass; fairways (59.5 acres) are a blue grass/rye grass blend. Each of these grass types is fertilized at different rates. The fertilizing season at Wolf Run Golf Course normally starts in March and extends through October. Greens are fertilized on a two-week interval from March through October for a total of sixteen fertilizing episodes. Tees are fertilized every three weeks from April through October for a total of approximately ten fertilizing episodes. Fairways are fertilized monthly from April through October for a total of seven fertilizing episodes. Fertilizers include a wide variety of brands and nitrogen sources. Both organic and synthetic fertilizers are consistently used.

Fertilizers are generally identified by the nitrogen, phosphorus, and potassium (NPK) content as the primary components. For example, a fertilizer identified as 24-5-11 contains 24% nitrogen, 5% phosphorus, and 11% potassium. Secondary nutrients include calcium, magnesium, sulfur, iron, manganese, boron, zinc, copper, and chlorine. Fertilizer application rates are determined by the amount of nitrogen desired for each grass type. According to information provided by Wolf Run Golf Course personnel, greens are fertilized at a rate of one-half pound nitrogen per 1,000 square feet of turf per fertilizing episode. Tees and fairways are fertilized at a rate of one pound nitrogen per 1,000 square feet of turf per fertilizing episode. During the past year, fertilizer formulations used on greens included 6-2-0, 14-2-14, 13-2-13, 19-5-19 and 5-11-0. Formulations used on tees included 25-5-11, 14-2-14, 21-0-0, 25-5-5, 16-6-8, 15-15-15, and 6-2-0. Formulations used on fairways included 24-5-11, 21-0-0, 25-5-5, 16-6-8, and 15-15-15. The table below summarizes fertilizer use over the past year at Wolf Run Golf Course.

Table 1: Approximate annual nitrogen application rate

	Acres	*Square feet (1000's)*	*Nitrogen per 1000 square feet (pounds)*	*Total Nitrogen per fertilizing episode (pounds)*	*Fertilizing episodes per year*	*Total Nitrogen per year (pounds)*
Greens	3.5	152	0.5	76	16	1,216
Tees	18	784	1.0	784	10	7,840
Fairways	59.5	2,592	1.0	2,592	7	18,144
TOTAL						**27,200**

The approximate amount of phosphorus and potassium applied to the golf course over the past year can be estimated from the fertilizer formulations and the nitrogen application rate. Since the exact weight of each formulation used over the past year is not known, an average phosphorus and potassium weight percent is used in the calculations. The average weight percent nitrogen was calculated for each grass type. The number of pounds of fertilizer applied to arrive at the required weight of nitrogen was then calculated. The weight of

phosphorus and potassium for that weight of fertilizer was used to estimate annual phosphorus and potassium application rates. Tables summarizing those calculations are included below.

Table 2: Normalized annual weight of fertilizer

	Annual Nitrogen requirement (pounds)	*Average fertilizer Nitrogen concentration (%)*	*Weight of fertilizer required to provide annual Nitrogen requirement (pounds)*
Greens	1,216	11	11,054
Tees	7,840	17	46,117
Fairways	18,144	20	90,720

Table 3: Approximate annual phosphorus and potassium application rates

	Normalized annual weight of fertilizer (pounds)	*Average fertilizer Phosphorus concentration (%)*	*Average fertilizer Potassium concentration (%)*	*Total Phosphorus per year (pounds)*	*Total Potassium per year (pounds)*
Greens	11,054	4	9	442	995
Tees	46,117	5	8	2,305	3,689
Fairways	90,720	6	8	5,443	7,258
TOTAL				**8,190**	**11,942**

Based on the calculations presented above, it appears that approximately 27,200 pounds of nitrogen, 8,200 pounds of phosphorus, and 11,900 pounds of potassium were delivered to the golf course turf through fertilizer application last year.

B. White's Creek

White's Creek rises from White's Canyon on the north flank of Mt. Rose in the Carson Range. There are also contributions from drainages on the east flank of Alpine Walk Peak immediately north of Mt. Rose. The creek debouches onto the Pre-Lake Lahontan alluvial fan approximately ½-mile north of the Mt. Rose Highway (Nevada 431), and flows slightly north of east in a single channel for approximately 3 miles. The natural channel divides into four smaller channels at this point in the eastern portion of Section 30, Township 18 North, Range 20 East at White's Creek Park. However, a concrete flow control structure restricts creek flow into just two of the channels. One of these flows north-northeast along the base of a small bluff for approximately ½ mile before passing through culverts under Arrowcreek Parkway and onto the Wolf Run Golf Course.

The NAC defines water quality standards for various bodies of water in the State of Nevada. *Class B waters* are defined in NAC 445A.125 as "waters of portions of waters which are

located in areas of light or moderate human habitation, little industrial development, light-to-moderate agricultural development and where the watershed is only moderately influenced by man's activity. Class B waters include standards for floating and settleable solids, sludge deposits, sewage, industrial wastes, odor-producing substances, toxic materials, pH, dissolved oxygen, temperature, fecal coliform, phosphates, and total dissolved solids. The definition of Class B waters from NAC 445A.125 is attached.

White's Creek is designated as Class B waters from below the east line of Section 33, Township 18 North, Range 19 East, Mount Diablo Baseline & Meridian. This designation includes the portions of the creek present on the Wolf Run Golf Course.

Wolf Run Golf Course was provided with analytical data by WCDWR from water samples collected from the South Truckee Meadows Sewer Treatment Plant (STMWTP). The data includes temperature, pH, biochemical oxygen demand, carbonaceous biochemical oxygen demand, total suspended solids, fecal coliform, nitrogen as ammonia, nitrogen as nitrate, total kjeldahl nitrogen, and total phosphorus. The samples were collected and analyzed between April, 1997 and March, 1998. Ditch temperatures did not exceed 70 degrees Fahrenheit during the period over which data is available. The pH did not exceed 8.0 or fall below 7.1. Samples were analyzed for nitrogen and phosphorus on a monthly basis. The table below lists the analytical results for pH, fecal coliform, total coliform, total nitrogen, and total phosphorus. Total nitrogen is composed of nitrite, nitrate, ammonia, and organic nitrogen. Where total nitrogen was not explicitly stated on the laboratory report, it was calculated. Laboratory reports are attached.

Table 4: South Truckee Meadows Sewer Treatment Plant effluent analytical data April, 1997 through March, 1998

Date	*pH*	*Fecal Coliform (#/100ml)*	*Total Coliform (MPN/100ml)*	*Total Nitrogen (mg/l)*	*Total Phosphorus (mg/l)*
4/1/97	7.5	2			
4/7/97		<2		1.4	3.44
4/8/97	7.7				
4/15/97		<1			
4/25/97		<1			
4/29/97	7.6	<1			
5/1/97				4.1	4.05
5/5/97		<1			
5/6/97	7.4				
5/13/97	7.6	<1			
5/19/97		<1			
5/20/97	7.6				
5/27/97	7.4	<1			
6/3/97	7.6				
6/5/97		<1			3.9

Table 4: South Truckee Meadows Sewer Treatment Plant effluent analytical data April, 1997 through March, 1998 (continued)

Date	*pH*	*Fecal Coliform (#/100ml)*	*Total Coliform (MPN/100ml)*	*Total Nitrogen (mg/l)*	*Total Phosphorus (mg/l)*
6/9/97		<1			
6/10/97	7.6				
6/16/97		<1			
6/17/97	7.5				
6/24/97	7.7				
6/25/97		<1			
6/30/97		<1			
7/1/97	7.8			3.0	3.3
7/7/97		<1			
7/8/97	7.6				
7/15/97	7.6	<1	5.1		
7/21/97		<1	9.2		
7/22/97	8.0				
7/28/97		1	23		
7/29/97	7.4				
8/5/97	7.7				
8/6/97		1	3.6	6.4	4.04
8/12/97	7.6				
8/13/97		<1	<2		
8/19/97	7.7				
8/22/97		<1	<2		
8/25/97		<1	<1.1		
9/2/97	7.6	<1	2.2		
9/8/97		4	12		
9/9/97	7.8				
9/16/97		<1	<1.1		
9/18/97	7.5				
9/23/97		1.1	6.9	2.9	3.68
9/25/97	8.0				
10/2/97	7.4			3.2	4.2
10/6/97		1.1	5.1		
10/9/97	7.5				
10/14/97		<1	2.2		
10/16/97	7.5				
10/22/97		4	<1.1		
10/23/97	7.5				
10/29/97	7.6				
11/5/97		<1.1	2.2		
11/6/97	7.1				
11/10/97		<1.1	2.2	1.41	3.73
11/13/97	7.8				
11/17/97		<1	6		
11/20/97	7.5				
11/25/97		<2			
11/27/97	7.8				
11/28/97	7.8				

Table 4: South Truckee Meadows Sewer Treatment Plant effluent analytical data April, 1997 through March, 1998 (continued)

Date	*pH*	*Fecal Coliform (#/100ml)*	*Total Coliform (MPN/100ml)*	*Total Nitrogen (mg/l)*	*Total Phosphorus (mg/l)*
12/1/97		1			
12/3/97	7.6			3.34	2.33
12/9/97		4.7			
12/11/97	7.7				
12/15/97		<1.1			
12/18/97	7.5				
12/22/97		<1			
12/26/97	7.4				
12/30/97		3			
1/5/98		<1			
1/9/98	7.4				
1/12/98		<1.1		2.51	2.33
1/15/98	7.7				
1/22/98	7.6				
1/23/98		8			
1/27/98		3			
1/29/98	7.6				
2/3/98		<1.1			
2/6/98	7.5				
2/10/98		<1.1			
2/12/98	7.7				
2/16/98		1		1.9	4.53
2/19/98	7.7				
2/24/98		<1			
2/26/98	7.8				
3/2/98		1			
3/5/98	7.5				
3/9/98		<2		2.48	4.45
3/10/98		<1			
3/12/98	7.4				
3/19/98	7.6				
3/26/98		<1			
3/30/98		<1			

The average total nitrogen concentration over the period was 2.47 mg/l. The average phosphorus concentration over the same period was 3.67 mg/l.

The irrigation schedule at Wolf Run Golf Course generally runs from March through October. During the 1999 irrigation season, the golf course used approximately 130 million gallons of water. A table indicating daily and monthly averages for that season is below.

Table 5: Wolf Run water use during 1999 irrigation season

Month	*Water Use (gallons)*	*Daily Average (gallons)*
January	0	0
February	0	0
March	2,350,000	76,000
April	3,750,000	125,000
May	19,200,000	619,000
June	22,600,000	753,000
July	28,100,000	906,000
August	25,500,000	823,000
September	17,100,000	570,000
October	9,300,000	300,000
November	2,500,000	83,000
December	666,000	21,000
TOTAL	**131,066,000**	**359,000**

The average concentrations of nitrogen and phosphorus from Table 4 and the volume of water used during the 1999 irrigation season can be used to calculate the amount of those nutrients available to the irrigated turf from effluent supplied by the STMWTP. Table 6 below summarizes the calculation and estimates the weights of nitrogen and phosphorus from the proposed effluent use.

Table 6: Annual nitrogen and phosphorus available from effluent

Gallons/year	*liters/year*	*Total N (mg/l)*	*Total P (mg/l)*	*N (mg)*	*P (mg)*	*N (lbs.)*	*P (lbs.)*
131,066,000	496,138,780	2.47	3.67	1,225,462,789	1,820,829,326	2,702	4,014

Based on fertilizer application rate and water use information from the 1999 season, and available analytical data from STMWTP, it appears that approximately one-tenth of the nitrogen demand and one-half of the phosphorus demand can be supplied through the use of treated effluent on the golf course.

1. Sprinkler Use

Irrigation cycles at Wolf Run are from 9:00 PM to 7:00 AM seven days per week. Hand watering is done during the day on an as-needed basis. The irrigation system consists of approximately 2,000 valve-in-head sprinklers using 62 controllers separated into 4 separate zones. Sprinkler times range from 3 to 25 minutes per station depending on evapotranspiration rates.

A variety of sprinklers are in use at the golf course. Communication with representatives of Wolf Run indicate that the majority are manufactured by Toro Irrigation Products, and are the 650/670 Series or equivalent. At this writing, most of the sprinklers are of the full-circle type.

Based on information published by the manufacturer and provided by Wolf Run Golf Course personnel, the sprinklers each distribute water at approximately 40 gallons per minute (gpm).

At this writing, approximately 100 of the sprinkler heads are within a water distribution radius of White's Creek. Irrigation water can consequently be introduced directly to the creek during watering cycles. These sprinklers will eventually be changed by the golf course to half- or quarter-circles to prevent irrigation water discharge to the creek.

At a sprinkler rate of 40 gpm, 100 sprinklers distribute 4,000 gpm. A sprinkler cycle of 20 minutes per day through a 10 month irrigation season would yield approximately 4,500 minutes of irrigation, or a total of 24 million gallons. Should 10% of the irrigation water be discharged directly to White's Creek, approximately 2.4 million gallons enter the creek through irrigation. Using the average concentration of phosphorus from above, this equates to an annual contribution of approximately 74 pounds of phosphorus to White's Creek from irrigation with treated effluent. Using the low average flow rate of 6.5 cfs from the USGS gaging station data (see *Irrigation Schedule*, below), over the 10-month irrigation season this 74 pounds would be distributed through approximately 1.5 billion gallons of water. Evenly distributed over this time frame, the average concentration would be approximately 0.007 mg/l, approximately 3 orders of magnitude below the total phosphates limit for Class B waters from NAC 445A.125. It is our opinion that this is a conservative estimate in that we have used a relatively long sprinkler cycle time (20 minutes per station), a relatively low flow rate for White's Creek (6.5 cfs). Should the calculation be performed at a sprinkler cycle time of 25 minutes with 100% of the flow entering White's Creek, The average phosphorus concentration over the 10-month irrigation season would still be only approximately 0.08 mg/l. Calculation sheet is attached.

1. Run-off & Storm Drains

As can be see on the Plates, White's Creek is downslope from the majority of the golf course and will therefore receive run-off from the golf course during storm or flood events. Irrigation is performed in such a manner as to minimize run-off of irrigation water to the creek.

The portion of White's Creek that flows through the Wolf Run Golf Course also receives stormwater from the Fieldcreek Ranch subdivision. There are four outfalls from the subdivision into the creek on the golf course. The upstream outfall is located near the south property line on the creek at the bank supporting Arrowcreek Parkway. The second is located approximately 1,000 feet downstream, adjacent to the 15th fairway. The third outfall is located immediately east of the storage reservoir. The downstream outfall is located approximately 500 feet farther downstream, near the White's Creek crossing between the 12th and 18th holes.

Dissolved or suspended material entering White's Creek during precipitation events on the Wolf Run Golf Course can therefore be attributable to both the golf course and the subdivi-

sion. Should it be desirable to differentiate between contributions from the golf course and the subdivision, surface water sampling should be performed. Background samples can be collected at the upstream entrance of White's Creek to the golf course. Additional sampling can occur along the reach of the creek near the stormwater outfalls. During a precipitation event, the sampling can be duplicated, with additional samples collected directly from outfall discharge to the creek.

C. Storage Reservoir

Near the center of the golf course property is a storage reservoir used as a distribution point for irrigation water. The reservoir is located very near the crossing of Steamboat Ditch by White's Creek. Information provided by Wolf Run Golf Course personnel indicates the reservoir has a usable capacity of is approximately 2 million gallons. Water is introduced to the reservoir through either a gate from Steamboat Ditch or through a diversion from White's Creek. Should effluent use be approved at the golf course, effluent will be supplied through a pipeline from the STMWTP. Construction on the line is scheduled to start this fall and should be completed by December 31, 2000.

The Federal Emergency Management Agency (FEMA) administers the National Flood Insurance Program. Part of this program includes the identification and delineation of Special Flood Hazard Areas. These areas are those that are inundated by a 100-year flood, which is a flood volume that has a 1% chance of occurring during any year. Special Flood Hazard Areas are identified on Flood Insurance Rate Maps published by FEMA.

The portion of White's Creek on the Wolf Run Golf Course can be located on FEMA Flood Insurance Rate Map 32031C3170E, effective September 30, 1994. A copy of the map is attached as Plate 5. The area in the vicinity of the crossing of Steamboat Ditch by White's Creek is identified on the map as being in Zone A. Zone A is a Special Flood Hazard Area in which no base flood elevations have been determined. Consequently, the 100-year flood zone is more loosely defined in this area (Zone A) than in an area where base flood elevations have been determined (Zone AE). The exact boundaries of Zone A and the fact that base flood elevations have not been determined in this area may be a moot point since the golf course did not exist when the map was compiled. Grading associated with golf course construction has most likely altered the drainage into White's Creek on the golf course property. Nonetheless, the proximity of the reservoir to White's Creek ensures that it is most likely in the 100-year flood zone.

Should effluent be used for irrigation purposes at the Wolf Run Golf Course, it will be stored in the reservoir. The issues posed by this storage are that the effluent could negatively impact ground water quality, and may be released directly to White's Creek during a flood event.

1. Lining

The storage reservoir has an areal extent of approximately ½-acre. The elevation of the bottom of the pond is approximately 4758 feet above mean sea level (AMSL). The normal pool elevation is approximately 4765 feet AMSL. The elevation of the top of the berm protecting the reservoir on the downslope side is approximately 4768 feet AMSL; leaving approximately 3 feet of freeboard between normal pool elevation and an overflow condition. An overflow channel is set in to the berm southeast of the reservoir, between the reservoir and White's Creek..

The reservoir was lined after construction with a 40 mil lining manufactured by Barber-Webb of Los Angeles, California. The lining is approximately 91,000 square feet in area and was installed on April 1, 1997. The purpose of the lining is to make the reservoir impervious to prevent leakage. The lining extends above normal pool elevation to the top of the berm. It was completely inspected and re-sealed in 1998. The inspection is performed every 3 years, and will next occur during the winter months of 2001.

2. Irrigation Schedule

Investigation into "normal" flow volumes in White's Creek was conducted through the United States Geologic Survey (USGS) database. Two gaging stations were identified in the Truckee drainage basin on White's Creek. Daily flow volumes from the first station (Station No. 10349700) were available from October 1, 1961 through September 30, 1966. Daily flow volumes for the second (Station No. 10349710) were available from May 1, 1982 through September 30, 1982. Flow volumes at the first station ranged from 1.9 cubic feet per second (cfs) to one reading of 100 cfs. The average flow rate from the first station was 6.5 cfs. Flow volumes at the second station ranged from 7.0 cfs to 60 cfs. The average flow rate from the second station was 16.6 cfs. The USGS gaging station data is attached.

A copy of the *Preliminary White's Creek Basin Management Study (Second Draft)* was provided this office by a representative of the WCDWR. The study was performed by Cella Barr Associates of Sacramento, California and is dated April 4, 1994. The study area includes the portion of White's Creek from its bifurcation at White's Creek Park east to (then proposed) U.S. Highway 395. The study indicates that discharge during a 100-year flood event would be approximately 700 cubic feet per second in the branch of White's Creek that flows through Wolf Run Golf Course. The study indicates a zone approximately 250 feet wide along the creek would be flooded at depths of greater than 1 foot. It should be noted that the golf course was not in place during the study. A copy of the study is attached.

As indicated above, the reservoir is located very near the crossing of Steamboat Ditch and White's Creek. Although flood elevations for the FEMA map were generated using approximate methods only, the reservoir is most likely in the 100-year flood zone. The reservoir has a usable capacity of approximately 2 million gallons. Relocating the reservoir is problematic

and Wolf Run wishes to avoid that avenue if possible. It is our understanding that the threat of release of effluent from the reservoir during flood events can be minimized through management. That is, the reservoir can be allowed to remain in place, and the release threat can be minimized by maintaining a low volume of effluent in the reservoir during the flood-prone winter and early spring seasons. It is also our understanding that irrigation is not generally required during these months, which will allow the reservoir level to be lowered without an adverse effect on the golf course.

As indicated in Table 5, the irrigation intensive months are March through October. During these months the storage reservoir will be in use and at or near capacity. During the winter and early spring (the season when flood potential is at its highest) the storage reservoir will be drawn down to approximately half its capacity. This will leave approximately 1 million gallons in the reservoir. Using the average phosphorus concentration from above, 1 million gallons of effluent contains approximately 31 pounds of phosphorus. If the reservoir were to overflow during a flood event, it would first fill to capacity, then overflow. The 31 pounds of phosphorus would be distributed through approximately 2 million gallons prior to overflow. The Cella Barr Associates study referenced above indicates a flow volume of 700 cfs through the Wolf Run Golf Course during a 100-year flood event. It is assumed that during a 100-year flood event the reservoir would fill and then be mixed with the 700 cfs of White's Creek flow. Should this flood event occur, it would take approximately 2 hours of flood flow to dilute the phosphorus concentration in the storage reservoir to below the 0.1 mg/l limit for Class B waters. Calculations are attached

III. Conclusions:

The use of effluent as irrigation water is a necessity for the future of Wolf Run Golf Course. It is our opinion and the opinion of regulatory and affected agencies contacted concerning this project that the physical circumstances of the golf course should not preclude the use effluent for irrigation. This report has attempted to provide information intended to be supportive of the *Nevada Groundwater Discharge Permit Application.* Should the *Application* be approved, it will be included in an *Effluent Management Plan* also to be submitted to the NDEP for approval prior to the use of treated effluent at the golf course.

It is our understanding that in addition to the information provided herein, groundwater monitoring should be performed at the property prior to effluent use. Correspondence with representatives of Wolf Run Golf Course indicates that it is their understanding that three monitoring wells will be required. One of the monitoring wells will be installed near the entrance of White's Creek to the golf course property, the second will be installed near STMGID #3 near the center of the course. The third will be installed near the exit of White's Creek from the golf course. The installation and construction of the monitor wells will be in compliance with applicable regulations. The frequency and analytical methods of ground-water sampling is left to the discretion of the NDEP.

IV. Permit Application:

NEVADA GROUNDWATER DISCHARGE PERMIT APPLICATION FORM Permit #_____

(Must be accompanied by the appropriate fee as described in NAC445A.232)

1. **Owner/Responsible Party Information**

Name of Organization Athletic Association University of Nevada

Contact person(s) Rick Reviglio Phone number(s) 784-6900 Fax 784-4497

Mailing address University of Nevada, Intercollegiate Athletics/232

City Reno County Washoe State Nevada Zipcode 89557

NOTE: A separate permit application form must be completed for each discharging facility operated by the applicant.

