

8.10. Irrigation

To avoid impacting the groundwater supply or aquifer recharge areas, the use of treated effluent is planned for irrigation of the golf course. This irrigation source is presently being utilized by several courses in the area such as Osoyoos, Fairview Mountain, Predator Ridge and Vernon Golf Course.

The program is governed by Minister of Environment regulations including an on going monitoring commitment. Detail information of the required studies necessary to upgrade the present sewage treatment plant at Silver Star are contained in the Wastewater Management section (8.11), Minister of Environment letter of July 29, 1997 and Novatec's Wastewater Treatment and Disposal studies.

The actual in-ground fully automated irrigation system will be a dual head control with the ability to isolate greens and tees. It is engineered to irrigate in three cycles over a night that will vary from 3 to 10 minutes each. This interrupted form of irrigation avoids the potential of run-off. Ground sensors communicate with computers as to grass plant irrigation requirements to avoid over watering.

8.11. Waste Water Management

SILVER STAR MOUNTAIN RESORT

A CANADIAN CLASSIC

September 19, 1997

Mr. Bob Brodie
Ministry of Environment, Lands and Parks
1259 Dalhousie Drive
Kamloops, BC V2C 5Z5

Attention: Mr. Brodie

Re: Application for Amendment to the Waste Management Act

Silver Star Mountain Resorts Ltd. has made application for amendment to its waste water permit. As well as hosting M.O.E. staff on the proposed golf course site the following attended a meeting at the Minister of Environment offices in Penticton;

Tim Forty	M.O.E.
Jeff Randall	M.O.E.
Rose Gunoff	M.O.E.
Sam Turk	Nova Tec - WTI
Brian LaCas	LaCas Consulting
Mike Randell	Mountain Manager
Dick Munn	Project Manager

This was a very productive meeting that determined M.O.E. requirements necessary for the permit amendment process. The commitments by Silver Star were evaluated relative to other site studies and a proposed project time line.

The proposed upgrading of the present treatment plant by Silver Star was received very favorably by M.O.E. staff since dealing with a long term plan for the mountain was their priority over a short-term plan to only fulfill the golf course approval requirement.

M.O.E. requirements are detailed in Jeff Randall's letter of July 29th and Silver Star has retained NovaTec WTI and EBA Engineering to address and undertake them. Some of the studies require hydrological and geotechnical work on site which are inappropriate impacts on the site with its present park status. Therefore, we are suggesting that Silver Star will agree to conduct these studies as soon as possible following transfer of the land from Parks to Lands.

If your offices can attach these requirements to the lease conditionally, possibly Mr. Randall could list the requirements to be undertaken presently and those that can be done at the post- approval stage.

In anticipation of your approval of this concept, we have undertaken pre-design studies included in this report and will anticipate further instruction from your offices on this matter.

Yours truly,

R. J. Munn
Project Manager

RM/sls



July 29, 1997

File: PE06738

Silver Star Mountain Resort
P.O. Box 2
Silver Star Mountain
British Columbia VOE 1G0

007

Attention: Mr. M. Randell, Mountain Manager

Dear Mr. Randell:

Re: Application for Amendment to the Waste Management Act for Silver Star Mountain Resorts Ltd.

Further to the above noted application, would you please provide the following information:

1. In accordance with Section 5.5 of the September 1975 Pollution Control Objectives for Municipal Type Waste Discharges in British Columbia, and Section 3.0 of the January 1981 Pollution Control Guidelines for Municipal Effluent Application to Land, **submit a hydrogeological report and environmental assessment of the area to be used for spray irrigation** of treated effluent prepared by a person professionally qualified in such matters and licensed to practice in the Province of British Columbia. On site assessments of the area to be irrigated must be carried out by a qualified Pedologist, Professional Agrologist, Hydrogeologist or Engineer, using current climate and soils data to substantiate that the land is capable of accepting the quantity and quality of the effluent to be discharged within the guidelines herein-after set forth. This assessment shall describe potential soil and water problems that may be caused or aggravated by irrigation and propose remedial measures.
2. **A review of technical data regarding design of the existing infiltration basin is required.** We understand that this mode

of disposal will become a backup to the proposed golf course irrigation. Consideration should be given to having more than one basin available. There should also be provision for cleaning out the basins. **The review should use existing technical information and update the calculations as specified below.** A hydrogeological and environmental assessment of the area to be used for infiltration of treated effluent prepared by a person professionally qualified in such matters and licensed to practice in the Province of British Columbia. This should include (but not restricted to) soil stratigraphy, cross-sections using boreholes in the effluent disposal area, - this is to include the installation of piezometers in the boreholes, materials of construction for piezometers to meet standard requirements, a groundwater monitoring program should be recommended with hydrogeologically appropriate locations for upgradient and downgradient wells, effluent flow path (inferred direction of groundwater flow by using groundwater elevation and contour map), and Darcy's law to calculate the capability of the soil to transmit design effluent flow. Please actual calculations for groundwater mounding, including maximum infiltration capacity, natural discharge capacity, height of effluent mound, seepage velocity and travel time.