2. **Facility/Site Information**

Facility name Wolf Run Golf Course

Contact person(s) Ron Gribble Phone number(s) 851-7720 Fax 851-4403

Street address/location 1400 Wolf Run Road

City Reno County Washoe State Nevada Zipcode 89511

Latitude _____ Longitude _____

Township 18 North MDBM Range 20East MDBM Section 19

If you are supplying effluent or biosolids to other sites, please provide the location for each:

Name _____ Permit # _____

Street Address/location _____

City _____ County _____ State _____ Zipcode _____

3. **Maps:** please include a topographic map and a site map showing the location of the proposed discharge and location c any existing or proposed groundwater monitoring wells.

4. 30 day average flow of discharge up to 1 in MGD (million gallons/day) _____ in gpm (gallons/min)

Maximum design flow _____ in MGD _____ in gpm

Does the 30 day average flow exceed 85% of the design flow? N/A If yes, then: Have plans for expansio been submitted for approval by the NDEP? _____ Date of submittal _____

If plans for expansion have not been submitted, please explain why: _____

5. Describe the activity producing the discharge. (Example - wastewater treatment, dewatering, cooling,manufacturing Also provide a Process Flow Diagram. Golf Course irrigation. Effluent supplied by South Truckee Meadows Water Treatment Plant

6. Describe the method of disposal or reuse application method (irrigation, percolation, evaporation, spray, disk, inject, etc.)

Spray & drip irrigation

7. Describe the treatment or process that will be used to meet the discharge limits. **For Biosolids Application only:** describe pathogen and vector control. N/A

A. Has NDEP approved the design of this treatment works? Yes_____ No _____

B. Does this facility have an approved Operations and Maintenance Manual or Effluent Management Plan?

Yes_____ No XX Date approved_____

8. Enter the average annual results of the parameters listed below **that may be present in the discharge and in the monitoring wells. Also attach copies of all Lab Analysis Reports. (For Biosolids Application only:** An analysis of arsenic, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium and zinc on a dry weight basis must accompany this application). From 4/97 to 3/98 STMWTP

BOD_5	2.5	Total Nitrogen as N	2.7
Total Suspended Solids	3.8	Kjeldahl Nitrogen as N	1.2
Total dissolved solids	N/A	Nitrate as N	1.4
Fecal coliform	1.3	Cyanide (as applicable)	N/A
pH (standard units)	7.6	Total Phosphorous	3.7
Chloride	N/A	Other	

Also include: Depth to groundwater Approximately 150' to 300'

Groundwater elevation Approximately 4550' to 4700'

GW flow direction Generally northeast

If lab reports indicate the presence of any of any **toxic materials** in the discharge – organics, solvents, total metals, petroleum products(this includes BTXE, MTBE and TPH) or other contaminants and pollutants – please complete **the attached sheet.** This table is a compilation of the materials listed in NAC445A.144 and the standards found in 40 CFR 141.

9. If, to the best of your knowledge, you expect that none of the analytes listed above will be present in your discharge and a lab analysis was not conducted, then please provide a brief explanation why you believe the listed analytes will not be present: The service area is primarily commercial and residential. There are no heavy industrial or agricultural contributions to the wastewater stream.

*RENEWAL APPLICANTS ONLY: Permittees renewing existing permits must also complete items 10 - 12.

List and briefly describe any changes to the production, treatment or disposal processes of the facility since the issuance of the last permit: N/A

11. List Discharge Monitoring Report (DMR) dates and parameters where the facility exceeded the permitted discharge limits (attach additional sheets if necessary): N/A

12. Submit graphs of the monitored parameters in the discharge and in the groundwater wells over the time period of the existing permit (e.g. - plot BOD_5 vs. month). The time scale should not be less frequent than the permitted sampling frequency. N/A

I certify that I am familiar with the information contained in the application and that to the best of my knowledge and ability such information is true, complete and accurate.

Richard J. Revich — Print Name of Applicant

Main President — Title

Richard J. Revich — Signature of Applicant

7/14/00 — Date of Signature

Any person who knowingly makes any false statement, representation or certification in any application, record, report, plan or other document filed or required to be maintained by the provisions of NAC 445.131 to 445.354, inclusive, or by any permit, rule, regulation or order issued pursuant thereto or who falsifies, tampers with or knowingly renders inaccurate any monitoring device or method required to be maintained under the provisions of NAC 445.131 to 445.354, inclusive, or by any permit, rule, regulation or order issued pursuant thereto, is guilty of a gross misdemeanor and shall be punished by a fine of not more than $10,000 or by imprisonment in the county jail for not more than 1 year, or by both fine and imprisonment.

Nevada Division of Environmental Protection
Bureau of Water Pollution Control Attention: Permitting
333 W. Nye Lane
Carson City, NV 89706-0851

V. References:

Bonham, H. F. *Geology and Mineral Deposits of Washoe and Storey Counties, Nevada.* Reno: Nevada Bureau of Mines & Geology, University of Nevada, Reno, 1969.

Bonham Jr., H.F. and David K. Rogers. *Mt. Rose NE Quadrangle Geologic Map.* Reno: Nevada Bureau of Mines & Geology, University of Nevada, Reno, 1983.

Cella Barr Associates. *Preliminary Whites Creek Basin Management Study (Second Draft).* Sacramento: Cella Barr Associates. 1994

Federal Emergency Management Agency. *Flood Insurance Rate Map, Washoe County, Nevada and Incorporated Areas.* Panel 3170 of 3350. 1994.

Jackson, Julia A., ed. *Glossary of Geology.* Alexandria: American Geological Institute, 1997.

Thompson, G.A. and D.E. White. *Regional Geology of the Steamboat Springs Area Washoe County, Nevada.* Geological Survey Professional Paper 458-A. Washington: U.S. Government Printing Office, 1964.

The Toro Company. *Toro Irrigation Products Catalog 1998-1999.* Riverside: The Toro Company. 1997.

The Toro Company. *Toro Irrigation Division Irrigation Products Illustrated Parts Breakouts 1999.* Riverside: The Toro Company. 1999.

United States Department of Agriculture, Soil Conservation Service. *Soil Survey of Washoe County, Nevada, South Part.* Washington: U. S. Government Printing Office, 1983.

———. *Mt. Rose NE Folio Soil Map.* Reno: Nevada Bureau of Mines & Geology, University of Nevada, Reno, 1977.

United States Geological Survey. *Mount Rose NE Quadrangle.* 7.5 Minute Series Map (Topographic). 1:24,000. Denver: USGS, 1994.

VI. Distribution:

2 copies:
Mr. Ron Gribble
Golf Vision
1400 Wolf Run Road
Reno, Nevada 89511
TEL (775) 851-7720
FAX (775) 851-4403

1 original, 1 copy:
Ms. Jennifer Carr
Nevada Division of Environmental Protection
Bureau of Water Pollution Control
333 West Nye Lane
Carson City, Nevada 89706-0851
TEL (775) 687-4670, Ext. 3141
FAX (775) 687-5856

1 copy:
Ms. Sylvia Harrison
McDonald Carano Wilson McCune
Bergin Frankovich & Hicks LLP
241 Ridge Street
Reno, Nevada 89509
TEL (775) 788-2000
FAX (775) 788-2020

VII. Attachments:

Attachment 1: Aerial Photograph
Attachment 2: STMGID Well Logs
Attachment 3: Class B waters from *NAC 445A.125*
Attachment 4: STMWTP Laboratory Reports
Attachment 5: USGS White's Creek Flow Data
Attachment 6: Phosphorus concentration calculation sheet
Attachment 7: *Preliminary White's Creek Basin Management Study (Second Draft)*

Arrowcreek Parkway

PINK—WELL DRILLER'S COPY

DIVISION OF WATER RESOURCES

WELL DRILLERS REPORT

PRINT OR TYPE ONLY — **Please complete this form in its entirety**

Log No. 25725
Permit No. 47066, 52862
Basin TRUCKEE MEADOWS 6-87

NOTICE OF INTENT NO. 2571

SOUTH TRUCKEE

OWNER MEADOWS GENERAL IMPROVEMENT DISTRICT
MAILING ADDRESS DEPT OF PUBLIC WORKS
1205 MILL STREET RENO, NV 89520

ADDRESS AT WELL LOCATION STMGID #3
1½ miles west on Zolezzi Lane

2. LOCATION NW ¼ NE SE ¼ Sec. 19 T. 18 (N) S R. 20 E WASHOE County

PERMIT NO. 47066 (Issued by Water Resources) | Parcel No. | Subdivision Name

3. TYPE OF WORK: New Well ☒ Recondition ☐ Deepen ☐ Other ☐

4. PW #3 PROPOSED USE: Domestic ☐ Irrigation ☐ Test ☐ Municipal ☒ Industrial ☐ Stock ☐

5. TYPE WELL: Cable ☐ Rotary ☒ Other ☐ REVERSE

6. LITHOLOGIC LOG

Material	Water Strata	From	To	Thickness
silt, sand, & boulders		0	130	130
hard drlg, silts, sand & boulders		130	160	30
silt to boulders		160	190	30
silty sand & gravel		190	220	30
mixed sand, gravel & boulders	XX	220	280	60
silt to med sand	XX	280	300	20
fine sand to fine gravel	XX	300	325	25
fine silt to coarse sand	XX	325	335	10
silt to fine gravel	XX	335	370	35
silty sand	XX	370	375	5
silt to fine gravel, minor clay - intermittent	XX	375	470	95
clayey, silty sand	XX	470	490	20
decreasing clay, coarse sand	XX	490	500	10
silty sand to med gravel	XX	500	545	45
dirty silty sand	XX	545	580	35
clay, silt, sand, gravel		580	590	10
Lost Circulation Zone		50	200	

Date started AUGUST 6, 1984
Date completed SEPTEMBER 10, 1984

7. WELL TEST DATA

Pump RPM	G.P.M.	Draw Down	After Hours Pump
1000	120	23	1½
1200	245	46	1½
1350	385	73	1
1300	300	73	43½

BAILER TEST

G.P.M. ..... Draw down ..... feet ..... hours
G.P.M. ..... Draw down ..... feet ..... hours
G.P.M. ..... Draw down ..... feet ..... hours

8. WELL CONSTRUCTION

Diameter hole 22 inches Total depth 590 feet
Casing record 14" od x .375 wall
Weight per foot 54.57 Thickness

Diameter	From	To
14/22 inches	+2 feet	590 feet
inches	feet	feet
inches	feet	feet
inches	feet	feet
inches	feet	feet
inches	feet	feet

Surface seal: Yes ☒ No ☐ Type cement slurry
Depth of seal 70' pumped under pressure feet
Gravel packed: Yes ☒ No ☐
Gravel packed from 70 feet to 590 feet
Monterey Sand 8 x 16

Perforations:
Type perforation JOHNSON SCREEN 14" HY-CAP
Size perforation 50 SLOT STANDARD WEIGHT
From 240 feet to 580 feet
From feet to feet
From feet to feet
From feet to feet
From feet to feet

9. WATER LEVEL

Static water level 160 feet below land surface
Flow G.P.M. P.S.I.
Water temperature bottom 67 °F. Quality good

10. DRILLERS CERTIFICATION

This well was drilled under my supervision and the report is true to the best of my knowledge.

Name CHARLES SARGENT IRRIGATION, INC. (Contractor)
Address P. O. BOX 2480 RENO, NEVADA 89505 (Contractor)
Nevada contractor's license number 21246
Nevada contractor's drillers number 1391 LARRY WHITESEL
Nevada driller's license number 1413 MERRICK WHITESEL (Actual Driller)
Signed [signature] (Contractor)
Date SEPTEMBER 10, 1984

USE ADDITIONAL SHEETS IF NECESSARY

(Rev. 6-81) O-627 CR434

PINK—WELL DRILLER'S COPY

DIVISION OF WATER RESOURCES

WELL DRILLERS REPORT

Please complete this form in its entirety

Log No. 25321
Permit No.
Basin TR. MEADOWS 6-87

PRINT OR TYPE ONLY
SOUTH TRUCKEE

TEST 2567
NOTICE OF INTENT NO. 2570

OWNER MEADOWS GENERAL IMPROVEMENT DISTRICT
MAILING ADDRESS DEPT OF PUBLIC WORKS
205 MILL STREET RENO, NV 89520

ADDRESS AT WELL LOCATION
3/4 mile west on Zolezzi Lane
≠ SMG10#2

2. LOCATION SE ¼ NE ¼ Sec. 19 T 18 N/S R. 20 E WASHOE County
PERMIT NO. 46778 (Issued by Water Resources) | Parcel No. | Subdivision Name

3. TYPE OF WORK
New Well ☒ Recondition ☐
Deepen ☐ Other ☐

4. PROPOSED USE
Domestic ☐ Irrigation ☐ Test ☐
Municipal ☒ Industrial ☐ Stock ☐

5. TYPE WELL
Cable ☐ Rotary ☒
Other ☐ Reverse

6. LITHOLOGIC LOG

Material	Water Strata	From	To	Thickness
silty sand, gravel, cobbles & boulders		0	40	40
cobbles & boulders		40	60	20
silty sand & gravel		60	70	10
silty sand to boulders		70	80	10
mixed clay to boulders		80	100	20
silty sand & gravel, some cobbles		100	125	25
gravel & cobbles		125	135	10
silty sand w/fine pebbles	xx	135	360	225
silty sand & fine pebbles mixed w/clay	xx	360	390	30
silty to coarse sand	xx	390	400	10
silty to coarse sand mixed w/clay	xx	400	490	90
silty to coarse sand	xx	490	520	30
silty sand w/light blue clay		520	540	20
silty to med sand w/some clay; volcanic & mica rich	xx	540	580	40
fine to med sand	xx	580	590	10
med grained sand clean	xx	590	640	50
fine to med sand	xx	640	660	20
silty to fine sand	xx	660	680	20
weathered andesite		680	710	30
andesite flow		710	715	5

Date started APRIL 2, 19 84
Date completed APRIL 25, 19 84

7. WELL TEST DATA

Pump RPM	G.P.M.	Draw Down	After Hours Pump
1200	109	42	~~1~~ 1½
1300	152	65	23½
1400	179	92½	23½

BAILER TEST
G.P.M. ..... Draw down ..... feet ..... hours
G.P.M. ..... Draw down ..... feet ..... hours
G.P.M. ..... Draw down ..... feet ..... hours

8. WELL CONSTRUCTION
Diameter hole 22 inches Total depth 515 feet
Casing record 14" x .312
Weight per foot 45.61 Thickness

Diameter	From	To
22 inches	+2 feet	515 feet
inches	feet	feet
inches	feet	feet
inches	feet	feet
inches	feet	feet
inches	feet	feet

Surface seal: Yes ☒ No ☐ Type Sand-cement grout
Depth of seal 88 feet
Gravel packed: Yes ☒ No ☐
Gravel packed from 88 feet to 515 feet
Monteray 8 x 16
Perforations:
Type perforation Johnson Screen 14" Hycap
Size perforation 50 slot
From 255 feet to 505 feet
From feet to feet
From feet to feet
From feet to feet
From feet to feet

9. WATER LEVEL
Static water level 132 feet below land surface
Flow bottom G.P.M. P.S.I.
Water temperature 68 ° F. Quality good

10. DRILLERS CERTIFICATION
This well was drilled under my supervision and the report is true to the best of my knowledge.
Name CHARLES SARGENT IRRIGATION, INC. (Contractor)
Address P. O. BOX 2480 RENO, NV 89505 (Contractor)
Nevada contractor's license number 21246
Nevada contractor's drillers number 1391 LARRY WHITESEL
Nevada driller's license number 1388 GENE MAPEL (Actual Driller)
Signed Gene Mapel (Contractor)
Date APRIL 30, 1984

(Rev. 6-81) USE ADDITIONAL SHEETS IF NECESSARY

O-627 CR434

CANARY—CLIENT'S COPY
PINK—WELL DRILLER'S COPY

DIVISION OF WATER RESOURCES

WELL DRILLERS REPORT

Please complete this form in its entirety

Log No. 25322
Permit No. 42878, 57213
Basin 12. MEADOWS 6-87

PRINT OR TYPE ONLY

SOUTH TRUCKEE

TEST 2566
NOTICE OF INTENT NO. 2569

OWNER MEADOWS GENERAL IMPROVEMENT DISTRICT
MAILING ADDRESS DEPT OF PUBLIC WORKS 1205 MILL STREET RENO, NV 89520
ADDRESS AT WELL LOCATION 3/4 mile west of Zolezzi Lane STMGID #1

2. LOCATION NE ¼ NE ¼ Sec. 19 T. 18 N/S R. 20 E WASHOE County

PERMIT NO. 46421 (Issued by Water Resources) | Parcel No. | Subdivision Name

3. TYPE OF WORK
New Well ☒ Recondition ☐
Deepen ☐ Other ☐

4. PROPOSED USE
Domestic ☐ Irrigation ☐ Test ☐
Municipal ☒ Industrial ☐ Stock ☐

5. TYPE WELL
Cable ☐ Rotary ☒ Reverse
Other ☐

6. LITHOLOGIC LOG

Material	Water Strata	From	To	Thickness
cobbles & boulders		0	30	30
cobbles, silty sand		30	40	10
silty sand, gravels, cobbles		40	120	80
mostly silty sand & gravel, some cobbles		120	160	40
mostly silty sand & gravel		160	200	40
clay lenses w/silty sand & gravel	xx	200	260	60
mixed clay, sand & pebbley gravel	xx	260	320	60
cleaner gravel, cobbles	xx	320	340	20
silty sand & cobbles	xx	340	360	20
silty clay & gravels or cobbles	xx	360	400	40
mixed silt & gravels	xx	400	420	20
clays, silts, & sand	xx	420	440	20
silty sands & clay	xx	440	540	100
sands disappear		540	550	10
lenses of blue clays, light brn clays		550	570	20
mostly light brn clay, some blue clays		570	620	50
purplish clay "weathered andesite	flow	620	645	25

Date started March 5, 1984
Date completed March 28, 1984

7. WELL TEST DATA

Pump RPM	G.P.M.	Draw Down	After Hours Pump
1400	600	110	48

BAILER TEST
G.P.M. ..... Draw down ..... feet ..... hours
G.P.M. ..... Draw down ..... feet ..... hours
G.P.M. ..... Draw down ..... feet ..... hours

8. WELL CONSTRUCTION
Diameter hole 20 inches Total depth 530 feet
Casing record 12" x .250 wall
Weight per foot 33.38 Thickness

Diameter	From	To
12 inches	+2 feet	530 feet
inches	feet	feet
inches	feet	feet
inches	feet	feet
inches	feet	feet
inches	feet	feet

Surface seal: Yes ☒ No ☐ Type sand-cement grout
Depth of seal 54 feet
Gravel packed: Yes ☒ No ☐
Gravel packed from 54 feet to 530 feet
Monteray Sand 8 x 16
Perforations:
Type perforation Johnson Screen 12" Hycap
Size perforation 50 slot
From 260 feet to 520 feet
From feet to feet
From feet to feet
From feet to feet
From feet to feet

9. WATER LEVEL
Static water level 90 feet below land surface
Flow G.P.M. P.S.I.
Water temperature bottom 68 °F. Quality good

10. DRILLERS CERTIFICATION
This well was drilled under my supervision and the report is true to the best of my knowledge.
Name CHARLES SARGENT IRRIGATION, INC. (Contractor)
Address P. O. BOX 2480 RENO, NV 89505 (Contractor)
Nevada contractor's license number 21246
Nevada contractor's drillers number 1391 LARRY WHITESEL
Nevada driller's license number 1388 GENE MAPEL (Actual Driller)
Signed [signature] (Contractor)
Date APRIL 30, 1984

USE ADDITIONAL SHEETS IF NECESSARY

(Rev. 6-81) O-627 CR434

NAC 445A.125 Class B waters: Description; beneficial uses; quality standards.

1. Class B waters include waters or portions of waters which are located in areas of light or moderate human habitation, little industrial development, light-to-moderate agricultural development and where the watershed is only moderately influenced by man's activity.

2. The beneficial uses of class B water are municipal or domestic supply, or both, with treatment by disinfection and filtration only, irrigation, watering of livestock, aquatic life and propagation of wildlife, recreation involving contact with the water, recreation not involving contact with the water, and industrial supply.

3. The quality standards for class B waters are:

Item	Specifications
(a) Floating solids, settleable solids or sludge deposits.	Only such amounts attributable to man's activities which will not make the waters unsafe or unsuitable as a drinking water source, injurious to fish or wildlife or impair the waters for any other beneficial use established for this class.
(b) Sewage, industrial wastes or other wastes.	None which are not effectively treated to the satisfaction of the department.
(c) Odor-producing substances.	Only such amounts which will not impair the palatability of drinking water or fish or have a deleterious effect upon fish, wildlife or any beneficial uses established for waters of this class.
(d) Toxic materials, oil, deleterious substances, colored or other wastes, or heated or cooled liquids.	Only such amounts as will not render the receiving waters injurious to fish or wildlife or impair the receiving waters for any beneficial uses established for this class.
(e) pH.	Range between 6.5 to 8.5.
(f) Dissolved oxygen.	For trout waters, not less than 6.0 milligrams/liter; for nontrout waters, not less than 5.0 milligrams/liter.
(g) Temperature.	Must not exceed 20° C for trout waters or 24° C for nontrout waters. Allowable temperature increase above natural receiving water temperatures: None.

(h) Fecal coliform.	The fecal coliform concentration, based on a minimum of 5 samples during any 30-day period, must not exceed a geo-metric mean of 200 per 100 milliliters, nor may more than 10 percent of total samples during any 30-day period exceed 400 per 100 milliliters.
(i) Total phosphates.	Must not exceed 0.3 mg/l.
(j) Total dissolved solids.	Must not exceed 500 mg/l or one-third above that characteristic of natural con-ditions (whichever is less).

Calculation Sheet:
Phosphorus concentration in White's Creek due to sprinklers

Sprinkler flow rate: 40 gpm
Number of sprinklers: 100
Minutes of flow per day: 20
Irrigation days per year: 300
White's Creek flow: 6.5 cfs

Gallons of irrigation water per year:
(40 gpm)(100 heads)(20 minutes)(300 days/irrigation year) = 24,000,000 gallons/irrigation year

10% of which is discharged directly to creek:
(24,000,000)(0.10) = 2,400,000 gallons/irrigation year

In liters:
(2,400,000)(3.7854 liters/gallon) = 9,084,960 liters/irrigation year

Amount of phosphorus:
(9,084,960 liters/irrigation year)(3.67 mg/l P) = 33,341,803 mg P

White's Creek Flow:
(6.5 cfs)(60 sec/min)(60 min/hour)(24 hrs/day)(365 days/year) = 204,984,000 cf/year
(204,984,000 cf/year)(7.4805 gallons/cubic foot) = 1,533,386,805 gallons/year

(1,533,386,805 gallons/year)(3.7854 liters/gallon) = 5,804,482,412 liters
(5,804,482,412 liters)(300 irrigations days/365 days per year) = 4,770,795,038 liters/irrigation year

Total Flow in an Irrigation year (Irrigation water to creek + creek flow):
9,084,960 liters + 4,770,795,038 liters = 4,779,879,998 liters/irrigation year

Phosphorus concentration in White's Creek during an irrigation year:
(33,341,803 mg P) /(4,770,795,038 liters) = 0.007 mg/l

Calculation Sheet:
Phosphorus concentration in White's Creek due to reservoir overflow

Phosphorus in 1 million gallons of reservoir effluent:
(1 million gallons)(3.7854 liters/gallon)(3.67 mg/l P) = 13,893,461 mg P

White's Creek 100-year flood event:
(700 cfs)(60 sec/ min)(60 min/ hour)(7.4805 gallons/cf)(2 hours) = 37,701,720 gallons
(37,701,720 gallons)(3.7854 liters/gallon) = 142,716,535 liters

Phosphorus content in creek after 2-hour event:
(13,893,461 mg P) /(142,716,535 liters) = 0.0974 mg/l

Estimate of Whites Creek flow volume at Wolf Run Golf Course resulting from a 25-year 24-hour precipitation event

WOLF RUN GOLF COURSE

RENO, NEVADA

Prepared For

Wolf Run Golf Course
1400 Wolf Run Road
Reno, Nevada 89511

Job No. 2281.17B

March 28, 2001

Pezonella Associates, Inc.
Consulting Engineers and Geologists
520 EDISON WAY • RENO, NEVADA 89502 • (775) 856-5566

Pezonella Associates, Inc.
Geotechnical & Environmental Engineers & Geologists
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FAX • (775) 856-6042

March 28, 2001
Job No. 2281.17B

Wolf Run Golf Course
1400 Wolf Run Road
Reno, Nevada 89511

Attn: Mr. Ron Gribble

Re: *Draft Nevada Groundwater Discharge Permit No. NEV98018*, Wolf Run Golf Course
1400 Wolf Run Road, Reno, Nevada

Dear Mr. Gribble:

This office is in receipt of a draft *Authorization to Discharge* for the use of treated effluent at the above-referenced facility. The *Authorization* was issued by Mr. Joseph Maez of the Nevada Division of Environmental Protection, Bureau of Water Pollution Control in response to the June 23, 2000 *Effluent Discharge Report to Accompany Nevada Groundwater Discharge Permit Application*, and the January 9, 2001 *Supplemental Document to Accompany Nevada Groundwater Discharge Permit Application.*

Part III.A.3 of the *Authorization to Discharge* requires that:

> If any effluent is placed in ponds, such ponds shall be located, operated and constructed so as to:
>
> a. contain with no discharge the once-in-a-twenty five year 24 hour storm at said location;
> b. withstand the once-in-one-hundred year flood of said location without physical damages to berms and other pond structures;
> c. prevent escape of treated effluent by leakage other than as authorized by this permit;
> d. maintain freeboard at a minimum of 2 feet, unless otherwise approved by the Division.

As you will recall, a site meeting was held at the Wolf Run Golf Course on February 15, 2001. At that meeting, Mr. Maez indicated that we should demonstrate that there would be no discharge from the pond as a result of the 25-year 24-hour storm event. This document is an attempt to provide that information.

Introduction

Included in the original June 23, 2000 permit application was an April 4, 1994 hydrology report prepared by Cella Barr Associates of Sacramento, California. The report, *Preliminary Whites Creek Basin Management Study (Second Draft)* was prepared for Washoe County Department of Public Works in order to "derive a unified set of conclusions with respect to existing flood hazards and develop interim policies for new development and infrastructure improvements within the watershed."

The Cella Barr Associates report cites a previous report prepared by Nimbus Engineers of Reno, Nevada. That report, *Whites Creek Detention Facility Feasibility Study* was prepared for the Nevada Department of Transportation and submitted in June, 1993. As part of the study, Nimbus Engineers provided peak discharge and hydrograph information for the Whites Creek watershed using the US Army Corps of Engineers hydrologic computer model HEC-1. The model involves separating the watershed into sub-basins, assigning curve numbers related to type of soil and ground cover to these sub-basins, and calculating runoff and flow volumes based on rainfall and water travel-time through the watershed. The model was reviewed by Cella Barr Associates, who concluded that the 100-year discharge for Whites Creek (5,100 cfs) calculated by Nimbus Engineers through the use of the HEC-1 model should be used for basin management planning activities. A copy of the Nimbus Engineers study (without appendices) is attached.

In order to estimate the flood volume of Whites Creek at the storage reservoir on the Wolf Run Golf Course, Pezonella Associates, Inc. obtained a copy of the Nimbus Engineers hydrologic study for the watershed. The part of the watershed upstream of the flow splitter at Whites Creek park was re-analyzed using the same sub-basins and curve numbers as the Nimbus Engineers study, but applying 25-year precipitation values and the United States Department of Agriculture, Soil Conservation Service model *Urban Hydrology for Small Watersheds*, Technical Release 55 (TR-55).

As you know, Whites Creek is carried across Steamboat Ditch on the golf course property adjacent to the storage reservoir. This is accomplished through the use of a 36-inch corrugated metal pipe culvert that can accommodate a relatively small portion of any extreme flood event on Whites Creek. It is anticipated that during flood events, the culvert will create a backwater effect above the inlet and the majority of Whites Creek will enter Steamboat Ditch over its southern bank. A low area exists on the north bank of the ditch east of the storage reservoir and directly south of the 17th green. This low point appears to be the location that a flood event would overtop the Steamboat Ditch bank and continue north through the Whites Creek floodway.

After the February 15, 2001 site meeting, Vpoint Consulting Engineers prepared rating curves for the culvert that carries Whites Creek across Steamboat Ditch, and a proposed broad-crested weir to be located at the low point of the north bank of Steamboat Ditch directly south of the 17th green. The proposed weir would be 75 feet long and set at an elevation of 4,772.0 feet above mean sea level. A drawing that indicates the weir location and the rating curves are attached. The volume of flow in Whites Creek associated with the 25-year 24-hour storm event was calculated and compared to the rating curves to determine the depth of flow over the weir during that event.

Whites Creek Hydrology

The methods of TR-55 were used to calculate the flow volume in White's Creek associated with the 25-year 24-hour storm event. The 25-year event is one that has a 4% chance of occurring in any one year (1 in 25). Parameters used in the model include basin area; runoff curve number based on soil type, cover, impervious area, and antecedent moisture content; rainfall; and basin travel time.

Basin Area

The Whites Creek watershed above the flow splitter at Whites Creek Park is shown on Drawing 1 based on United States Geological Survey topographic maps. The maps used are: *Mt. Rose NW, Nev.* (1968, photorevised 1980); *Mt. Rose NE, NV* (1994); *Washoe City, NV* (1994); and *Mount Rose, NV* (1992). Sub-basins indicated are those of the 1993 Nimbus Engineers study. The drainage areas were measured from the maps using a compensating planimeter.

Curve Numbers

Runoff curve numbers used in the model are generated by identifying the hydrologic group of the soils within the basin. Soils are grouped as either A, B, C, or D. Group A soils absorb water rapidly, Group D soils have low infiltration rates. Runoff curve numbers for the various sub-basins are those of the 1993 Nimbus Engineers study.

Precipitation

The Type II storm was the rainfall selected for the previous model. That type of storm was used again in this analysis. Rainfall depth associated with the 25-year 24-hour storm event was obtained from the National Oceanic and Atmospheric Administration (NOAA) Atlas 2 *Precipitation Frequency Maps for the Western United States.*

Basin Travel Time

Basin travel time is the time it takes water to reach the outlet from the hydraulically most distant point in the basin. Basin travel times used in this analysis are those of the 1993 Nimbus Engineers study.

Runoff Estimation

The TR-55 method of estimating runoff from a basin is based on the curve number. The runoff equation is:

$$Q = \frac{(P - 0.2S)^2}{(P + 0.8S)}$$

where:

Q = runoff in inches
P = rainfall in inches
S = potential maximum retention after runoff begins in inches

S is related to soil and water conditions through the curve number. It is related by the equation:

$$S = \frac{1000}{CN} - 10$$

Initial Abstraction

Initial abstraction is all losses before runoff begins. It includes water retained in surface depressions, water intercepted by vegetation, evaporation, and infiltration. It is variable but is generally correlated with soil and ground cover parameters. It is related to curve number, and the values below were obtained from Table 4-1 of TR-55.

Initial Abstraction to Precipitation Ratio (Ia/P)

The initial abstraction to precipitation ratio generates a curve that relates the unit peak discharge from the basin to the precipitation (in cubic feet per second per square mile per inch of precipitation, csm/in). For the analysis performed here, The initial abstraction to precipitation ratio was calculated for each of the sub-basins and averaged. The precipitation for each sub-basin was multiplied by the area of that sub-basin and divided by the total area of the watershed upstream of the flow splitter at Whites Creek Park. This generated a weighted average for the precipitation over the area of interest. The unit peak discharge was then obtained from the table that is Exhibit 4-II in TR-55. A table summarizing the Whites Creek hydrologic information used in this analysis is presented below.

Whites Creek Hydrologic Parameters

Sub-Basin	Area, *A* (square miles)	Curve Number, *CN*	Travel Time (hours)	Precipitation, *P* (inches)	Runoff, *Q* (inches)	Initial abstraction I_a	I_a/P	*QA* (square mile-inches)
1	1.36	63	0.21	4.2	1.03	1.175	0.279762	1.399
2	0.84	65	0.17	4.1	1.09	1.077	0.262683	0.913
3	1.38	65	0.23	4.0	1.03	1.077	0.269250	1.419
4	1.47	57	0.27	3.8	0.53	1.509	0.397105	0.785
5	1.27	58	0.28	3.7	0.53	1.448	0.391351	0.678
6	1.43	57	0.44	3.2	0.31	1.509	0.471563	0.443
7	0.85	68	0.17	2.7	0.48	0.941	0.348519	0.407
8	0.75	65	0.29	2.4	0.26	1.077	0.448750	0.196

The weighted average runoff over the watershed upstream of the flow splitter at Whites Creek Park is 0.67 inches (sum of QA divided by total area). The average ratio of initial

abstraction to precipitation over the same area is 0.36. Unit peak discharge (from Exhibit 4-II, TR-55) is approximately 170 csm/in. Peak discharge using the Graphical Peak Discharge Method is given by the equation:

$$q_p = q_u A_m Q F_p$$

where:

q_p	=	peak discharge in cubic feet per second
q_u	=	unit peak discharge in cfs per square mile per inch of precipitation
A_m	=	drainage area in square miles
Q	=	runoff in inches
F_p	=	pond and swamp adjustment factor

The pond and swamp factor adjusts for ponding and flow retardation in pond and swamp areas. Table 4-2 in TR-55 gives the factor as varying between 0.72 (for 5% pond and swamp area in the watershed) and 1.00 (for 0% pond and swamp area in the watershed). For this analysis, a pond and swamp factor of 1.00 was used. Peak discharge using the above-referenced equation was therefore 1,060.7 cfs for a 25-year 24-hour duration event.

Whites Creek at Wolf Run Golf Course

White's Creek historically separated into four channels on the alluvial fan at or near Whites Creek Park. According to the Nimbus Engineers study, the four channels do not have the combined capacity to convey the calculated 100-year discharge volume of approximately 5,100 cfs. A flow splitting structure has been installed at this location. A picture of the structure was included in the January 9, 2001 *Supplemental Document to Accompany Nevada Groundwater Discharge Permit Application.* The splitter directs Whites Creek into two halves, the north half of which flows through Wolf Run Golf Course.

In their *Preliminary Whites Creek Basin Management Study*, Cella Barr Associates evaluated the ratio of available conveyance in each of the four historic channels of Whites Creek. They recommended that 100-year peak discharges be divided between the channels as follows:

Channel 1: 700 cfs (14%)
Channel 2: 1950 cfs (38%)
Channel 3: 1100 cfs (22%)
Channel 4: 1350 cfs (26%)

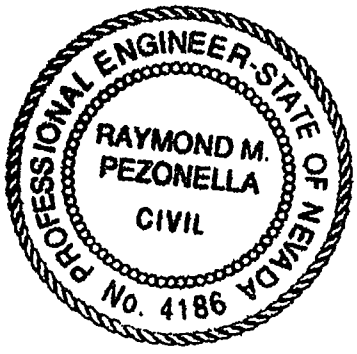
Channel 1 is the branch of Whites Creek that flows through the Wolf Run Golf Course. Based on the above-calculated discharge volume from a 25-year 24-hour storm event, and a flow distribution similar to that recommended by Cella Barr Associates for conveyance of peak discharge, approximately 150 cfs would be directed down the channel towards the Wolf

Run Golf Course during a 25-year 24-hour storm event. A comparison of this flow volume with the weir rating curve supplied by Vpoint Consulting Engineers indicates a flow depth of approximately 7½ inches of water. An additional 50% flow volume to account for the two stormwater outfalls above the crossing of Steamboat Ditch results in an increase of water depth to approximately 10½ inches. The flow volume would have to be nearly double the calculated amount before the flow would be 1 foot deep over the weir. The elevation of the proposed weir is approximately 3 feet below the berm surrounding the storage reservoir. It is therefore our opinion that the 25-year 24-hour storm event does not pose a threat to the storage reservoir from Whites Creek.

If you have any questions or require further information, please do not hesitate to contact us.

Respectfully,

PEZONELLA ASSOCIATES, INC.



3-28-01

John H. Johnson
Senior Geologist, EM – 1507

Raymond M. Pezonella
Civil Engineer – 4186

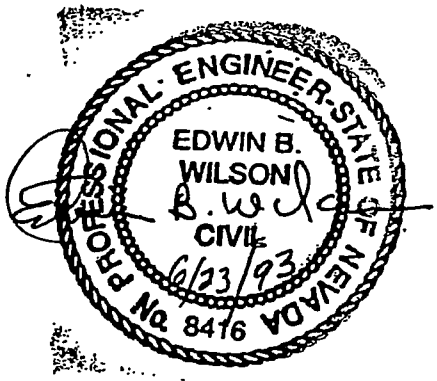
cc: Mr. Joseph L. Maez, Nevada Division of Environmental Protection,
Bureau of Water Pollution Control, 333 West Nye Lane, Carson City, NV 89710
Mr. Darrell Rasner, Nevada Division of Environmental Protection,
Bureau of Water Pollution Control, 333 West Nye Lane, Carson City, NV 89710
Mr. Joe Howard, Washoe County Department of Water Resources,
P.O. Box 11130, Reno, NV 89520
Mr. Jim Litchfield, Kennedy Jenks Consultants, 5190 Neil Road, Suite 210,
Reno, NV 89502

Whites Creek Detention Facility Feasibility Study

Washoe County, Nevada

Prepared for:

Nevada Department of Transportation
1263 South Stewart
Carson City, Nevada



Nimbus Job # 9302

Revised June 1993

Nimbus Engineers
3710 Grant Dr., Reno, NV 89509
(702) 689-8630

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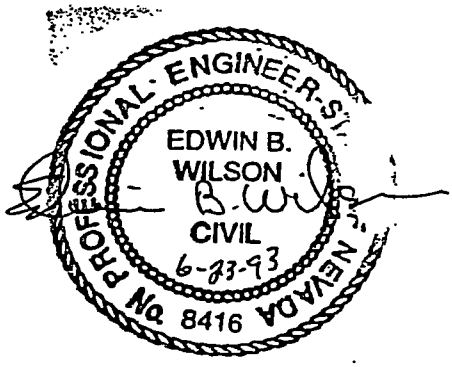

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1.0 Introduction

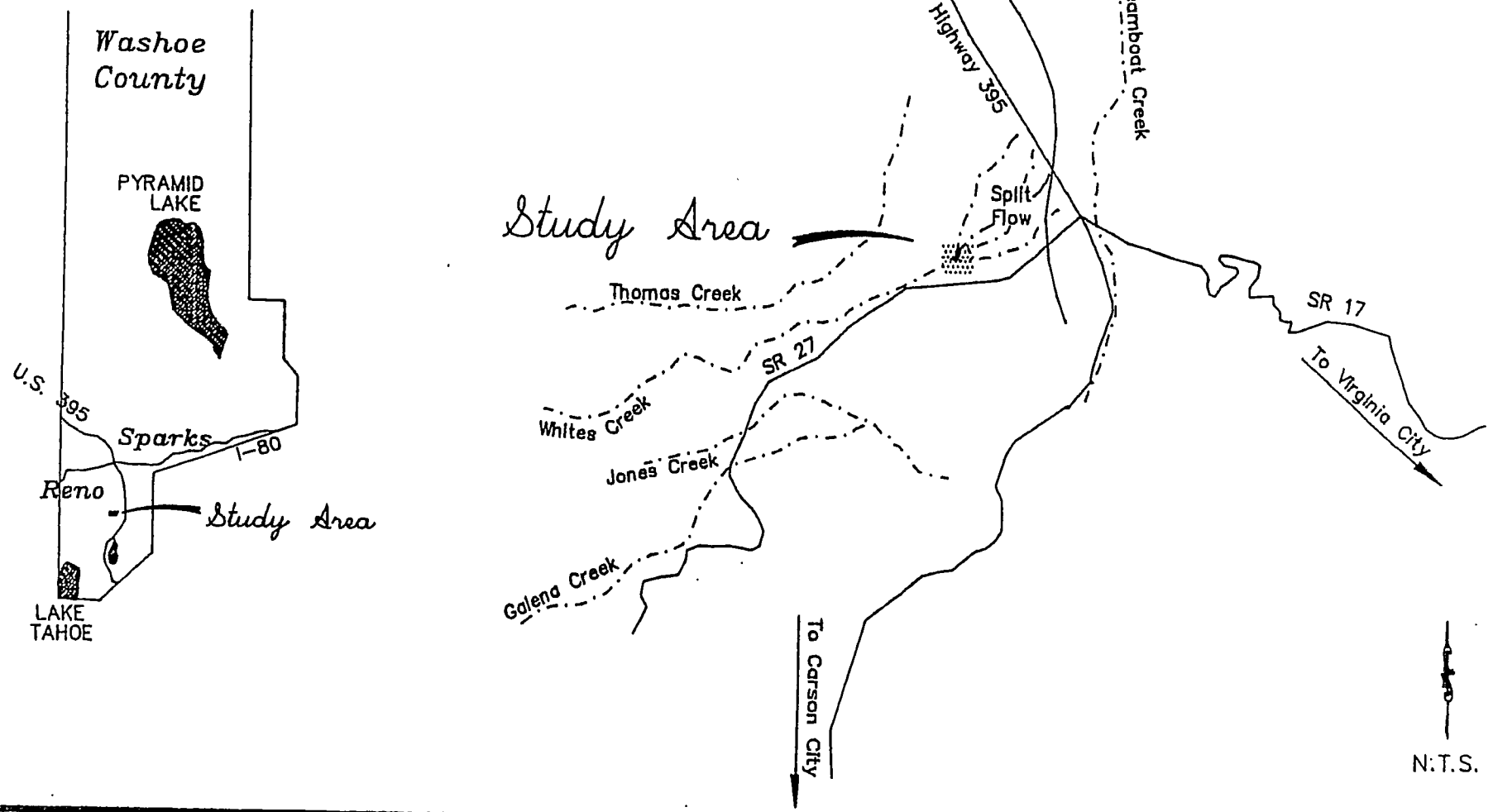
This study was prepared for the Nevada Department of Transportation (NDOT) under Agreement No. P107-93-010. The scope of the study was to evaluate the benefits of a detention basin on White's Creek in the South Truckee Meadows. NDOT is currently designing an elevated freeway extension of US 395/I 580 which will cross all four branches of White's Creek. Washoe County has prepared a concept level Flood Control Master Plan which proposes a detention basin on White's Creek which will mitigate the flood hazard to existing and future development. This study was authorized to prepare technical data, i.e. existing peak flows and approximate flood limits and to apply that data in the evaluation of the effectiveness of a detention facility. Preliminary meetings were held between NDOT and Washoe County to discuss the possibility of a joint project. NDOT would contribute the savings realized from the reduced sizes of drainage structures to the construction costs of the potential basin. The location of the proposed project is shown on Figure 1.

The proposed elevated freeway extension is located in the designated floodplain of Whites Creek. The regulatory floodplain shown for this area indicates that Whites Creek diverges into four distinct branches in Section 30, Township 17N, Range 18E which is approximately 2 miles upstream of the proposed freeway alignment. One of the alternative solutions for collecting and conveying the peak 100-Year flows under the proposed freeway, which is being reviewed, is a detention basin upstream. A detention basin could reduce the peak flow to a flow more easily managed, possibly to a single structure location instead of four separate locations.

This analysis was prepared to establish an acceptable peak discharge and runoff hydrograph suitable for a preliminary detention basin feasibility analysis. Much of the information in this report has been based on a previous feasibility study by Nimbus Engineers for a detention facility at Huffaker Narrows (Reference 5). Whites Creek was analyzed in that study as a contributing watershed. Substantial revision was necessary to incorporate additional concentration points and to include a higher level of detail in the analysis.