3. **An investigation to determine the suitability of subsurface soils**, percolation rates to determine disposition of the effluent (to include classification and hydraulic conductivities of soils in the spray irrigation area), nutrient removal capability of the soil (%P removal anticipated by doing P sorption tests on the soil), determine if soil stability problems will be produced either on the subject or neighbouring properties. Also comment if any structures or underground services will interfere with the flow path of the effluent.
4. **A review of the current groundwater and surface water monitoring** is to be provided by the groundwater hydrogeologist. This is to include additions or modifications to the present program.
5. **All the detailed engineering assumptions, calculations, etc. used in the design** of the aerated lagoons, storage basin, chlorine facilities, aeration devices, pump station, spray irrigation facilities and their appurtenances. The design

calculations are to include the proper equations (i.e., complete mix, plug flow) used for designing the aerated lagoons which would include aeration performance. Assumptions should include but are not limited to influent suspended solids, influent soluble BOD₅, effluent soluble BOD₅, effluent suspended solids, growth constants, first order soluble BOD₅, removal rate constant, flow, summer temperature, winter temperature, temperature coefficient, aeration constants, lagoon depth, mean cell residence time etc. The amount of BOD₅ removed should be expressed in kg BOD₅/day for both summer and winter conditions. Calculations of the standard oxygen requirement are to be based on a residual dissolved oxygen of 2.0 mg/L. The oxygen requirements should be expressed in kg/hr for both winter and summer conditions.

6. Include a **detailed inventory** of the facilities contributing to the system. In this regard, "Estimated Minimum Daily Sewage Flows in Imperial Gallons" from the Ministry of Environment Information Bulletin should be used as the basis for estimating flow volumes where applicable.
7. It is extremely important for design purposes to consider daily maximum flow. The peak periods of usage need to be examined carefully. This is necessary to design for proper storage. **Provide detailed calculations** including inflow, precipitation, evaporation and outflow to show what storage requirements are necessary for this proposed system.
8. Please provide a **general process flow schematic** of the existing treatment system and proposed modifications to the treatment system. Also provide a **mass balance diagram** of the treatment system for existing flows at the ski hill and for future projected flows at the ski hill.
9. **Details and specifications** of the liners are to be provided for the proposed storage basin.
10. **Engineered drawings** of the proposed storage basin, chlorination facility, pump station, modifications to the aerated lagoons, aeration devices, spray irrigation devices and appurtenances are to be submitted to this office.

Please be advised that submission of this information does not prejudice the Regional Waste Manager's decision. If further clarification is required, please contact the undersigned.

Yours truly,

A handwritten signature in cursive script, appearing to read "J.J. Randall".

J.J. Randall, P.Eng.
Municipal Engineer
Pollution Prevention
Southern Interior Region

RANDALL/jm

cc: Mr. Sam Turk, Ph.D., P.Eng.
NovaTec-wti
224 West 8th Avenue
Vancouver BC V5Y 1N5

Mr. Brian LaCas, P.Eng.
LaCas Consultants Inc.
#550 Sun Life Plaza
1100 Melville Street
Vancouver BC V6E 4A6

Mr. John Balfour, P.Eng.
EBA Engineering Consultants
#550 Sun Life Plaza
1100 Melville Street
Vancouver BC V6E 4A6

SILVER STAR MOUNTAIN RESORT WASTEWATER TREATMENT AND DISPOSAL

Existing System

Wastewater treatment and disposal at Silver Star Mountain Resort is carried out under Waste Management Branch Permit No.6738. The Permit allows for:

- a maximum daily discharge of 544.8 m³/d (averaged monthly)
- treated effluent BOD₅ level of under 45 mg/L
- treated effluent TSS level of under 60 mg/L

The wastewater treatment facility consists of three aerated lagoons followed by a storage/infiltration basin. The permit allows treated effluent disposal either by ground infiltration or effluent snowmaking (or a combination of both). To-date, snowmaking has not been practised at Silver Star for effluent disposal.