2.0 Physical Description

Whites Creek originates in the Sierra Nevada Range and flows to the East into Steamboat Creek (See Figure 2). Approximately 2 miles upstream of Virginia Street, the watercourse diverges into four smaller channels. These channels travel east as wide, shallow flow across South Virginia then reunite and flow north towards the Double Diamond Ranch. Because of the wide and shallow characteristics of the flood flows, collection and management of the flood flows would be difficult.



Nimbus Engineers

Figure 1
Vicinity Map

Job No. : 9302 Date : June 1993

The contributing watershed extends to an elevation of over 10,600 feet. The diffluence is at an elevation of approximately 5,000 feet. The basin is vegetated mainly with pine trees and mahogany brush in the upper subbasins and sagebrush, pasture and residential areas in the lower subbasins. Approximately 16 square miles contribute runoff to the proposed freeway and approximately 9 square miles of the watershed is upstream of the proposed detention facility site.

3.0 Preliminary Soils & Geologic Analysis

Harding Lawson & Associates was retained by Nimbus (with NDOT approval) to review and research existing available data concerning geologic constraints and soils conditions. They were unable to do new field sampling or investigation because right-of-entry onto private property could not be obtained within the specified schedule. Their investigation was limited to a literature search and a site investigation on the public property. Several sites were selected for their evaluation. Their verbal recommendations were: 1) that the facility be placed at grade due to active faults in the area, 2) that the facility be used for flood control only not as reservoir storage and 3) that the preferred site based upon information available be near the diffluence or further downstream.

4.0 Hydrologic Analysis

The SCS methods were used in the Corps of Engineers hydrologic computer model (HEC-1) to estimate the 100-Year discharges for all the contributing areas. The 100-Year event is an event with a one percent chance of occurring in any given year.

The following parameters were used within the models to calculate runoff:

1) Basin area in square miles.

2) Runoff curve number, which relates how much rainfall will become runoff for a given basin. The number is based upon soil type, relative soil moisture content, impervious areas, vegetation type and cover density.

3) Rainfall depth, duration, and distribution.

4) Basin lag time, which is defined as the time from the center of mass of rainfall excess to the peak discharge, expressed in hours.

6) Hydrograph routing parameters.

Table 1 on page 7 presents the parameters for each basin which were selected for this study.

Basin Area

The watershed boundaries were identified using USGS quadrangle maps (Reference 14) and field inspection. The area of each contributing drainage area was measured from the maps.

Curve Numbers

To estimate a curve number, the types of soil within the basin must be identified by a hydrologic group. Soils are classified by the SCS into four hydrologic soil groups; A, B, C and D. Group A soils have a rapid infiltration rate and include very porous soils such as sandy soils. Group D soils have a very slow infiltration rate which results in a larger percentage of the rainfall expressed as runoff. For this study, the soil groups determined in the Huffaker study were reevaluated with more detail which resulted in a larger percentage of more porous soils and consequently lower curve numbers.

Types of soils and their respective hydrologic groups were identified using the SCS Soil Survey for Washoe County (Reference 6).

Relative soil moisture content is described in the SCS methodology by a term identified as "antecedent moisture condition" (AMC). Three different relative conditions are described by the SCS: AMC I, II and III. AMC I is an extremely dry condition where soil moisture has been depleted and infiltration rates for the soil are near their maximum, and AMC III is a saturated condition. AMC II is an average condition. This condition is the standard used for hydrologic analysis in the Western States and was used in selecting the appropriate table of curve numbers.

Vegetation and cover density for the drainage areas were determined from field inspection and United States Forest Service (USFS) color aerial photos.

Using the above mentioned information, curve numbers were selected using the tables in SCS TR-55 and NEH-4 (References 7 and 8). As a basin is typically comprised of multiple hydrologic soil groups, cover densities, and vegetative cover; a weighted average of these parameters was calculated to determine a composite curve number for each basin.

Rainfall

A SCS Type II storm was selected for this modeling effort after discussions with NDOT and Washoe County. It was the consensus during the discussion that there is a high likelihood of a thunderstorm being the most severe event due to the shape of the watershed and the historic high flows on adjacent Galena Creek. This distribution is a dimensionless temporal distribution developed by the SCS using regional averages.

The 100-Year, 24 Hour point rainfall depths used in the HEC-1 models were obtained from NOAA Atlas 2, Volume VII - Nevada (Reference 13). As the watershed area above the proposed site is less than 10 square miles, areal reduction of the rainfall was neglected.

Basin Lag

Basin travel time, or time of concentration, is the time it takes for water to reach the outlet from the hydraulic most distant point in the basin. Travel times were developed using the Upland Method described in NEH-4. This method estimates flow velocity based on channel slope and ground cover.

Due to the variability of the channel characteristics, all travel times were calculated on a reach by reach analysis. The resulting travel times were then multiplied by the empirical factor of 0.6 (NEH-4) to obtain the subbasin lag time.

Routing

Channel routing and overland flow routing were performed with the Muskingum method. The parameters for the reaches modeled with the Muskingum method were estimated using channel and overbank characteristics, lengths, slopes and typical roughness. Manning's equation and the Upland Method were used to estimate flow velocity, and the guidelines included in the HEC-1 manual were used to estimate values for k, t, and x (Reference 10).

Routing through the proposed detention basin was done with the Modified Puls Method in the HEC-1 model.

The following table presents selected subbasin parameters developed.

TABLE 1

WHITES CREEK
SUBBASIN PARAMETERS

Subbasin	Area sq. mi.	Curve Number	Lag Time hr.	100-Year, 24 Hour Rainfall in.
W1R	1.36	63	0.21	5.50
W2R	0.84	65	0.17	5.40
W3R	1.38	65	0.23	5.25
W4R	1.47	57	0.27	5.00
W5R	1.27	58	0.28	4.80
W6R	1.43	57	0.44	4.10
W7R	0.85	68	0.17	3.40
W8R	0.75	65	0.29	3.00
W9R	2.39	69	0.51	2.80
W10R	0.30	55	0.32	2.80
W11R	0.32	75	0.27	2.70
W12R	0.60	61	0.45	2.80
W13R	2.00	61	0.52	2.80
W14R	0.18	77	0.26	2.70
W15R	0.21	79	0.21	2.70
W16R	0.11	81	0.21	2.70
W17R	0.58	67	0.31	2.80
W18R	0.85	80	1.33	2.70
W19R	0.33	60	0.22	2.75
W20R	0.22	61	0.22	2.73

Diversions

As mentioned earlier, Whites Creek diverges into four less defined channels as the creek exits the steeper portion of the watershed. Individually, these channels do not have the capacity to convey the 100-Year discharge (Approximately 5100 cfs). A small diversion structure has been built which directs low flows into channels #1 and #3. Due to the constant water supply, these two channels are heavily vegetated with brush and willow trees and appear to be quite stable. The other two channels remain dry until flood events and are cleaner channels with silty, gravelly bottoms and vegetated with sagebrush in the overbanks.

The small capacity of the channels and dense vegetation at the diffluence made the determination of a flow distribution difficult. For this analysis, the assumption was made that the channels would not significantly degrade or migrate and that flood debris would not significantly redirect flows. Nimbus realizes these conditions could occur to some degree but also feels that with the weight of that uncertainty the results of this analysis are reasonable to use as design flows for this project.

A previous study by SEA Engineering (1980) estimated the percent of flow in each channel, however, a copy of that report has not been located. It is not known how the distribution was determined, but it is understood the report states that 75% of the total flow is contained within channel #1, and the remaining 25% is equally distributed among the other three channels (channels #2, 3 and 4).

Nimbus estimated the distribution of flows using a ratio of available conveyance. Survey data was collected around this diffluence to supplement existing topography. Using this data, cross section geometries and slopes were coded into the U.S. Army Corps of Engineers' water surface program, HEC-2 (Reference 9). This program estimates a water surface elevation based on standard hydraulic equations. All the information used to develop the distribution, including cross sections, and a workmap showing topography and cross section layout is included in the appendix.

Using the detailed output from the HEC-2 model, a flow distribution within each section was determined and consequently a channel capacity. The model was refined until producing a consistent distribution within itself (i.e. the distribution within a cross section should be similar to the adjacent upstream and downstream section).

Split flow also occurs approximately 8,000 feet downstream of this diffluence. Channels #2 and 3 commingle for a distance then diverge again. The distribution of flow between the channels was determined in a similar manner resulting in an equal split.

Additionally, a third flow split occurs near channel #1 and Zolezzi Lane. The amount of split flow is controlled by inadequate channel capacity upstream of Zolezzi Lane.

The capacity of the channel was determined with Manning's Equation. Flows over this amount were diverted east along Zolezzi Lane towards Virginia Street. The information used to determine these split flow estimations are also included in the appendix.

The following table presents the 100-Year values computed.

TABLE 2

WHITES CREEK
SUMMARY OF DISCHARGES

Concentration Point	100-Year Discharge CFS
@ Diffluence	5100
Channel #1B @ Proposed I-580	170
Channel #1 & #2 @ Proposed I-580	1850
Channel #3 @ Proposed I-580	1350
Channel #4 @ Proposed I-580	1550
@ CP DD (Southern Property Line of Double Diamond Ranch)	4450

In order to prepare a basin design, a hydrograph was also developed during this analysis. The total volume of runoff was calculated to be 593 acre feet with a peak flow of 5100 cfs as noted in Table 2. The goal of the project was to reduce the peak flow to 1000 cfs. As illustrated in the design hydrograph shown in Figure 3, 230 acre feet must be stored.

5.0 Proposed Detention Basin

The analysis for the basin feasibility was developed based on several variables including hydraulic and hydrologic efficiencies of the sites, topographic and geologic considerations, land value and identifiable benefits to the lower reaches of the watershed; consideration was also given to the project's construction schedule. The impacts of time required for permit application, review and approval from the Federal Government and Corps of Engineers were considered as major constraints.

Because of the diversion into four less defined channels at the diffluence, which is located in Section 30, Township 17N, Range 18E, the possible basin locations were

determined to be in the area of the diffluence for maximum benefit. A location further upstream was reviewed; however, because of the large number of recent active faults in that area and verbal information received from Harding Lawson, further investigation was abandoned.

Three alternative locations in Section 30 were analyzed. Alternative #1 was located immediately upstream and generally northeast of the diffluence. The natural gradient of the area ranged from approximately 7% to 12.5%. The preliminary analysis indicated that the total storage capacity of 230 acre feet would require at least 5 individual basins in order to control the size of the cut slope in the storage area. This alternative would require approximately 47 acres of land for construction of the basin site.

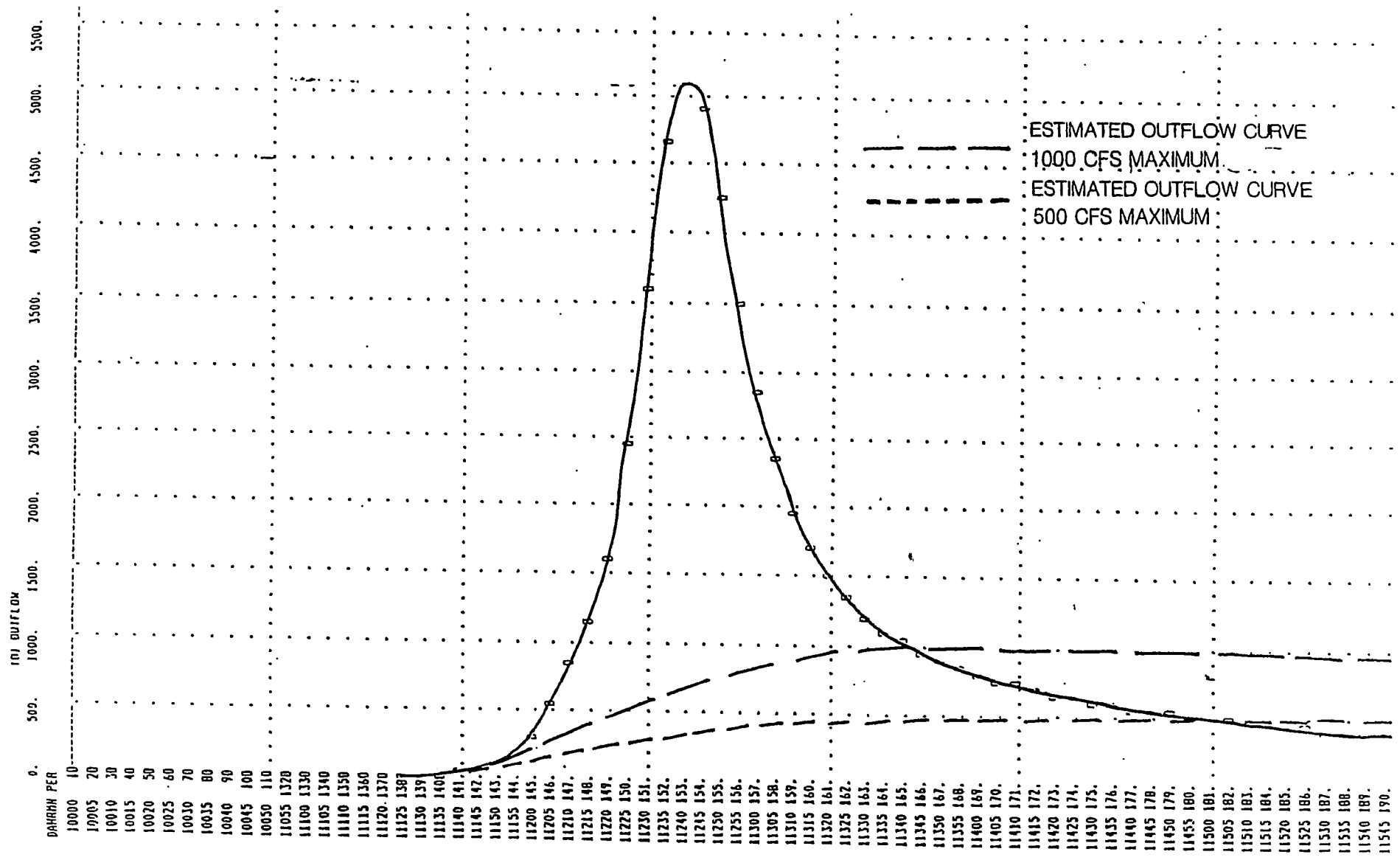
Alternative #2 was located at the diffluence and incorporated the existing county park area as well as approximately 32 additional acres to the south and east of the diffluence. The basin would utilize a multi-level structure in order to minimize the embankment required for the storage.

The third alternative was located north and east of the diffluence and would require approximately 35 acres. Both the areas for Alternatives #2 and #3 have natural slopes of approximately 6% and will require at least 4 separate basins to accommodate the required 230 acre feet of storage.

The targeted peak 100-Year flow of 1000 cfs from the basin was established by hydrograph comparison to optimize the ratio between the storage requirements and the discharge rate. The 1000 cfs discharge and the 230 acre-feet of storage appears to achieve the optimum benefit. A 50% further reduction in discharge, to approximately 500 cfs total, would require a minimum of an additional 50% of storage or 350+ acre feet total volume. The attenuated peak flows from the basins, for the purposes of this study, were divided into each of the four existing downstream channels. The diverted flow quantities were based on the percentages of the natural peak flow splits under existing conditions. Other discharge scenarios are possible and can be evaluated in more in-depth studies.

Based on discussions with Washoe County and review of the assessors valuations of the properties, it appears that Alternative #3 would require the least costly right-of-way. Alternative #2 would equal Alternative #1 for land costs in excess of 25% more than Alternative #3.

The estimated construction costs of each alternative were nearly equal. The excavation required for the basins is approximately 1 million cubic yards. The Nevada Department of Transportation has indicated if the material is suitable, it may be used as embankment material for the freeway. Preliminary indications are that the material can be utilized.



Nimbus Engineers

Figure 3
Design Hydrograph

Job No. : 9302 Date : June 1993

The basin slopes shown on Figure 4 vary from 2:1 (horizontal to vertical) to 3:1. It is assumed (prior to further study) that these cut slopes will be stable. All embankments are designed at 3:1 slopes and will have a minimum of 3 foot of freeboard above the emergency spillway elevation.

After careful review of the preliminary information, it is Nimbus Engineers' opinion that Alternative #3 shown on Figure 4 is the most favorable and cost effective detention basin site. If the project proceeds into the final design and property acquisition stage, not only will property purchases be included in the acquisition, but also access and drainage easements. The easements will be necessary for basin management and accessibility and for minimal disruption of private property during the construction as well as the operation and maintenance of the basin.

6.0 Conclusions and Recommendations

Based on the results of this analysis, a detention facility is a feasible option for controlling flood waters within the White's Creek basin. An approximate thirty-five acres of right-of-way will be required to reduce peak 100-Year flows from 5000 to 1000 cfs. Further reduction can take place with additional area and excavation; however, it does not appear that it would be cost effective.

As a function of the basin feasibility, NDOT has indicated that if the basin excavated material meets their specifications it would be used in the embankment of the freeway extension. Sampling and materials testing should be required as one of the first major tasks, if the basin concept is adopted and approved for further design. If the material meets or exceeds NDOT's requirements, the cost benefit is there to further pursue the basin concept. Depending upon the cost effectiveness of the excavation scheme, a larger basin to further reduce flows may be appropriate to consider in final design.

The additional benefits to be realized from the construction of the basin as presented is:

1. Substantially reduced number and size of drainage structures required to convey the White's Creek flows under the US 395/I-580 extension.

2. Public and private properties downstream of the basin location would be protected from the 100-Year floods especially those properties adjacent to South Virginia Street. Under existing conditions, these properties are potentially subject to sheet flows up to 3 feet deep.

3. The attenuated flows would substantially reduce the size of future drainage structures across developable land between the freeway and Steamboat Creek.

4. The attenuated flows would protect properties along Zolezzi Lane which are subject to flows from diversion channel #1.

5. The homes in the Homestead Lot area directly below the diffluence of White's Creek virtually stand in the mouth of the canyon. The proposed basin is the only practical solution to their flood hazard potential. Without the basin, their probability of severe flood damage is equal to the probability of a 25-Year event, or in some cases a less frequent storm.

As information was developed, joint meetings were held with NDOT and Washoe County staff. Informal meetings were also held with other interested parties including developers (and their representatives) of properties which would benefit from the construction and two Washoe County Commissioners. The County staff and commissioners requested that the information be presented at a public hearing during a regularly scheduled commission meeting and at the Citizens Advisory Board (CAB). The decision to proceed was made with the next step in the process being the public presentation.

A presentation of the study findings was made as an agenda item on the CAB regularly scheduled meeting April 22, 1993. The citizens and home owners present at that meeting demonstrated no support for the basin. The flood potential of the area below the diffluence did not seem to be a real threat to any of those present. The CAB voted to oppose the project at the public hearing at the County Commissioner's meeting. At the County Commissioner's meeting of Tuesday, April 27, 1993 the commissioners voted to reject NDOT's offer.

Based on the public and political reception of the plan, the concept was abandoned and the NDOT design for the US 395/I-580 extension will proceed without the benefit of the basin alternative.

7.0 References

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2. Federal Emergency Management Agency, Flood Insurance Study: Washoe County, Nevada, Unincorporated Areas, April 1990.

3. Federal Emergency Management Agency, Flood Insurance Rate Maps, Washoe County, Nevada, Panels 1463, 1464, and 1501.

4. Kennedy/Jenks, Concept Level Report, Washoe County Master Plan, Volume I and II, January 1991.

5. Nimbus Engineers, Feasibility Analysis for Huffaker Hills Detention Facility, February 1990.

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

7. U.S. Department of Agriculture, Soil conservation Service, Engineering Division, Urban Hydrology for Small Watersheds, Technical Release 55, June 1986.

8. U.S. Department of Agriculture, Soil Conservation Service, SCS National Engineering Handbook, Section 4, Hydrology, March 1985.

9. U.S Department of the Army, Corps of Engineers Hydrologic Engineering Center, Computer Program 723-X6-LZ02A, HEC II Water Surface Profiles, September 1988 updated June 1990.

10. U.S. Department of the Army, Corps of Engineers, Hydrologic Engineering Center, Flood Hydrograph Package, February 1981, revised June 1988.

11. U.S. Department of the Army, Corps of Engineers, Sacramento District, Floodplain Information, Southwest Foothills Streams (Evans, Thomas and Whites Creek & Skyline Wash): Reno, Nevada, June 1974.

12. U.S. Department of the Army, Corps of Engineers, Sacramento District, Truckee River, California and Nevada, Hydrology, February 1980.

13. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, NOAA Atlas 2, Precipitation - Frequency Atlas of the Western United States, Volume VII - Nevada, 1973.

7.0 References (cont.)

14. U.S. Department of the Interior, Geological Survey, 7.5-Minute Series Topographic Maps, Scale 1:24,000, Contour Intervals 10, 20, and 40 feet: Mount Rose NE (1982) Steamboat (1982) Mount Rose NW (1982) Mount Rose (1982), Nevada.

15. U.S. Department of the Interior, Geological Survey, 15-Minute Series Topographic Maps, Scale 1:62,500, Contour Interval 40 feet: Mt. Rose (1950) and Virginia City (1950), Nevada.

16. U.S. Department of Transportation, Federal Highway Administration, Office of Engineering, Bridge Division, Hydraulic Branch, Hydraulic Charts for the Selection of Highway Culverts, Hydraulic Engineering Circular No. 5, June 1980.

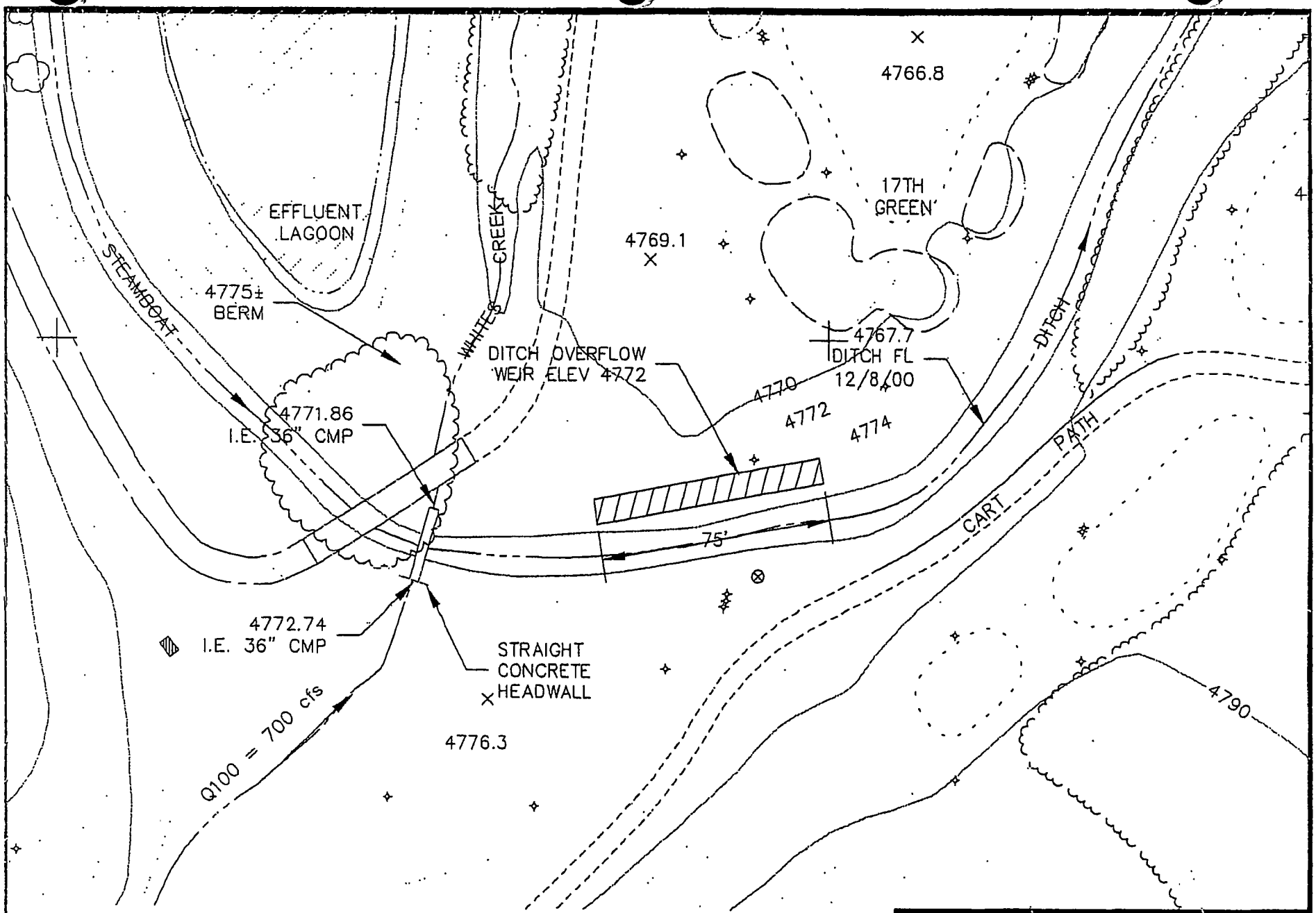

FIGURE 1 - PLAN VIEW
WHITES CREEK STEAMBOAT DITCH AREA

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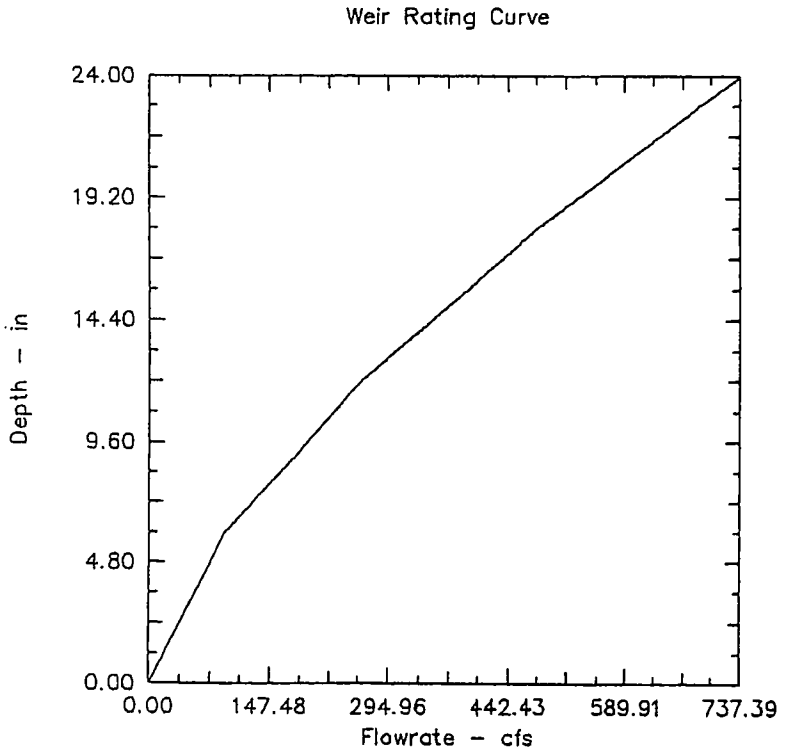
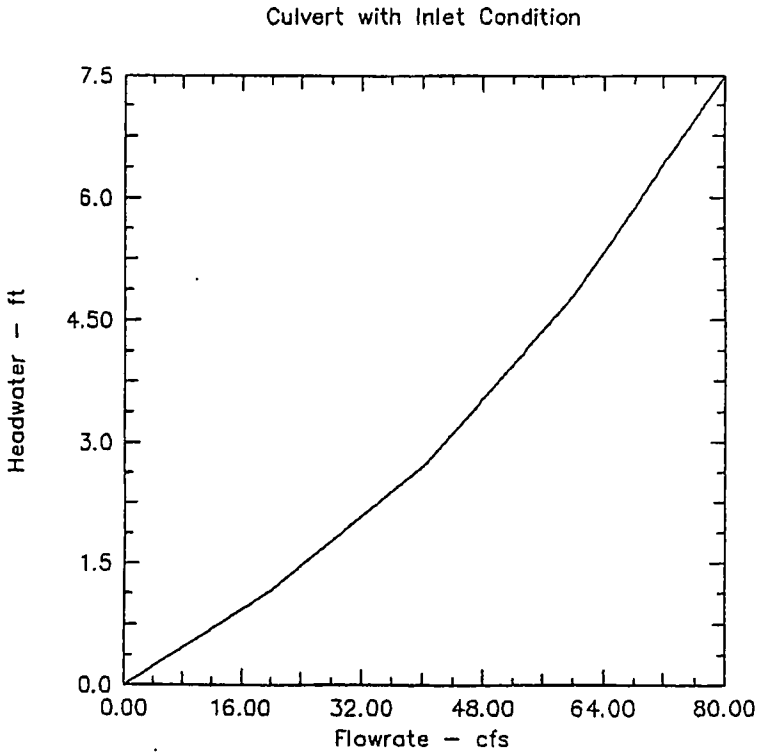


75 FT WEIR



36" CULVERT

FIGURE 2 - RATING CURVES
WHITES CREEK STEAMBOAT DITCH AREA

VPOINT
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Permit: NEV98018

Nevada Division of Environmental Protection

AUTHORIZATION TO DISCHARGE

In compliance with Chapter 445A of the Nevada Revised Statutes,

University of Nevada-Reno Athletic Association
Wolf Run Golf Course
1400 Wolf Run Road
Reno, Nevada

is authorized to use treated effluent at a facility located at

Wolf Run Golf Course
1400 Wolf Run Road
City of Reno, Washoe County, Nevada 89511
Longitude: 119° 50' W, Latitude: 39° 23' N
Township 18 N., Range 20 E., Section 19

in accordance with effluent limitations, monitoring requirements, and other conditions set forth in Part I, II and III hereof.

This permit shall become effective on April 11, 2001.

This permit and the authorization to discharge shall expire at midnight, April 11, 2006.

Signed this 11 day of April, 2001.

Joseph L. Maez

Joseph L. Maez, P.E.
Bureau of Water Pollution Control

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PART I

Introduction: The Wolf Run Golf Course is an 18-hole course located near the Field Creek Subdivision in south Reno. The course covers 82 acres and is characterized by crossings of Steamboat Ditch and Whites Creek. Annual water usage for the course is estimated to be around 390 (126.1 million gallons) acre-feet per year.

Reclaimed water is provided by the South Truckee Meadows Water Reclamation Facility which is owned by Washoe County. This facility provides reclaimed water that meets Category C quality (NAC 445A.276) and has total nitrogen levels below 10 mg/l.

I.A. EFFLUENT LIMITATIONS, MONITORING REQUIREMENTS AND CONDITIONS

I.A.1. During the period beginning on the effective date of this permit, and lasting until the permit expires, the permittee is authorized to use reclaimed water from the South Truckee Meadows Water Reclamation Facility on the Wolf Run Golf Course

I.A.2. Flow monitoring shall be recorded at the magnetic flow meter on the irrigation delivery line prior to reuse. Reclaimed water quality shall be in accordance with the limits set forth in Permit NEV40024 for the South Truckee Meadows Water Reclamation Facility.

The discharge shall be limited and monitored by the permittee as specified below:

TABLE I.1

PARAMETERS	EFFLUENT DISCHARGE LIMITATIONS		MONITORING REQUIREMENTS	
	30 Day Annual Average	Monthly Maximum	Measurement Frequency	Sample Type
Flow, Million Gallons per Month (MGM)	M & R	M & R[3]	Continuous	Flow meter
Annual Application Volume (AF)	424 Acre-Feet (AF) (Volume determined from Consumptive Use Balance)[2]		Cumulative	Flow Meter
Fecal Coliform[1] (CFU, MPN)	2.2 CFU (MPN)/100 ml	23 CFU(MPN) /100 ml	Weekly	Discrete

1 Sample results to be recieved from NEV40024. Permittee does not need to provide this data.
2. Annual application volume is based upon 110% of the application volume determined in the EMP.
3. Monthly application rates in the EMP should be used as a guide.

I.B. EFFLUENT MANAGEMENT

I.B.1. The irrigation storage pond, distribution system, and ancillary facilities shall be operated in accordance with the Effluent Management Plan (EMP). The EMP must be submiteed to this Division by **July 11, 2001.** The EMP shall contain the information required to comply with this permit. It is recommended that the Permittee utilize "WTS-1B: General Criteria for Preparing an Effluent Management Plan" (NDEP 2000), as a guidance to prepare the EMP.

I.B.2. The permittee shall provide a copy of a brief, but complete and understandable, document describing the possible hazards and proper hygiene of working with and around treated wastewater to all grounds keepers and other affected personnel. Copies shall be included in the EMP.

I.B.3. If the actual annual application volume exceeds the calculated annual application limit, the Permittee shall prepare a report which includes an evaluation of the application rates in the EMP, an explanation of conditions (overseeding, reseeding, weather conditions, etc.) which led to the exceedance, and any planned changes the Permittee deems necessary. This evaluation shall be submitted with the quarterely discharge monitoring report (DMR).

I.B.4. The effluent irrigation system and effluent storage pond shall not cause objectionable odors on or off the site.

I.B.5. The irrigation system, storage pond, 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.

I.B.6. The irrigation areas and the storage pond shall be posted with conspicuous warning signs clearly stating that reclaimed water is utilized and to avoid contact. Ancillary equipment used for effluent shall be clearly marked to indicate use with effluent. Notification signs shall be placed at the First and Tenth Tee's.

I.B.7. Drinking water fountains shall be covered during effluent irrigation.

I.B.8. Irrigation of the golf course shall be performed in such a manner as to reduce standing water to a minimum and to prevent run-off of effluent to any creeks or ditches.

I.B.9. The permittee shall maintain a 2-foot minimum freeboard in the storage pond.

I.B.10. The Permittee shall provide documentation to the Division that notification has been made to the local water purveyor and the local health agency, of the Permittee's intent to use effluent at this facility. The documentation shall describe the plan for complying with the cross-connection control requirements of the local water purveyor. This documentation shall be received prior to effluent reuse as detailed in the schedule of compliance.

I.B.11. All terms and conditions stated herein shall not supercede the requirements of the Nevada Division of Water Resources.

I.C. GENERAL CONDITIONS

I.C.1. There shall be no discharge of substances that would cause a violation of water quality standards of the State of Nevada.

I.C.2. The permittee shall remit an annual review and services fee in accordance with NAC 445A.232 starting **July 1, 2001** and every year thereafter until the permit is terminated.

I.C.3. The Discharge Monitoring Reports (DMRs) must be signed by the facility's highest ranking officer. The first DMR submitted under this permit must include the written designation of the officer (required by Part III A.2) as the authorized representative to sign the DMRs. If the officer in responsible charge changes, a new designation letter must be submitted. Item I.B.3 of this permit must be addressed in the DMRs.

I.D. SCHEDULE OF COMPLIANCE

I.D.1 The permittee shall implement and comply with the provisions of the following schedule of compliance after approval by the Administrator, including in said implementation and compliance, any additions or modifications which the Administrator may make in approving the schedule of compliance.

a. The permittee shall achieve compliance with the effluent flow monitoring requirements upon issuance of the permit.

b. A final Effluent Management Plan (EMP) shall be prepared by a qualified professional and submitted to the Division by **July 11, 2001.**

c. **Prior to use of treated effluent,** the Permittee shall submit the cross-connection control documentation required by part I.B.10.

I.E. MONITORING AND REPORTING

I.E.1. Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge. Analysis shall be performed by a State of Nevada certified laboratory. Results from this lab must accompany the Discharge Monitoring Report.

I.E.2. **Reporting**

a. Annual Report

i. The fourth quarter report shall contain a plot of the date (x-axis) versus concentration (y-axis) for each analyzed constituent. The plot shall include data from the preceding five years, if available. Any data point from the current year that is greater than the limits in Part I.A. must be explained by a narrative.

ii. The fourth quarter report shall demonstrate that the facility has maintained compliance with the annual application volume. If the annual application volume exceeds the limit listed in Table I.1, an evaluation shall be submitted with the fourth quarter report in accordance with the requirements listed in permit condition I.B.3.

ii. The fourth quarter report shall contain all data required to be collected annually.

b. Quarterly Report

i. Monitoring results obtained during the previous three (3) months shall be summarized for each month and reported quarterly on a Discharge Monitoring Report (DMR) Form received in this office no later than the 28th day of the month following the end of each quarter. The first report is due on (July 28, 2001). An original signed copy of these, and all other reports required herein, shall be submitted to the State at the following address:

Division of Environmental Protection
Bureau of Water Pollution Control
ATTN: Compliance Coordinator - Jennifer McMartin
333 West Nye Lane
Carson City, Nevada 89706-0851

ii. If the monthly maximum volume exceeds the limit listed in Table I.1, an evaluation shall be submitted with the fourth quarter report in accordance with the requirements listed in permit condition I.B.3.

I.E.3. **Definitions**

a. The "30-day average discharge" means the total discharge during a month divided by the number of samples in the period that the facility was discharging. Where less than daily sampling is required by this permit, the 30-day average discharge shall be determined by the summation of all the measured discharges divided by the number of samples during the period when the measurements were made.

b. The "daily maximum" is the highest measurement during the monitoring period.

c. The "30-day average concentration", other than for fecal coliform bacteria, means the arithmetic mean of measurements made during a month. The "30-day average concentration" for fecal coliform bacteria means the geometric mean of measurements made during a month. The geometric mean is the "n^{th}" root of the product of "n" numbers. Geometric mean calculations where there are non-detect results for fecal coliform shall use one-half the detection limit as the value for the non-detect results.

If fewer than four measurements are made during a month, the compliance or noncompliance with the 30-day average concentration limitation shall not be determined.

d. A "discrete" sample means any individual sample collected in less than 15 minutes.

e. For flow-rate measurements a "composite" sample means the arithmetic mean of no fewer than six individual measurements taken at equal time intervals for 24 hours, or for the duration of discharge, whichever is shorter.

For other than flow-rate a "composite" sample means a combination of no fewer than six individual flow-weighted samples obtained at equal time intervals for 24 hours, or for the duration of discharge, whichever is shorter. Flow-weighted sample means that the volume of each individual sample shall be proportional to the discharge flow rate at the time of sampling.

g. "cfu" means colony forming units.

I.E.4. **Test Procedures**

Test procedures for the analysis of pollutants shall conform to regulations (40 CFR, Part 136) published pursuant to Section 304(h) of the Act, under which such procedures may be required unless other procedures are approved by the Division.

I.E.5. **Recording the Results**

For each measurement or sample taken pursuant to the requirements of this permit, the permittee shall record and maintain at the facility, the following information:

a. the exact place, date, and time of sampling;
b. the dates the analyses were performed;
c. the person(s) who performed the analyses;
d. the analytical techniques or methods used; and
e. the results of all required analyses.

I.E.6. **Additional Monitoring by Permittee**

If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit, using approved analytical methods as specified above, the results of such monitoring shall be included in the calculation and reporting of the values required in the Discharge Monitoring Report Form. Such increased frequency shall also be indicated.

I.E.7. **Records Retention**

All records and information resulting from the monitoring activities required by this permit, including all records of analyses performed and calibration and maintenance of instrumentation and recordings from continuous monitoring instrumentation, shall be retained for a minimum of three (3) years, or longer if required by the Administrator.

I.E.8. **Modification of Monitoring Frequency and Sample Type**

After considering monitoring data, stream flow, discharge flow and receiving water conditions, the Division, may for just cause, modify the monitoring frequency and/or sample type by issuing an order to the permittee.

I.E.9. **All laboratory analysis conducted in accordance with this discharge permit must have detection at or below the permit limits.**

PART II

II.A. MANAGEMENT REQUIREMENTS

II.A.1. Change in Discharge

All discharges authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any pollutant identified in this permit more frequently than or at a level in excess of that authorized shall constitute a violation of the permit. Any anticipated facility expansions, or treatment modifications which will result in new, different, or increased discharges of pollutants must be reported by submission of a new application or, if such changes will not violate the effluent limitations specified in this permit, by notice to the permit issuing authority of such changes. Any changes to the permitted treatment facility must comply with Nevada Administrative Code NAC 445A.283 to 445A.285. Pursuant to NAC 445A.263, the permit may be modified to specify and limit any pollutants not previously limited.

II.A.2. Facilities Operation

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

II.A.3. Adverse Impact

The permittee shall take all reasonable steps to minimize any adverse impact to receiving waters resulting from noncompliance with any effluent limitations specified in this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying discharge.

II.A.4. Noncompliance, Unauthorized Discharge, Bypassing and Upset

a. Any diversion, bypass, spill, overflow or discharge of treated or untreated wastewater from wastewater treatment, conveyance facilities, or holding ponds under the control of the permittee is prohibited except as authorized by this permit. In the event the permittee has knowledge that a diversion, bypass, spill, overflow or discharge not authorized by this permit is probable, the permittee shall notify the Division immediately.

b. The permittee shall notify the Division within twenty-four (24) hours of any diversion, bypass, spill, upset, overflow or release of treated or untreated discharge other than that which is authorized by the permit. A written report shall be submitted to the Administrator within five (5) days of diversion, bypass, spill, overflow, upset or discharge, detailing the entire incident including:

(1) time and date of discharge;
(2) exact location and estimated amount of discharge;
(3) flow path and any bodies of water which the discharge reached;
(4) the specific cause of the discharge; and
(5) the preventive and/or corrective actions taken.

c. The following shall be included as information which must be reported within 24 hours: any unanticipated bypass which exceeds any effluent limitation in the permit; any upset which exceeds any effluent limitation in the permit; and violation of a limitation for any toxic pollutant or any pollutant identified as the method to control a toxic pollutant.

d. The permittee shall report all instances of noncompliance not reported under Part II.A.4.b. at the time monitoring reports are submitted. The reports shall contain the information listed in Part II.A.4.b.

e. An "upset" means an incident in which there is unintentional and temporary noncompliance with the permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

f. In selecting the appropriate enforcement option, the Division shall consider whether or not the noncompliance was the result of an upset.

g. The burden of proof is on the permittee to establish that an upset occurred.

In order to establish that an upset occurred, the permittee must provide, in addition to the information required under paragraph II.A.4.b. above, properly signed contemporaneous logs or other documentary evidence that:

(1) The facility was at the time being properly operated as required in paragraph II.A.2. above; and

(2) All reasonable steps were taken to minimize adverse impacts as required by paragraph II.A.3. above.

II.A.5. **Removed Substances**

Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of waste waters shall be disposed of in a manner such as to prevent any pollution from such materials from entering any navigable waters.

II.B. RESPONSIBILITIES

II.B.1. Right of Entry

The permittee shall allow the Administrator and/or his authorized representatives, upon the presentation of credentials:

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

b. at reasonable times, to have access to and copy any records required to be kept under the terms and conditions of this permit; to inspect any monitoring equipment or monitoring method required in this permit; and to perform any necessary sampling to determine compliance with this permit or to sample any discharge.

II.B.2. Transfer of Ownership or Control

In the event of any change in control or ownership of facilities from which the authorized discharge emanates, the permittee shall notify the succeeding owner or controller of the existence of this permit, by letter, a copy of which shall be forwarded to the Administrator. ALL transfer of permits shall be approved by the Division.

II.B.3. Availability of Reports

Except for data determined to be confidential under NRS 445A.665, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the office of the Division. As required by the Act, effluent data shall not be considered confidential. Knowingly making any false statement on any such report may result in the imposition of criminal penalties as provided for in NRS 445A.710.

II.B.4. **Furnishing False Information and Tampering with Monitoring Devices**

Any person who knowingly makes any false statement, representation, or certification in any application, record, report, plan or other document filed or required to be maintained by the provisions of NRS 445A.300 to 445A.730, inclusive, or by any permit, rule, regulation or order issued pursuant thereto, or who falsifies, tampers with or knowingly renders inaccurate any monitoring device or method required to be maintained under the provisions of NRS 445A.300 to 445A.730, inclusive, or by any permit, rule, regulation or order issued pursuant thereto, is guilty of a gross misdemeanor and shall be punished by a fine of not more than $10,000 or by imprisonment. This penalty is in addition to any other penalties, civil or criminal, provided pursuant to NRS 445A.300 to 445A.730, inclusive.