The majority of the wastewater flow at Silver Star is generated in the winter months with some high flows also occurring in the spring (Figure 1). To-date, the month with the highest daily flow was May 1997, and it averaged 434 m³/d.

The total wastewater flow generated annually (June to May). It amounted to 85,000 m³ for the 1995/1996 season, and 96,700 m³ for the 1996/1997 season. With some minor exceptions, the treated effluent quality has historically been better than that required by Permit.

Proposed Treatment and Disposal System Expansion

As part of the planned expansion of the resort, an application is being prepared to amend the discharge permit for an increase in flow. A meeting was held with Ministry of Environment officials on July 28, 1997 to review the general concepts of the proposed Permit amendment and to solicit input on issues and concerns to be addressed.

Subsequent to the meeting, the Ministry provided Silver Star with a detailed list of activities that will have to be undertaken for purposes of processing the amendment application. These cover issues relating to the type of treatment, hydrogeological investigations, surface and groundwater impacts and numerous other considerations including monitoring program.

The general concept for the treatment and disposal system is to expand the aerated lagoon system in stages as the resort expands, store most of the treated effluent in a new lined storage basin over the winter months and dispose of its content by seasonal irrigation over a proposed golf course. The balance of the treated effluent will be disposed of by winter snowmaking.

Figure 2 shows a preliminary layout of the expanded aeration basins and the new storage lagoon.

It is proposed that the new effluent limits comply with the future limits to be adopted in the proposed B.C. Environmental Protection Act. The treated effluent discharging from the aerated lagoons will thus meet considerably stricter discharge limits than those imposed in the current Permit. As a result, the minimum required retention time in the aerated lagoon system will have to increase to 35 days.

The highly treated effluent will be further polished by its long term storage over the winter and spring. Before disposal, the polished effluent will be disinfected.

Disposal during the summer will be by application over a proposed golf course as reclaimed water for irrigation, thus allowing nutrients in the reclaimed water to be utilized by the golf course vegetation. Irrigation will occur only when the golf course is not in use (evening, nights and early morning). Irrigation setbacks from property boundaries, creeks and gulleys would be respected.

Furthermore, the quantity of renovated effluent to be applied over the golf course is selected to match the water demand of the vegetation thereby minimizing any losses to groundwater or surface runoff.

During the winter, excess treated effluent will be disposed of by snowmaking. The existing storage/exfiltration basin will be converted into two exfiltration basins that would handle any surplus to the needs of golf course irrigation and effluent snowmaking. Normally, treated effluent would not be stored in the exfiltration basins.

Groundwater monitoring wells will be installed downstream of the treatment works, long term storage basin, snowmaking operation, and golf course. Creeks downstream of the treatment and effluent storage and disposal areas will also be monitored.

The wastewater generated at the golf course will be treated through a separate wastewater treatment plant and disposal system.

A summary of the design criteria for the proposed expansion are summarised in Table 1. The projected water balance at the end of the planned Phase 2 expansion is presented in Table 2, using the present permit limit for snowmaking. Should it prove necessary in the future, Silver Star would apply for a permit amendment to increase the permit limit for volume of effluent disposed of by snowmaking.

The future use of the golf course for effluent irrigation will virtually eliminate the need for using the exfiltration basins thereby addressing existing concerns about potential groundwater contamination from this practice.

TABLE 1
SILVER STAR MOUNTAIN RESORT
Sewage Treatment and Disposal System Preliminary Design Criteria

Design Flows

Phase 1 expansion		
Maximum month sewage flow:		960 m ³ /d
Maximum volume for disposal:		237,000 m ³ /year

Phase 2 expansion		
Maximum month sewage flow:		1,260 m ³ /d
Maximum volume for disposal:		302,000 m ³ /year

Aerated Lagoons

Minimum total retention time:		35 days
Minimum number of cells:		3

Storage Basin

Volume		150,000 m ³
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Treated effluent quality

BOD ₅		30 mg/L
TSS		30 mg/L
Faecal coliform (for irrigation)		< 200 MPN/100 ml

Irrigation

Golf course demand		120,000 - 180,000 m ³ / season
Irrigation season:		June to October

Snowmaking (as per the existing Permit)

Maximum allowable discharge:		124,214 m ³ /year
Snowmaking season:		November 15 to April 15
Minimum storage before snowmaking:		60 days