II.B.5. **Penalty for Violation of Permit Conditions**

Nevada Revised Statutes NRS 445A.675 provides that any person who violates a permit condition is subject to administrative and judicial sanctions as outlined in NRS 445A.690 through 445A.705.

II.B.6. **Permit Modification, Suspension or Revocation**

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

a. violation of any terms or conditions of this permit;

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

c. a change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

II.B.7. **Toxic Pollutants**

Notwithstanding Part II.B.6. above, if a toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under Section 307(a) of the Act for a toxic pollutant which is present in the discharge and such standard or prohibition is more stringent than any limitation for such pollutant in this permit, this permit shall be revised or modified in accordance with the toxic effluent standard or prohibition and the permittee so notified.

II.B.8. **Liability**

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable Federal, State or local laws, regulations, or ordinances.

II.B.9. **Property Rights**

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

II.B.10. **Severability**

The provisions of this permit are severable, and if any provision of this permit, or the application of any provisions of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

PART III

III.A. OTHER REQUIREMENTS

III.A.1.**Reapplication**

If the permittee desires to continue to discharge, he shall reapply not later than 180 days before this permit expires on the application forms then in use. The Permittee shall submit the reapplication fee required by NAC 445A.232 with the application.

III.A.2. **Signatures required on application and reporting forms.**

a. Application and reporting forms submitted to the department must be signed by one of the following:

(i) A principal executive officer of the corporation (of at least the level of Vice President) or his/her authorized representative who is responsible for the overall operation of the facility from which the discharge described in the application or reporting form originates;

(ii) A general partner of the partnership;

(iii) The proprietor of the sole proprietorship; or

(iv) A principal executive officer, ranking elected official or other authorized employee of the municipal, state or other public facility.

b. Each application must contain a certification by the person signing the application that he is familiar with the information provided, that to the best of his knowledge and belief the information is complete and accurate and that he has the authority to sign and execute the application.

c. **Changes to Authorization.** If an authorization under paragraph b. of this section is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph b. of this section must be submitted to the Division prior to or together with any reports, information, or applications to be signed by an authorized representative.

III.A.3. **Storage Pond Conditions**

If any effluent is placed in ponds, such ponds shall be located, operated and constructed so as to:

a. contain with no discharge the once-in-a-twenty-five year 24 hour storm at said location;

b. withstand the once-in-one-hundred year flood of said location without physical damages to berms and other pond structures;

c. prevent escape of treated effluent by leakage other than as authorized by this permit;

d. maintain freeboard at a minimum of 2 feet, unless otherwise approved by the Division.

AGREEMENT FOR RECLAIMED WATER SERVICE BY WASHOE COUNTY TO WOLF RUN GOLF COURSE

THIS AGREEMENT is entered into this ___ day of March, 2000, by and between Golf Vision Development, LLC, ("GOLF VISION"), a Nevada limited-liability company and the Athletic Association of the University of Nevada ("AAUN"), a Nevada non-profit corporation and Washoe County ("COUNTY"), a political subdivision of the State of Nevada. GOLF VISION and AAUN are sometimes collectively referred to herein as "WOLF RUN".

W I T N E S S E T H

WHEREAS, COUNTY is a provider of reclaimed water service; and

WHEREAS, AAUN is the fee title holder of the real property (Exhibit "A") on which the Wolf Run Golf Course ("Golf Course") is situated; and

WHEREAS, GOLF VISION operates and manages the Golf Course; and

WHEREAS, the parties desire to resolve a dispute over the conditions applicable to WOLF RUN for the receiving of reclaimed water service from COUNTY for the Golf Course.

NOW, THEREFORE, THE PARTIES AGREE AS FOLLOWS:

1.0 RECLAIMED WATER SERVICE AND CONTINUATION OF SERVICE

1.1 COUNTY agrees to authorize, on a temporary basis, the use by WOLF RUN for irrigation of the Golf Course, through temporary or permanent permits obtained from the State Engineer, of Whites Creek and Steamboat Ditch water rights owned by COUNTY commencing upon execution of this Agreement.

1.2 COUNTY agrees to provide reclaimed water services through its reclaimed water facilities to WOLF RUN to commence as soon as WOLF RUN has constructed the necessary facilities, and obtained all necessary permits, to allow such service.

1.3 The provision of reclaimed water service as described in 1.1 and 1.2 hereinabove is subject to Article 3, Conditions of Service, as set forth in Ordinance No. 1038, Reclaimed Water Ordinance, and as the ordinance may be amended from time to time.

1.4 The authorization for the use of water as described in 1.1 hereinabove is subject to GOLF VISION and AAUN diligently pursuing the obtaining of a discharge permit from the Nevada Division of Environmental Protection and constructing the necessary infrastructure to utilize water from the COUNTY's reclaimed water facilities on the Golf Course. The temporary arrangement set forth in Section 1.1 above will expire December

31, 2000 and may not be renewed or further extended except by order of COUNTY's Board of Commissioners done in open session.

2.0 PAYMENT FOR SERVICES

2.1 GOLF VISION and AAUN, jointly and severally, agree to pay to COUNTY the amount of One Hundred Fifty Thousand ($150,000.00) and no/100 Dollars, with interest thereon at the rate of prime plus 2% pursuant to NRS 17.130, based upon a thirty (30) year amortization schedule, payable monthly in advance for a period of fifteen (15) years. The first payment shall be due on or before April 1, 2000, and subsequent payments, shall be due on or before the first day of each month thereafter, to and including April 1, 2015, on which date the entire balance of principal and interest then owing shall be due. All payments shall be made according to the estimated schedule attached hereto as Exhibit "B". The total balance of principal and interest owing at any time may be prepaid without penalty.

2.2 The interest rate shall be adjusted on July 1 and January 1 of each year.

2.3 COUNTY agrees to submit an accounting to GOLF VISION AND AAUN on July 1 and January 1 of each year indicating the amount due and owing COUNTY, including interest, and the installment amounts due for the next six month period.

2.4 GOLF VISION AND AAUN, jointly and severally, agree to pay a late charge equal to 20% of any installment not received by COUNTY within ten (10) days after due date.

2.5 GOLF VISION AND AAUN acknowledge and agree that failure to make timely payment of any installment within ten (10) days after due date, shall result in termination of all water usage referred to in this Agreement.

2.6 GOLF VISION and AAUN, jointly and severally, agree to pay to COUNTY within ten (10) days of execution of this Agreement the amount of Twenty-Two Thousand Forty-Seven ($22,047.50) and 50/100 Dollars, representing an accrued balance of Sixteen Thousand One Hundred Fifty ($16,150) and no/100 Dollars for ditch assessments and administrative costs associated with WOLF RUN's use of Whites Creek and Steamboat Ditch water rights owned by COUNTY through calendar year 1998 and an additional Five Thousand Nine Hundred Twenty-Two ($5,922.50) and 50/100 Dollars for such usage in the calendar year 1999.

2.7 GOLF VISION AND AAUN, jointly and severally, agree, commencing with any irrigation usage as set forth in Section 1 above, to pay the Zone 1 usage charge rates set forth in Article 4, Schedule of Rates and Charges, set forth in Ordinance No. 1038, Reclaimed Water Ordinance, and as the ordinance may be

amended from time to time, for the usage set forth in Section 1.1 above, and for subsequent usage after completion of necessary infrastructure, and obtaining necessary permits, for the Golf Course.

2.8 WOLF RUN agrees that there will be no set off from the ordinance rate due to the fact that the infrastructure for irrigating the Golf Course with reclaimed water from COUNTY's facilities is not in place.

2.9 WOLF RUN agrees that water usage from Whites Creek and the Steamboat Ditch will be monitored through WOLF RUN's meters and that records indicating usage will be maintained by COUNTY. COUNTY shall have continued access rights to the meters for monitoring and inspection purposes.

In the event that WOLF RUN obtains water from other sources, an additional meter shall be installed to differentiate between water obtained from COUNTY and water obtained from such other sources.

2.10 WOLF RUN agrees that no more than 337.6 acre-feet of Steamboat Ditch and Whites Creek water will be made available by COUNTY during the 2000 calendar year. If during the 2000 irrigation season the reclaimed system is on line within the Golf Course, then the sum total of Steamboat Ditch, Whites Creek and reclaimed water combined shall not exceed 337.6 acre-feet for the calendar year 2000, unless additional reclaimed water is secured as described in Section 4 below.

3.0 SECURITY

3.1 The parties agree that the payments required by Sections 2.1, 2.3 and 2.4 run with the land and that this Agreement may be recorded to provide notice to any future owners of the Golf Course property of the payment requirements.

3.2 COUNTY agrees to record a satisfaction of payment in the Office of County Recorder upon completion of payments required in Sections 2.1 and 2.6 above.

4.0 PROCEDURE FOR DETERMINING EXCESS WATER USAGE

4.1 WOLF RUN water usage will be monitored by COUNTY upon connection to COUNTY's reclaimed water facility through a facility meter. Upon said connection, all COUNTY ditch and creek permits will be withdrawn and said sources will no longer be available for use by the Golf Course.

4.2 COUNTY will provide WOLF RUN with monthly updates on reclaimed water usage.

303 772-8471 303

4.3 If usage of water provided by COUNTY exceeds 337.6 acre feet in a calendar year, reclaimed water service will be discontinued until such time as COUNTY receives a completed application, with appropriate fees and/or offers of dedication of water as set forth in Ordinance No. 1038, as amended from time to time, for the overage estimated by WOLF RUN to be needed for the remainder of the calendar year.

4.4 If additional usage is applied for pursuant to Section 4.3 above, the new total number of acre feet will become the new WOLF RUN golf course water budget for subsequent years.

5.0 TERM This Agreement shall remain in effect until April 1, 2015 or until the payments required under Section 2.1 are completed, whichever occurs first, after which WOLF RUN will remain obligated to pay for all reclaimed water usage pursuant to the provisions of Ordinance No. 1038.

6.0 SATISFACTION OF CLAIMS AND DEMANDS

6.1 Upon execution of this Agreement, WOLF RUN agrees to release COUNTY from any and all claims relating to the controversy culminating in this Agreement. Specifically, and except as set forth herein, WOLF RUN agrees to release COUNTY from any claims relating to the necessary requirements for connecting to COUNTY's reclaimed water system.

6.2 Upon execution of this Agreement, COUNTY agrees to release WOLF RUN from any and all claims relating to the controversy culminating in this Agreement. Specifically, and except as set forth herein, COUNTY agrees to release WOLF RUN from any claim relating to any additional financial requirements not mentioned herein for connecting to COUNTY's reclaimed water system.

7.0 NOTICE

7.1 Notice pursuant to this Agreement shall be given in writing to WOLF RUN through GOLF VISION at 1400 Wolf Run Road, Reno, Nevada 89511 or delivered personally to GOLF VISION offices at the Golf Course.

7.2 Notice to COUNTY pursuant to this Agreement shall be given in writing to COUNTY through its Utility Division Manager, Utility Division, Water Resources Department, Washoe County, 4930 Energy Way, Reno, Nevada 89502-4106 or delivered personally to COUNTY's offices at the same address.

8.0 MISCELLANEOUS

8.1 Enforcement. If either party is compelled to institute, prosecute, execute, defend, or enforce any action or

proceeding pertaining to this Agreement, the total of such sums, expenses, and losses, including reasonable attorneys fees, shall be due and payable to the prevailing party from the non-prevailing party within thirty days after such award.

8.2 Amendments. This Agreement may be amended, and may only be amended, by mutual written agreement of all parties. No action by COUNTY shall be deemed an amendment of this Agreement unless approved by motion of the Board of County Commissioners.

8.3 Assignment. Except as specifically provided herein, no party may assign all or any part of this Agreement, without the prior written consent of the other parties. Nonetheless all terms hereof shall be binding on the heirs, successors, and assigns of the parties.

8.4 Waiver. No term or condition of this Agreement may be waived, except by written consent of all parties. Forbearance or indulgence by any party, in any regard whatsoever, shall not constitute a waiver of any term, covenant, or condition.

8.5 Severability. If any provision of this Agreement or the application thereof to all parties or to any other person or circumstance is found or declared invalid, void or unenforceable, the remaining provisions, or the application of such provisions to the other parties, or to any other person or circumstance, shall remain in full force and effect.

8.6 Entire Agreement. This Agreement constitutes the entire Agreement between the parties as to the matter of WOLF RUN's connection to COUNTY reclaimed water facilities for irrigation of the Golf Course. All other agreements, promises, and representations with respect to the this matter, other than contained herein, are expressly revoked, as the parties have provided within this Agreement, in writing, all terms and provisions relating to the matter in controversy.

ATTEST:

_____
County Clerk

WASHOE COUNTY

By_____
Chairman
Board of County Commissioners

ATHLETIC ASSOCIATION OF
THE UNIVERSITY OF NEVADA

By _____

_____
(Title)

GOLF VISION DEVELOPMENT, LLC

By _____

_____
(Title)

STATE OF NEVADA)
: ss.
COUNTY OF WASHOE)

On this _____ day of _____, 2000, personally appeared before me, a Notary Public in and for said County and State, _____, known to me to be the _____ of Golf Vision Development, LLC, who acknowledged to me that he/she executed the foregoing instrument freely and voluntarily and for the uses and purposes therein mentioned on behalf of such organization.

_____
NOTARY PUBLIC

STATE OF NEVADA)
: ss.
COUNTY OF WASHOE)

On this _____ day of _____, 2000, personally appeared before me, a Notary Public in and for said County and State, _____, known to me to be the _____, Athletic Association of the University of Nevada, who acknowledged to me that he/she executed the foregoing instrument freely and voluntarily and for the uses and purposes therein mentioned on behalf of such organization.

_____
NOTARY PUBLIC

Wolf Run
Payment Schedule
$150,000
Settlement

Wolf Run Golf Course Note Payable
First Payment due upon signing
$150,000.00 Settlement
10.75% Interest Rate Prime +2 Wells Fargo 3/10/00
$1,387.88 Monthly Payment
Interest rate adjusted July 1st and January 1st of each year
First Payment due April 1st 2000

Wolf Run
Payment Schedule
$150,000
Settlement

	Payment	Principal Reduction	Interest Portion	Remaining Balance		
Apr-00	$1,387.88	$1,387.88	$0.00	$148,612.12		
May-00	$1,387.88	$56.46	$1,331.42	$148,555.66		
Jun-00	$1,387.88	$56.97	$1,330.91	$148,498.69		
Total	**$4,163.63**	**$1,501.31**	**$2,662.33**	**$148,498.69**	**Balance**	**Remaining**
Jul-00	$1,387.88	$57.48	$1,330.40	$148,441.21		
Aug-00	$1,387.88	$57.99	$1,329.88	$148,383.22		
Sep-00	$1,387.88	$58.51	$1,329.37	$148,324.71		
Oct-00	$1,387.88	$59.04	$1,328.84	$148,265.67		
Nov-00	$1,387.88	$59.57	$1,328.31	$148,206.10		
Dec-00	$1,387.88	$60.10	$1,327.78	$148,146.00		
Jan-01	$1,387.88	$60.64	$1,327.24	$148,085.37		
Feb-01	$1,387.88	$61.18	$1,326.70	$148,024.18		
Mar-01	$1,387.88	$61.73	$1,326.15	$147,962.45		
Apr-01	$1,387.88	$62.28	$1,325.60	$147,900.17		
May-01	$1,387.88	$62.84	$1,325.04	$147,837.33		
Jun-01	$1,387.88	$63.40	$1,324.47	$147,773.93		
Total	**$16,654.54**	**$724.76**	**$15,929.77**	**$147,773.93**	**Balance**	**Remaining**
Jul-01	$1,387.88	$63.97	$1,323.91	$147,709.96		
Aug-01	$1,387.88	$64.54	$1,323.33	$147,645.41		
Sep-01	$1,387.88	$65.12	$1,322.76	$147,580.29		
Oct-01	$1,387.88	$65.71	$1,322.17	$147,514.58		
Nov-01	$1,387.88	$66.30	$1,321.58	$147,448.29		
Dec-01	$1,387.88	$66.89	$1,320.99	$147,381.40		
Jan-02	$1,387.88	$67.49	$1,320.39	$147,313.91		
Feb-02	$1,387.88	$68.09	$1,319.79	$147,245.82		
Mar-02	$1,387.88	$68.70	$1,319.18	$147,177.11		
Apr-02	$1,387.88	$69.32	$1,318.56	$147,107.79		
May-02	$1,387.88	$69.94	$1,317.94	$147,037.86		
Jun-02	$1,387.88	$70.57	$1,317.31	$146,967.29		
Total	**$16,654.54**	**$806.64**	**$15,847.90**	**$146,967.29**	**Balance**	**Remaining**
Jul-02	$1,387.88	$71.20	$1,316.68	$146,896.09		
Aug-02	$1,387.88	$71.84	$1,316.04	$146,824.25		
Sep-02	$1,387.88	$72.48	$1,315.40	$146,751.77		
Oct-02	$1,387.88	$73.13	$1,314.75	$146,678.65		

Wolf Run
Payment Schedule
$150,000
Settlement

Nov-02	$1,387.88	$73.78	$1,314.09	$146,604.86	
Dec-02	$1,387.88	$74.45	$1,313.43	$146,530.42	
Jan-03	$1,387.88	$75.11	$1,312.77	$146,455.30	
Feb-03	$1,387.88	$75.79	$1,312.09	$146,379.52	
Mar-03	$1,387.88	$76.46	$1,311.41	$146,303.05	
Apr-03	$1,387.88	$77.15	$1,310.73	$146,225.91	
May-03	$1,387.88	$77.84	$1,310.04	$146,148.06	
Jun-03	$1,387.88	$78.54	$1,309.34	$146,069.53	
Total	**$16,654.54**	**$897.76**	**$15,756.78**	**$146,069.53**	**Balance Remaining**
Jul-03	$1,387.88	$79.24	$1,308.64	$145,990.29	
Aug-03	$1,387.88	$79.95	$1,307.93	$145,910.33	
Sep-03	$1,387.88	$80.67	$1,307.21	$145,829.67	
Oct-03	$1,387.88	$81.39	$1,306.49	$145,748.28	
Nov-03	$1,387.88	$82.12	$1,305.76	$145,666.16	
Dec-03	$1,387.88	$82.86	$1,305.02	$145,583.30	
Jan-04	$1,387.88	$83.60	$1,304.28	$145,499.70	
Feb-04	$1,387.88	$84.35	$1,303.53	$145,415.36	
Mar-04	$1,387.88	$85.10	$1,302.78	$145,330.26	
Apr-04	$1,387.88	$85.86	$1,302.01	$145,244.39	
May-04	$1,387.88	$86.63	$1,301.24	$145,157.76	
Jun-04	$1,387.88	$87.41	$1,300.47	$145,070.35	
Total	**$16,654.54**	**$999.18**	**$15,655.36**	**$145,070.35**	**Balance Remaining**
Jul-04	$1,387.88	$88.19	$1,299.69	$144,982.16	
Aug-04	$1,387.88	$88.98	$1,298.90	$144,893.17	
Sep-04	$1,387.88	$89.78	$1,298.10	$144,803.39	
Oct-04	$1,387.88	$90.58	$1,297.29	$144,712.81	
Nov-04	$1,387.88	$91.40	$1,296.48	$144,621.41	
Dec-04	$1,387.88	$92.22	$1,295.66	$144,529.20	
Jan-05	$1,387.88	$93.04	$1,294.84	$144,436.15	
Feb-05	$1,387.88	$93.87	$1,294.00	$144,342.28	
Mar-05	$1,387.88	$94.72	$1,293.16	$144,247.56	
Apr-05	$1,387.88	$95.56	$1,292.31	$144,152.00	
May-05	$1,387.88	$96.42	$1,291.46	$144,055.58	
Jun-05	$1,387.88	$97.28	$1,290.59	$143,958.30	
Total	**$16,654.54**	**$1,112.05**	**$15,542.49**	**$143,958.30**	**Balance Remaining**
Jul-05	$1,387.88	$98.16	$1,289.72	$143,860.14	
Aug-05	$1,387.88	$99.04	$1,288.84	$143,761.10	
Sep-05	$1,387.88	$99.92	$1,287.96	$143,661.18	
Oct-05	$1,387.88	$100.82	$1,287.06	$143,560.36	
Nov-05	$1,387.88	$101.72	$1,286.16	$143,458.64	
Dec-05	$1,387.88	$102.63	$1,285.25	$143,356.01	
Jan-06	$1,387.88	$103.55	$1,284.33	$143,252.46	

Wolf Run
Payment Schedule
$150,000
Settlement

Feb-06	$1,387.88	$104.48	$1,283.40	$143,147.98		
Mar-06	$1,387.88	$105.42	$1,282.46	$143,042.56		
Apr-06	$1,387.88	$106.36	$1,281.52	$142,936.20		
May-06	$1,387.88	$107.31	$1,280.57	$142,828.89		
Jun-06	$1,387.88	$108.27	$1,279.60	$142,720.62		
Total	**$16,654.54**	**$1,237.68**	**$15,416.86**	**$142,720.62**	**Balance**	**Remaining**
Jul-06	$1,387.88	$109.24	$1,278.63	$142,611.37		
Aug-06	$1,387.88	$110.22	$1,277.66	$142,501.15		
Sep-06	$1,387.88	$111.21	$1,276.67	$142,389.94		
Oct-06	$1,387.88	$112.21	$1,275.67	$142,277.73		
Nov-06	$1,387.88	$113.21	$1,274.67	$142,164.52		
Dec-06	$1,387.88	$114.23	$1,273.65	$142,050.29		
Jan-07	$1,387.88	$115.25	$1,272.63	$141,935.04		
Feb-07	$1,387.88	$116.28	$1,271.60	$141,818.76		
Mar-07	$1,387.88	$117.32	$1,270.55	$141,701.44		
Apr-07	$1,387.88	$118.38	$1,269.50	$141,583.06		
May-07	$1,387.88	$119.44	$1,268.44	$141,463.63		
Jun-07	$1,387.88	$120.51	$1,267.37	$141,343.12		
Total	**$16,654.54**	**$1,377.49**	**$15,277.04**	**$141,343.12**	**Balance**	**Remaining**
Jul-07	$1,387.88	$121.59	$1,266.29	$141,221.54		
Aug-07	$1,387.88	$122.67	$1,265.20	$141,098.86		
Sep-07	$1,387.88	$123.77	$1,264.10	$140,975.09		
Oct-07	$1,387.88	$124.88	$1,263.00	$140,850.21		
Nov-07	$1,387.88	$126.00	$1,261.88	$140,724.20		
Dec-07	$1,387.88	$127.13	$1,260.75	$140,597.07		
Jan-08	$1,387.88	$128.27	$1,259.61	$140,468.81		
Feb-08	$1,387.88	$129.42	$1,258.46	$140,339.39		
Mar-08	$1,387.88	$130.58	$1,257.30	$140,208.81		
Apr-08	$1,387.88	$131.75	$1,256.13	$140,077.06		
May-08	$1,387.88	$132.93	$1,254.95	$139,944.13		
Jun-08	$1,387.88	$134.12	$1,253.76	$139,810.02		
Total	**$16,654.54**	**$1,533.11**	**$15,121.43**	**$139,810.02**	**Balance**	**Remaining**
Jul-08	$1,387.88	$135.32	$1,252.56	$139,674.70		
Aug-08	$1,387.88	$136.53	$1,251.35	$139,538.16		
Sep-08	$1,387.88	$137.76	$1,250.12	$139,400.41		
Oct-08	$1,387.88	$138.99	$1,248.89	$139,261.42		
Nov-08	$1,387.88	$140.24	$1,247.64	$139,121.18		
Dec-08	$1,387.88	$141.49	$1,246.39	$138,979.69		
Jan-09	$1,387.88	$142.76	$1,245.12	$138,836.93		
Feb-09	$1,387.88	$144.04	$1,243.84	$138,692.89		
Mar-09	$1,387.88	$145.33	$1,242.55	$138,547.56		
Apr-09	$1,387.88	$146.63	$1,241.25	$138,400.93		

Wolf Run
Payment Schedule
$150,000
Settlement

May-09	$1,387.88	$147.94	$1,239.93	$138,252.99		
Jun-09	$1,387.88	$149.27	$1,238.61	$138,103.72		
Total	**$16,654.54**	**$1,706.30**	**$14,948.24**	**$138,103.72**	**Balance**	**Remaining**
Jul-09	$1,387.88	$150.61	$1,237.27	$137,953.11		
Aug-09	$1,387.88	$151.96	$1,235.92	$137,801.16		
Sep-09	$1,387.88	$153.32	$1,234.56	$137,647 84		
Oct-09	$1,387.88	$154.69	$1,233.19	$137,493.15		
Nov-09	$1,387.88	$156.08	$1,231.80	$137,337.07		
Dec-09	$1,387.88	$157.48	$1,230.40	$137,179.59		
Jan-10	$1,387.88	$158.89	$1,228.99	$137,020.71		
Feb-10	$1,387.88	$160.31	$1,227.57	$136,860.40		
Mar-10	$1,387.88	$161.75	$1,226.13	$136,698.65		
Apr-10	$1,387.88	$163.20	$1,224.68	$136,535.46		
May-10	$1,387.88	$164.66	$1,223.22	$136,370.80		
Jun-10	$1,387.88	$166.13	$1,221.75	$136,204.67		
Total	**$16,654.54**	**$1,899.05**	**$14,755.49**	**$136,204.67**	**Balance**	**Remaining**
Jul-10	$1,387.88	$167.62	$1,220.26	$136,037.05		
Aug-10	$1,387.88	$169.12	$1,218.76	$135,867.93		
Sep-10	$1,387.88	$170.64	$1,217.24	$135,697.29		
Oct-10	$1,387.88	$172.17	$1,215.71	$135,525.12		
Nov-10	$1,387.88	$173.71	$1,214.17	$135,351.41		
Dec-10	$1,387.88	$175.26	$1,212.61	$135,176.15		
Jan-11	$1,387.88	$176.84	$1,211.04	$134,999.31		
Feb-11	$1,387.88	$178.42	$1,209.46	$134,820.89		
Mar-11	$1,387.88	$180.02	$1,207.86	$134,640.88		
Apr-11	$1,387.88	$181.63	$1,206.25	$134,459.24		
May-11	$1,387.88	$183.26	$1,204.62	$134,275.99		
Jun-11	$1,387.88	$184.90	$1,202.98	$134,091.09		
Total	**$16,654.54**	**$2,113.58**	**$14,540.96**	**$134,091.09**	**Balance**	**Remaining**
Jul-11	$1,387.88	$186.56	$1,201.32	$133,904.53		
Aug-11	$1,387.88	$188.23	$1,199.65	$133,716.30		
Sep-11	$1,387.88	$189.91	$1,197.96	$133,526.39		
Oct-11	$1,387.88	$191.62	$1,196.26	$133,334.77		
Nov-11	$1,387.88	$193.33	$1,194.55	$133,141.44		
Dec-11	$1,387.88	$195.06	$1,192.81	$132,946.38		
Jan-12	$1,387.88	$196.81	$1,191.07	$132,749.57		
Feb-12	$1,387.88	$198.57	$1,189.30	$132,550.99		
Mar-12	$1,387.88	$200.35	$1,187.52	$132,350.64		
Apr-12	$1,387.88	$202.15	$1,185.73	$132,148.49		
May-12	$1,387.88	$203.96	$1,183.92	$131,944.53		
Jun-12	$1,387.88	$205.79	$1,182.09	$131,738.74		

Wolf Run
Payment Schedule
$150,000
Settlement

Total	**$16,654.54**	**$2,352.35**	**$14,302.19**	**$131,738.74**	**Balance Remaining**
Jul-12	$1,387.88	$207.63	$1,180.25	$131,531.11	
Aug-12	$1,387.88	$209.49	$1,178.39	$131,321.62	
Sep-12	$1,387.88	$211.37	$1,176.51	$131,110.25	
Oct-12	$1,387.88	$213.26	$1,174.62	$130,896.99	
Nov-12	$1,387.88	$215.17	$1,172.71	$130,681.82	
Dec-12	$1,387.88	$217.10	$1,170.78	$130,464.72	
Jan-13	$1,387.88	$219.04	$1,168.83	$130,245.67	
Feb-13	$1,387.88	$221.01	$1,166.87	$130,024.67	
Mar-13	$1,387.88	$222.99	$1,164.89	$129,801.68	
Apr-13	$1,387.88	$224.99	$1,162.89	$129,576.69	
May-13	$1,387.88	$227.00	$1,160.88	$129,349.69	
Jun-13	$1,387.88	$229.03	$1,158.84	$129,120.66	
Total	**$16,654.54**	**$2,618.08**	**$14,036.46**	**$129,120.66**	**Balance Remaining**
Jul-13	$1,387.88	$231.09	$1,156.79	$128,889.57	
Aug-13	$1,387.88	$233.16	$1,154.72	$128,656.42	
Sep-13	$1,387.88	$235.25	$1,152.63	$128,421.17	
Oct-13	$1,387.88	$237.35	$1,150.53	$128,183.82	
Nov-13	$1,387.88	$239.48	$1,148.40	$127,944.34	
Dec-13	$1,387.88	$241.62	$1,146.25	$127,702.71	
Jan-14	$1,387.88	$243.79	$1,144.09	$127,458.92	
Feb-14	$1,387.88	$245.97	$1,141.90	$127,212.95	
Mar-14	$1,387.88	$248.18	$1,139.70	$126,964.77	
Apr-14	$1,387.88	$250.40	$1,137.48	$126,714.37	
May-14	$1,387.88	$252.64	$1,135.23	$126,461.73	
Jun-14	$1,387.88	$254.91	$1,132.97	$126,206.82	
Total	**$16,654.54**	**$2,913.84**	**$13,740.70**	**$126,206.82**	**Balance Remaining**
Jul-14	$1,387.88	$257.19	$1,130.69	$125,949.63	
Aug-14	$1,387.88	$259.50	$1,128.38	$125,690.13	
Sep-14	$1,387.88	$261.82	$1,126.06	$125,428.31	
Oct-14	$1,387.88	$264.17	$1,123.71	$125,164.15	
Nov-14	$1,387.88	$266.53	$1,121.35	$124,897.61	
Dec-14	$1,387.88	$268.92	$1,118.96	$124,628.69	
Jan-15	$1,387.88	$271.33	$1,116.55	$124,357.36	
Feb-15	$1,387.88	$273.76	$1,114.12	$124,083.60	
Mar-15	$1,387.88	$276.21	$1,111.67	$123,807.39	
Total	**$12,490.90**	**$2,399.43**	**$10,091.47**	**$123,807.39**	

Plant Consumptive Use Worksheet: Calculates hydraulic loading based on crop water needs (Worksheet 1-A)

$$Lw_c = \frac{ET - P}{E(1 - Lr)}$$ where: $$Lr = \frac{ECw}{5ECe - ECw}$$

	greens (bent)	tees (rye)	fairways (blue/rye)
acres	3.5	18	59.5

		greens	tees	fairways
ET:	Evapotranspiration rate (in/yr). Multiplied by Cc if known	60	60	60
Cc:	Crop coefficient (% expressed as fraction)	0.8	0.8	0.8
P:	Precipitation rate (in/yr)	7.38	7.38	7.38
E:	Efficiency of irrigation system (% expressed as fraction)	0.75	0.75	0.75
ECe:	Salinity tolerance of crop (mmho/cm or dS/m; equivalent units)	2	4.5	3
ECw:	Salinity of applied effluent (mmho/cm or dS/m; equivalent units)	0.62	0.62	0.62
Lr:	***Leaching requirement (% expressed as fraction)***	***0.066098***	***0.028336***	***0.043115***
Lwc:	***Allowable hydraulic loading based on crop water needs (in/yr):***	***58.0***	***55.7***	***56.6***

Gallons of water per year from Plant Consumptive Use Worksheet (left)

greens	tees	fairways	TOTAL
5,511,663	27,244,100	91,447,813	***124,203,577***

Nitrogen Loading Limit Worksheet: Calculates hydraulic loading based on N loading rate (Worksheet 2-A)

$$Lw_n = \frac{Cp(P - ET) + 4.4U}{Cn(1 - f) - Cp}$$

		greens	tees	fairways
ET:	Evapotranspiration rate (in/yr). Multiplied by Cc if known	60	60	60
Cc:	Crop coefficient (% expressed as fraction)	0.8	0.8	0.8
P:	Precipitation rate (in/yr)	7.38	7.38	7.38
Cp:	Total nitrogen concentration in percolating water (mg/l)	5	5	5
U:	Nitrogen uptake rate by crop (lb/acre-year)	450	180	180
Cn:	Total nitrogen concentration in applied wastewater (mg/l)	6.4	6.4	6.4
f:	Applied total N removed by denitrification/volatilization (%):	0.2	0.2	0.2
Lwn:	***Allowable hydraulic loading based on N loading rate (in/yr):***	***14807.5***	***4907.5***	***4907.5***

Gallons of water per year from Nitrogen Loading Limit Worksheet (left)

greens	tees	fairways	TOTAL
1,407,301,135	27,244,100	91,447,813	***1,525,993,049***

Consumptive Use Requirement Worksheet:
Maximum Loading Rate Based on Plant Water Use Requirements (Worksheet 1-B)

			Hydraulic Loading (Lw)									
	ET (inches)	Precip. (inches)	greens (inches)	tees (inches)	fairways (inches)	Millions of Gallons per month greens	tees	fairways	*TOTAL (10^6 gal.)*	days/mo	MGPD*	GPD**
Jan	0.83	1.15	-0.46	-0.44	-0.45	0	0	0	*0*	31	0	0
Feb	0.90	1.00	-0.14	-0.14	-0.14	0	0	0	*0*	28	0	0
Mar	3.26	0.78	3.54	3.40	3.46	0.33653	1.663463	5.583595	*7.583588*	31	0.244632	244632
Apr	4.49	0.41	5.83	5.60	5.69	0.553646	2.736665	9.185914	*12.47622*	30	0.415874	415874
May	6.38	0.62	8.22	7.90	8.03	0.781617	3.863526	12.96835	*17.61349*	31	0.568177	568177
Jun	6.26	0.44	8.31	7.99	8.11	0.789759	3.903772	13.10344	*17.79697*	30	0.593232	593232
Jul	8.15	0.27	11.25	10.81	10.98	1.069296	5.285519	17.74142	*24.09624*	31	0.777298	777298
Aug	7.33	0.23	10.14	9.74	9.89	0.963452	4.762333	15.98529	*21.71108*	31	0.700357	700357
Sep	5.36	0.35	7.15	6.87	6.98	0.679844	3.360463	11.27976	*15.32007*	30	0.510669	510669
Oct	2.56	0.42	3.06	2.94	2.98	0.290393	1.435407	4.818102	*6.543902*	31	0.211094	211094
Nov	1.69	0.73	1.37	1.32	1.34	0.13027	0.643921	2.161392	*2.935582*	30	0.097853	97853
Dec	0.79	0.99	-0.29	-0.27	-0.28	0	0	0	*0*	31	0	0
Per year	**48.00**	**7.39**	**58.0**	**55.7**	**56.6**	**5.6**	**27.7**	**92.8**	***126.1***	**365**		

Monthly evapotranspiration (ET) rates based on annual ET rate of 60 inches per year and adjusted with a crop coefficient of 0.8.

	acres	leaching requirement (Lr)	irrigation system efficiency (E)
greens	3.5	0.066098	0.75
tees	18	0.028336	0.75
fairways	59.5	0.043115	0.75

Where precipitation per month exceeds ET per month hydraulic loading value is negative and zero gallons per month of effluent is used.

** million gallons per day*
*** gallons per day*

Worksheet 1-A

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

Page 1 of 3 Crop Type = Bent Grass

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

(A) Annual Evapotranspiration (ET, in/yr) = (60)(0.8) = 48
(Multiply by Crop Coefficient (Kc) if value is known)

(B) Annual Precipitation (P, in/yr) = 7.38

(C) (A) - (B) = 40.62 (in/yr)

(D) Salinity of Applied Effluent (ECw, mmho/cm) or ≈ (TDS, mg/l) ÷ 640 = 0.62
(Indicate which method was used to determine ECw, Direct Measurement or Approximation by Calculation.)

(E) Salinity Tolerance of Plant Crop (ECe, mmho/cm) = 2

(F) 5 x (E) = 10 (mmho/cm)

(G) (F) - (D) = 9.38 (mmho/cm)

(H) Leaching Requirement (Lr, %, expressed as a fraction) = (D) ÷ (G) = 0.066

(I) 1 - (H) = 0.934

(J) Efficiency of Irrigation System (E, %, expressed as a fraction) = 0.75

(K) (J) x (I) = 0.70

(L) (C) ÷ (K) = $Lw_{(c)}$ = 58.0 (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-A

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

Page 2 of 3 Crop Type = Rye Grass

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

(A) Annual Evapotranspiration (ET, in/yr) = (60)(0.8) = 48
(Multiply by Crop Coefficient (Kc) if value is known)

(B) Annual Precipitation (P, in/yr) = 7.38

(C) (A) - (B) = 40.62 (in/yr)

(D) Salinity of Applied Effluent (ECw, mmho/cm) or ≈ (TDS, mg/l) ÷ 640 = 0.62
(Indicate which method was used to determine ECw, Direct Measurement or Approximation by Calculation.)

(E) Salinity Tolerance of Plant Crop (ECe, mmho/cm) = 4.5

(F) 5 x (E) = 22.5 (mmho/cm)

(G) (F) - (D) = 21.88 (mmho/cm)

(H) Leaching Requirement (Lr, %, expressed as a fraction) = (D) ÷ (G) = 0.028

(I) 1 - (H) = 0.971

(J) Efficiency of Irrigation System (E, %, expressed as a fraction) = 0.75

(K) (J) x (I) = 0.73

(L) (C) ÷ (K) = $Lw_{(c)}$ = 55.7 (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-A

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

Page 3 of 3 Crop Type = Blue/Rye Grass blend

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

(A) Annual Evapotranspiration (ET, in/yr) = (60)(0.8) = 48
(Multiply by Crop Coefficient (Kc) if value is known)

(B) Annual Precipitation (P, in/yr) = 7.38

(C) (A) - (B) = 40.62 (in/yr)

(D) Salinity of Applied Effluent (ECw, mmho/cm) or ≈ (TDS, mg/l) ÷ 640 = 0.62
(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) = 14.38 (mmho/cm)

(H) Leaching Requirement (Lr, %, expressed as a fraction) = (D) ÷ (G) = 0.043

(I) 1 - (H) = 0.957

(J) Efficiency of Irrigation System (E, %, expressed as a fraction) = 0.75

(K) (J) x (I) = 0.72

(L) (C) ÷ (K) = $Lw_{(c)}$ = 56.6 (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 2-A

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

Page 1 of 3 Crop Type = Bent Grass

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

(A) Total Nitrogen in Percolating Water (Cp, mg/l) = 5

(B) Annual Precipitation (P, in/yr) = 7.38

(C) Annual Evapotranspiration (ET, in/yr) = (60)(0.8) = 48
(Multiply by Crop Coefficient (Kc) if value is known)

(D) (B) - (C) = -40.62 (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) = -203.1

(F) Crop Nitrogen Uptake (U, lb/ac-yr) = 450

(G) (F) x 4.4 = 1,980

(H) (E) + (G) = 1,776.9

(I) Fraction of Applied Total Nitrogen Lost to Denitrification and Volatilization (f) = 0.2

(J) 1- (I) = 0.8

(K) Total Nitrogen in Applied Effluent (Cn, mg/l) = 6.4

(L) (J) x (K) = 5.12

(M) (L) - (A) = 0.12

(N) (H) ÷ (M) = $Lw_{(n)}$ (inches/year) = 14,807.5

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-A

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

Page 2 of 3 Crop Type = Rye Grass

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

(A) Total Nitrogen in Percolating Water (Cp, mg/l) = 5

(B) Annual Precipitation (P, in/yr) = 7.38

(C) Annual Evapotranspiration (ET, in/yr) = (60)(0.8) = 48
(Multiply by Crop Coefficient (Kc) if value is known)

(D) (B) - (C) = -40.62 (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) = -203.1

(F) Crop Nitrogen Uptake (U, lb/ac-yr) = 180

(G) (F) x 4.4 = 792

(H) (E) + (G) = 588.9

(I) Fraction of Applied Total Nitrogen Lost to Denitrification and Volatilization (f) = 0.2

(J) 1- (I) = 0.8

(K) Total Nitrogen in Applied Effluent (Cn, mg/l) = 6.4

(L) (J) x (K) = 5.12

(M) (L) - (A) = 0.12

(N) (H) ÷ (M) = $Lw_{(n)}$ (inches/year) = 4,907.5

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-A

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

Page 3 of 3 Crop Type = Blue/Rye Grass blend

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

(A) Total Nitrogen in Percolating Water (Cp, mg/l) = 5

(B) Annual Precipitation (P, in/yr) = 7.38

(C) Annual Evapotranspiration (ET, in/yr) = (60)(0.8) = 48
(Multiply by Crop Coefficient (Kc) if value is known)

(D) (B) - (C) = -40.62 (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) = -203.1

(F) Crop Nitrogen Uptake (U, lb/ac-yr) = 180

(G) (F) x 4.4 = 792

(H) (E) + (G) = 588.9

(I) Fraction of Applied Total Nitrogen Lost to Denitrification and Volatilization (f) = 0.2

(J) 1- (I) = 0.8

(K) Total Nitrogen in Applied Effluent (Cn, mg/l) = 6.4

(L) (J) x (K) = 5.12

(M) (L) - (A) = 0.12

(N) (H) ÷ (M) = $Lw_{(n)}$ (inches/year) = 4,907.5

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 1-B

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

Page 1 of 3 Crop Type = Bent Grass

$Lw_{(c)} = \frac{(ET-P)}{[E \times (1-Lr)]}$; $Lr = \frac{ECw}{[(5 \times ECe)-ECw]}$; ECw ≈ TDS÷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 3.5 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	0.83	1.15	-0.46	0	0
Feb	28	0.90	1.00	-0.14	0	0
Mar	31	3.26	0.78	3.54	0.3365	0.0109
Apr	30	4.49	0.41	5.83	0.5536	0.0185
May	31	6.38	0.62	8.22	0.7816	0.0252
Jun	30	6.26	0.44	8.31	0.7898	0.0263
Jul	31	8.15	0.27	11.25	1.0693	0.0345
Aug	31	7.33	0.23	10.14	0.9635	0.0311
Sep	30	5.36	0.35	7.15	0.6798	0.0227
Oct	31	2.56	0.42	3.06	0.2904	0.0094
Nov	30	1.69	0.73	1.37	0.1303	0.0043
Dec	31	0.79	0.99	-0.29	0	0
Totals (in/yr):		48.00	7.39	58.0	Note: These totals should approximate the annual values calculated in Worksheet 1-A	

Worksheet 1-B

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

Page 2 of 3 Crop Type = Rye Grass

$Lw_{(c)} = \frac{(ET-P)}{[E \times (1-Lr)]}$; $Lr = \frac{ECw}{[(5 \times ECe)-ECw]}$; ECw ≈ TDS÷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 18 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	0.83	1.15	-0.44	0	0
Feb	28	0.90	1.00	-0.14	0	0
Mar	31	3.26	0.78	3.40	1.6635	0.0537
Apr	30	4.49	0.41	5.60	2.7367	0.0912
May	31	6.38	0.62	7.90	3.8635	0.1246
Jun	30	6.26	0.44	7.99	3.9038	0.1301
Jul	31	8.15	0.27	10.81	5.2855	0.1705
Aug	31	7.33	0.23	9.74	4.7623	0.1536
Sep	30	5.36	0.35	6.87	3.3605	0.1120
Oct	31	2.56	0.42	2.94	1.4354	0.0463
Nov	30	1.69	0.73	1.32	0.6439	0.0215
Dec	31	0.79	0.99	-0.27	0	0
Totals (in/yr):		48.00	7.39	55.7	Note: These totals should approximate the annual values calculated in Worksheet 1-A	

Worksheet 1-B

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

Page 3 of 3 Crop Type = Blue/Rye Grass blend

$Lw_{(c)} = \frac{(ET-P)}{[E \times (1-Lr)]}$; $Lr = \frac{ECw}{[(5 \times ECe)-ECw]}$; ECw ≈ TDS÷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 59.5 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	0.83	1.15	-0.45	0	0
Feb	28	0.90	1.00	-0.14	0	0
Mar	31	3.26	0.78	3.46	5.5836	0.1801
Apr	30	4.49	0.41	5.69	9.1859	0.3062
May	31	6.38	0.62	8.03	12.9683	0.4183
Jun	30	6.26	0.44	8.11	13.1034	0.4368
Jul	31	8.15	0.27	10.98	17.7414	0.5723
Aug	31	7.33	0.23	9.89	15.9853	0.5157
Sep	30	5.36	0.35	6.98	11.2798	0.3760
Oct	31	2.56	0.42	2.98	4.8181	0.1554
Nov	30	1.69	0.73	1.34	2.1614	0.0720
Dec	31	0.79	0.99	-0.28	0	0
Totals (in/yr):		48.00	7.39	56.6	Note: These totals should approximate the annual values calculated in Worksheet 1-A	

3.5 acres of greens (bent grass). Effluent volumes from Worksheet 1-B. Nitrogen concentration from 4/97 through 3/98 STMWTF data (maximum).