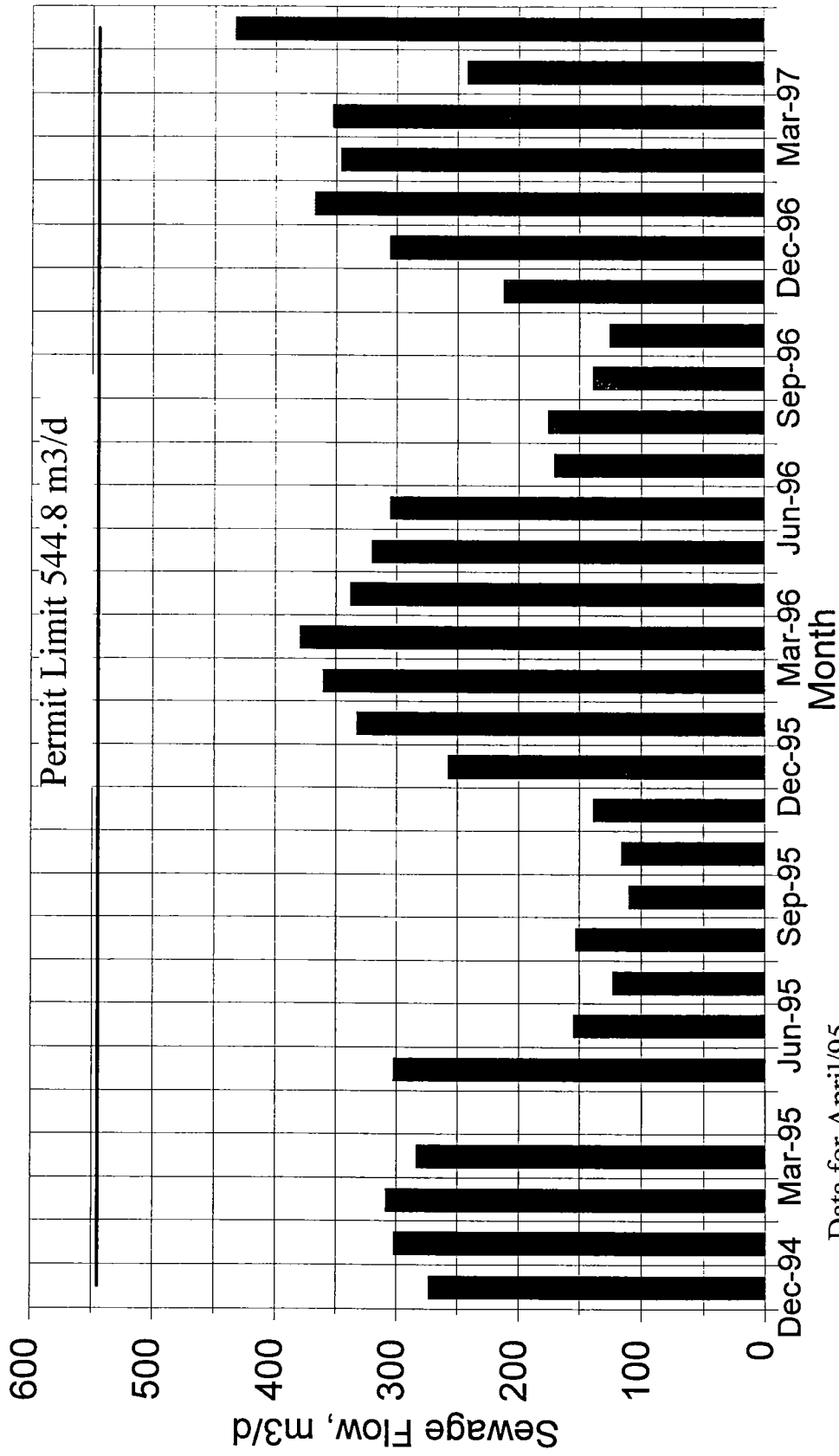
TABLE 2
 SILVER STAR MOUNTAIN RESORT
 Projected Water Balance At End Of Phase 2

09-Sep-97

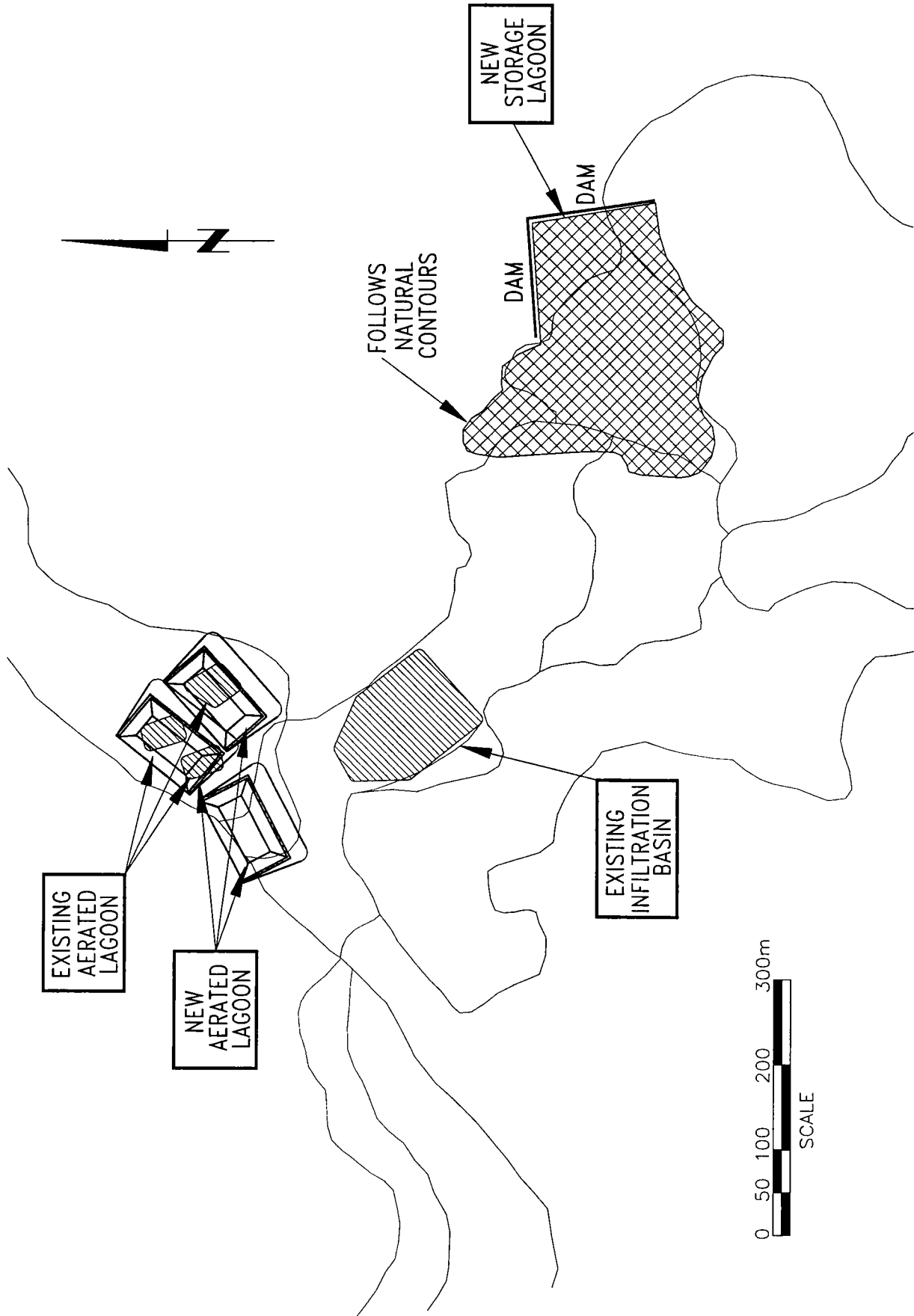
Parameter	Unit	Low Sewage Generation & Dry Year	Average Sewage Generation & Average Year	High Sewage Generation & Wet Year
WASTEWATER GENERATION:				
Sewage generated (1)	m3/year	178,000	221,000	265,000
Net precipitation over lagoons (2)	m3/year	11,000	34,000	55,000
Total Effluent To Be Disposed Of	m3/year	189,000	255,000	320,000
EFFLUENT DISPOSAL:				
Golf course irrigation (3)	m3/year	168,000	168,000	126,000
Effluent snowmaking (4)	m3/year	21,000	87,000	124,214
Exfiltration basins (5)	m3/year	0	0	69,786

- (1) Assumes some illegal roof drain connections
- (2) Based on 150,000 m3 storage lagoon surface area plus new aerated treatment lagoons surface area
- (3) Golf course irrigation requirements will be reduced in a very wet year (calculated reduction is around 25%)
- (4) Maximum allowable discharge is 124,214 m3/year. If necessary in the future, an application would be made for a permit amendment to increase the maximum allowable discharge.
- (5) To handle any surplus to irrigation needs and effluent snowmaking.

**Figure 1 : Silver Star Mountain Resort
Historical Sewage Flows (Averaged Monthly)**



Data for April/95
unavailable



Rev. 0 Date: 8,09,97

FIGURE 2

SILVER STAR MOUNTAIN RESORT
WASTEWATER TREATMENT, SITE PLAN



0 50 100 200 300m
SCALE