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 _____ ÷ 3.5 x 0.8
(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 = 450 (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	0	0	6.4	0		
Feb	28/29	0	0	6.4	0		
Mar	31	0.3365	0.0109	6.4	4.12		
Apr	30	0.5536	0.0185	6.4	6.77		
May	31	0.7816	0.0252	6.4	9.53		
Jun	30	0.7898	0.0263	6.4	9.63		
Jul	31	1.0693	0.0345	6.4	13.05		
Aug	31	0.9635	0.0311	6.4	11.76		
Sep	30	0.6798	0.0227	6.4	8.31		
Oct	31	0.2904	0.0094	6.4	3.56		
Nov	30	0.1303	0.0043	6.4	1.57		
Dec	31	0	0	6.4	0		
						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.

18 acres of tees (rye Grass). Effluent volumes from Worksheet 1-B.
Nitrogen concentration from 4/97 through 3/98 STMWTF data (maximum).

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 _____ ÷ 18 x 0.8
(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 = 180 (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	0	0	6.4	0		
Feb	28/29	0	0	6.4	0		
Mar	31	1.6635	0.0537	6.4	3.95		
Apr	30	2.7367	0.0912	6.4	6.49		
May	31	3.8635	0.1246	6.4	9.16		
Jun	30	3.9038	0.1301	6.4	9.26		
Jul	31	5.2855	0.1705	6.4	12.54		
Aug	31	4.7623	0.1536	6.4	11.30		
Sep	30	3.3605	0.1120	6.4	7.97		
Oct	31	1.4354	0.0463	6.4	3.40		
Nov	30	0.6439	0.0215	6.4	1.53		
Dec	31	0	0	6.4	0		
						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.

59.5 acres of blue/rye grass fairways. Effluent volume from Worksheet 1-B.
Nitrogen concentration from 4/97 through 3/98 STMWTF data (maximum).

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 _____ ÷ 59.5 x 0.8
(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 = _____ 180 _____ (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	0	0	6.4	0		
Feb	28/29	0	0	6.4	0		
Mar	31	5.5836	0.1801	6.4	4.01		
Apr	30	9.1859	0.3062	6.4	6.59		
May	31	12.9683	0.4183	6.4	9.31		
Jun	30	13.1034	0.4368	6.4	9.40		
Jul	31	17.7414	0.5723	6.4	12.73		
Aug	31	15.9853	0.5157	6.4	11.47		
Sep	30	11.2798	0.3760	6.4	8.10		
Oct	31	4.8181	0.1554	6.4	3.46		
Nov	30	2.1614	0.0720	6.4	1.55		
Dec	31	0	0	6.4	0		
						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.

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 _____ ÷ 3.5 x 0.8
(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 = Bent grass: 450 (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.

Pounds N per acre = _____ pounds per 1000 sq. feet X 43.56

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 = _____ (lb/ac-mo) = _____ MGD Applied x _____ (mg/l) Effluent N Conc. x 8.34 x _____ # days/mo ÷ 18 # Acres x 0.8 (1 -"f") (i.e. 0.2.)

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

Crop Name and Nitrogen Uptake Requirement = Rye grass: 180 (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.

Pounds N per acre = _____ pounds per 1000 sq. feet X 43.56

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 = _____ (lb/ac-mo) = _____ MGD Applied x _____ (mg/l) Effluent N Conc. x 8.34 x _____ # days/mo ÷ 59.5 # Acres x 0.8 (1 -"f") (i.e. 0.2.)

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

Crop Name and Nitrogen Uptake Requirement = Blue/rye grass: 180 (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.

Pounds N per acre = _____ pounds per 1000 sq. feet X 43.56

Washoe County
Department of
Water Resources
4930 Energy Way
Reno, NV 89502-4106
Tel: (775) 954-4600
Fax: (775) 954-4610

May 3, 2001

Department of Conservation and Natural Resources
Division of Environmental Protection
Bureau of Water Pollution Control
333 West Nye Lane
Carson City, NV 89706-0851
ATTN: Joe Maez

Subject: Reuse of Reclaimed Water at Wolf Run Golf Course

Dear Mr. Maez:

The Utility Services Division as the water purveyor of potable water has reviewed the subject application and has the following comments:

The applicant has satisfied our requirements pertaining to cross connection control. Coordinated shut down tests will be periodically required of the applicant to verify that no cross connections between the reclaim system and the potable water system have been inadvertently made.

Our other concern is protection of the groundwater and wellhead protection of the South Truckee Meadows General Improvement District wells. Today, most golf courses in Washoe County are subjected to a requirement for a "water quality management plan" reporting requirement with the special use permit conditions. This is not only for fertilizer, but inclusive of pesticide and herbicide application and storage. In the case of Wolf Run, the special use permit approval predates the implementation of that condition. Therefore, for the benefit of the wellhead protection program and as the water purveyor, we impose the following condition upon the applicant in conjunction with NDEP's approval of the "effluent management plan":

1. Location of the maintenance facilities or storage of pesticides, herbicides, solvents, fertilizers or similar materials shall be located outside the capture zone of any existing or planned well.

2. A "water quality management plan" must be developed for the golf course addressing both the protections of ground and surface waters. The plan shall be submitted to the Department of Water Resources for review and approval. Application rates of fertilizers, pest management and chemical applications shall be included. The plan shall identify location of monitoring points, schedule of sampling and parameters for analysis.

If you have any questions, please call me at 954-4649.

Sincerely,

E. Terri Svetich

E. Terri Svetich, P.E.
Licensed Engineer

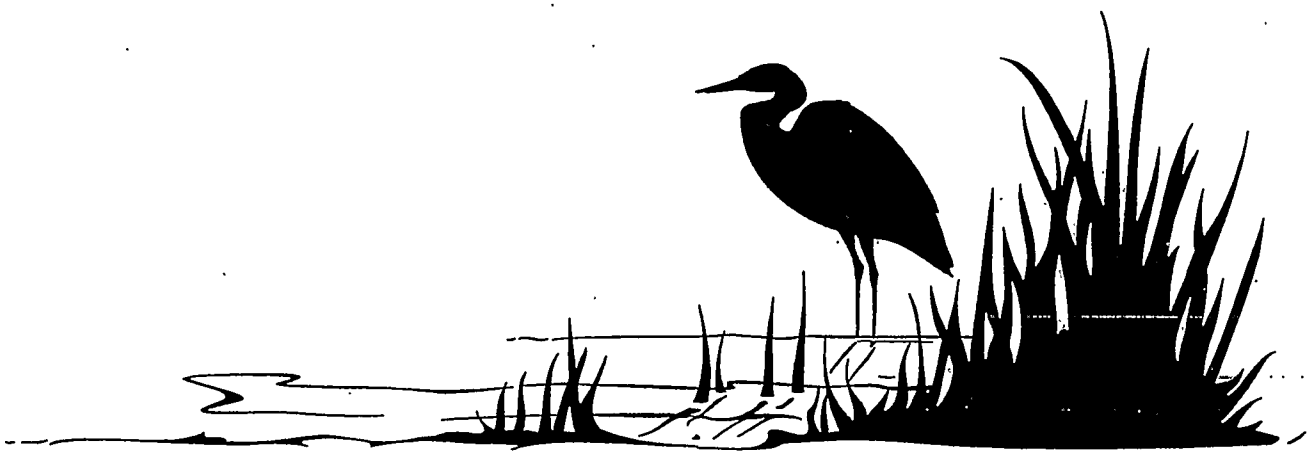
ETS/

c: John Collins, P.E., Manager, Utility Services Division
Paul Orphan, P.E., Senior Utility Engineer
Ron Gribble, Wolf Run Golf Course
Nevan Kane, NDEP

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.



Document Revision History

August 20, 2001	Original document submitted to Wolf Run Golf Course, Nevada Division of Environmental Protection Bureau of Water Pollution Control and Washoe County Department of Water Resources Utility Services Division
October 5, 2001	Revision 1: Deleted from Appendix A were tabulated historical flow data for Whites Creek, water quality data from the South Truckee Meadows Water Treatment Facility, and the April 4, 1994 Cella Barr Associates report *Preliminary Whites Creek Basin Management Study (Second Draft).* Nitrogen and water budgets were given additional attention in Section III.A – *Nitrogen and Water Budgets.* Worksheets concerning the budgets were included in Appendix E. The communication procedure for effluent delivery to the golf course was included in Section III.C – *Flow Monitoring and Communication.* Maintenance and inspection tasks associated with the effluent storage reservoir were described in Section II.C – *Surface Water.* Procedures for ponded water were described in Section III.D – *System Management.*
August 5, 2002	Revision 2: The description of "hand watering" during daylight hours in Section III.B – *Pumps and Piping* was expanded to allow watering by hydro-jet and in-ground sprinklers provided the watering was done under supervision, and sufficient time was allowed for water to have substantially evapotranspirated before golfers were allowed back on the holes.

ALLEN BIAGGI, *Administrator*

(775) 687-4670

TDD 687-4678

Administration
Facsimile 687-5856

Water Pollution Control
Facsimile 687-4684

Mining Regulation and
Reclamation
Facsimile 684-5259

STATE OF NEVADA
KENNY C. GUINN
Governor

R. MICHAEL TURNIPSEED, *Director*

Waste Management
Corrective Actions
Federal Facilities

Air Pollution Control
Air Quality Planning
Water Quality Planning

Facsimile 687-6396

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES

DIVISION OF ENVIRONMENTAL PROTECTION

333 W. Nye Lane, Room 138

Carson City, Nevada 89706

September 4, 2002

Mr. John Johnson
Pezonella Associates, Inc.
520 Edison Way
Reno, Nevada 89502

RE: Wolf Run Golf Course EMP- Amendment for Daytime Watering

Dear Mr. Johnson:

The Nevada Division of Environmental Protection has completed a review of the revisions to this EMP for daytime watering. Based upon our review, these proposed revisions are hereby approved.

If there are any questions on this approval, please contact me at 687-9431.

Sincerely,

Joseph L. Maez

Joseph L. Maez, P.E.
Bureau of Water Pollution Control

CC: Darrell Rasner, P.E.,NDEP
Diana Silsby, NDEP
Tim Davis, Wolf Run Golf Course, 1400 Wolf Run Road, Reno, NV 89511
Joe Howard, P.E., Washoe County Department of Water Resources

Pezonella
Associates, Inc.
Geotechnical & Environmental Engineers & Geologists
520 Edison Way, Reno, Nevada 89502
Tel: (775) 856-5566
Fax: (775) 856-6042

T R A N S M I T T A L

To: Mr. Tim Davis
Wolf Run Golf Course – *2 copies*
Project #: 2281.17B
Date: August 28, 2002
Via: US Mail
From: John H. Johnson
Re: *Effluent Management Plan, Wolf Run Golf Course*
REVISION 2
cc:1 copy each Mr. Joe Maez, P.E. Nevada Division of Environmental Protection, Bureau of Water Pollution Control, 333 West Nye Lane, Room 138, Carson City, NV 89706
Mr. Joe Howard, P.E. Washoe County Department of Water Resources, Utility Services Division, P.O. Box 11130, Reno, NV 89520

Gentlemen:
We have made a slight revision to the above-referenced *Effluent Management Plan* (EMP). In Section III.B – *Pumps and Piping*, the description of discretionary daytime watering has been expanded to include the use of the hydro-jet and in-ground sprinkler systems. The watering must be done under supervision, and sufficient time after watering must be allowed for water to have substantially evapotranspirated before golfers are allowed to return to the holes. In addition, the new revision is addressed to Mr. Tim Davis at Wolf Run Golf Course instead of Mr. Ron Gribble, and a new Appendix describing the history of document revision has been added.

The attached material will turn your binders of Revision 1 into Revision 2. The large packet that includes a cover and text replaces everything between the front cover of the binder and the packet that holds Plate 1. The cover and spine replace those on the binder itself. The *Appendix H* tab and *Document Revision History* go after Appendix G and the back cover. If you have any questions or comments, please do not hesitate to contact me.

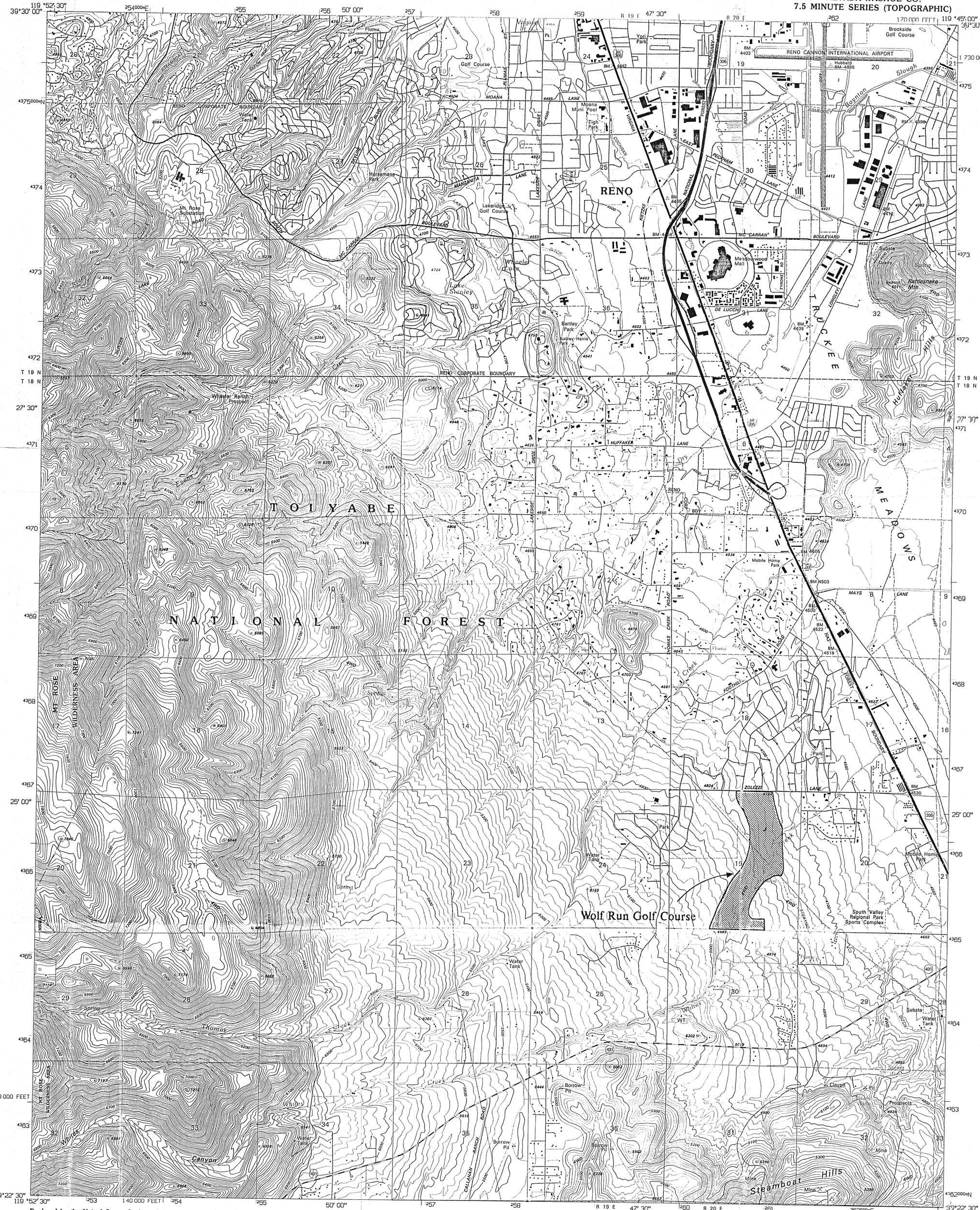
Sincerely,
PEZONELLA ASSOCIATES, INC.

John H. Johnson, P.E.
Senior Geologist

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Plate 1: Property Location Map

MOUNT ROSE NE QUADRANGLE
NEVADA-WASHOE CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



Produced by the United States Geological Survey
Control by USGS and NOS/NOAA

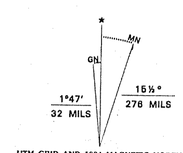
Compiled from aerial photographs taken 1966. Field checked 1969
Revised from aerial photographs taken 1990 and other sources
Map edited 1994. Contours and land elevations have not been revised and may conflict with other content

North American Datum of 1927 (NAD 27). Projection and blue 1000-meter ticks: Universal Transverse Mercator, zone 11
10 000-foot ticks: Nevada Coordinate System, west zone

North American Datum of 1983 (NAD 83) is shown by dashed corner ticks
The values of the shift between NAD 27 and 83 for 7.5-minute intersections are obtainable from National Geodetic Survey NADCON software

There may be private inholdings within the boundaries of the National or State reservations shown on this map

Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs. This information is unchecked



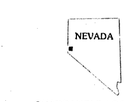
UTM GRID AND 1994 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

1 .5 0 KILOMETERS 1 2
1000 0 METERS 1000 2000
1 .5 0 1
MILES
1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000
FEET

CONTOUR INTERVAL 20 FEET
SUPPLEMENTARY CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
TO CONVERT FEET TO METERS MULTIPLY BY 0.3048
TO CONVERT METERS TO FEET MULTIPLY BY 3.2808

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY
DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST



QUADRANGLE LOCATION

1	2	3
4		5
6	7	8

1 Verdi
2 Reno
3 Vista
4 Mount Rose NW
5 Steamboat
6 Mount Rose
7 Washoe City
8 Virginia City

ADJOINING 7.5' QUADRANGLE NAMES

● INTERIOR - GEOLOGICAL SURVEY, RESTON, VIRGINIA - 1994

ROAD CLASSIFICATION

Primary highway
hard surface ..... ———
Secondary highway
hard surface ..... ———
Light-duty road, hard or
improved surface ..... ———
Unimproved road ..... ———

Interstate Route U.S. Route State Route

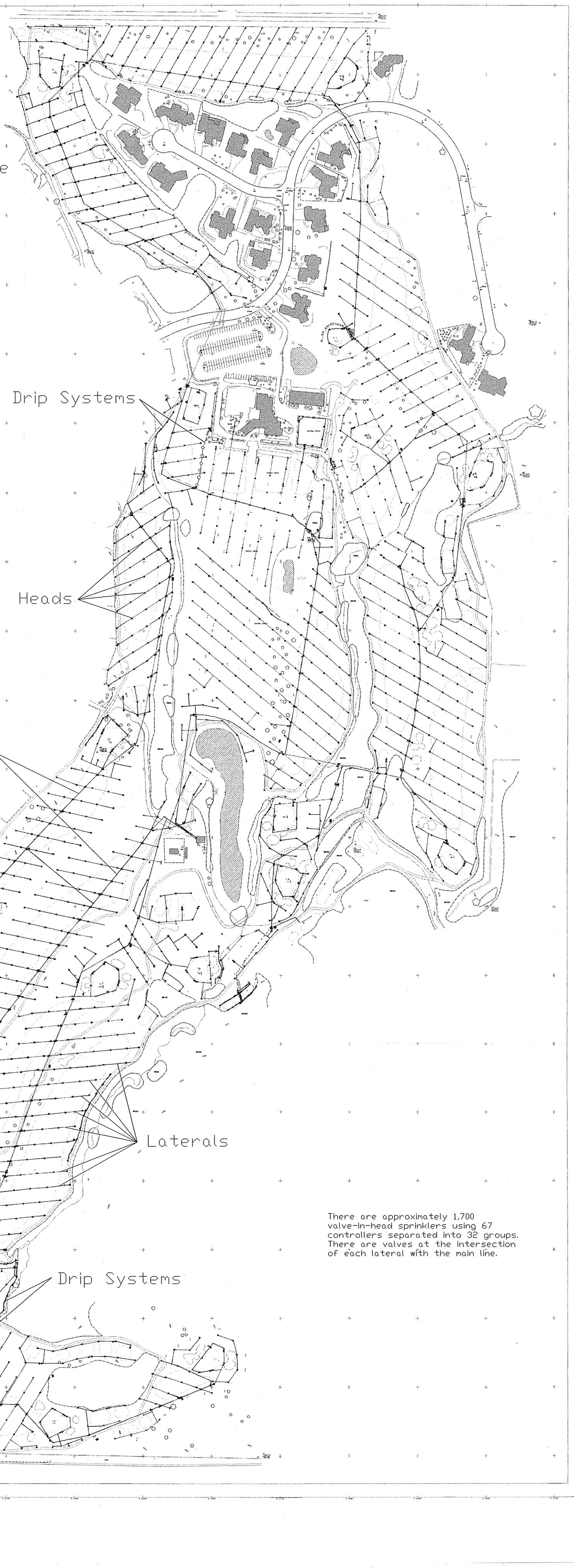
MOUNT ROSE NE, NV
39119-D7-TF-024

1994

DMA 2062 IV NE-SERIES V896

Plate 2: Wolf Run Golf Course
1400 Wolf Run Road
Reno, Nevada

Plate 3: Wolf Run Golf Course Irrigation System 1"=200'



There are approximately 1,700 valve-in-head sprinklers using 67 controllers separated into 32 groups. There are valves at the intersection of each lateral with the main line.