Appendix J

Water Budget for the Irrigation Pond and Island Green Pond

Water Budget Report for the Irrigation Pond and Island Green Pond

SILO RIDGE RESORT COMMUNITY

Town of Amenia
Dutchess County, New York

June 6, 2008

THE Chazen COMPANIES®

Engineers / Surveyors
Planners
Environmental Scientists
Landscape Architects

Prepared for:

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1.0 EXECUTIVE SUMMARY

1.1 Introduction

Higher Ground Country Club Management Co. L.L.C. is proposing the improvement of the existing Silo Ridge Country Club (hereinafter referred to as the "project site") into a resort community which, under the "Master Development Plan", will include 278 town home units, 60 single family homes, a 300-unit hotel, a banquet space, two restaurants, a winery, a conference space, a spa and wellness center as well as an improved golf course. The purpose of this report is to present the methodologies and results of a water budget analysis performed for two ponds used for irrigation purposes and located in the central portion of the project site.

1.2 Methodology & Analysis

Monthly water budget calculations were performed for the irrigation ponds under three climate scenarios (dry year, normal year, and wet year) and two irrigation scenarios (golf course grow-in and established).

The inflows considered were direct precipitation, stormwater runoff, groundwater contributions, stream flows, and treated wastewater and well water supplements. The outflows considered were evapotranspiration, surface discharge, and irrigation usage.

1.3 Conclusions

During the golf course grow-in period, the capacity of the irrigation ponds should be adequate to meet the irrigation demands under the normal and wet year scenarios. During a dry year, the irrigation ponds may not be capable of supplying 100 percent of the grow-in irrigation demands. Once the golf course and common landscaped areas are established, the irrigation ponds should have adequate capacity to supply 100 percent of the irrigation needs under any climate scenario.

The recycling of treated of wastewater effluent from the proposed waste water treatment plant into the irrigation ponds is not expected to significantly increase the water surface elevation or flow rates within the NYSDEC wetland AM-15, located to the southeast of the irrigation pond.

2.0 WATER BUDGET METHODOLOGY

2.1 General Principles

A water budget can be described as an accounting of water gains (inflows) and water losses (outflows) from an open system over a fixed period of time. If the amount of water stored in the system at the start of the time period is known, then one can calculate the amount of water stored in the system at the end of the time period by adding the inflows to, and subtracting the outflows from, the amount of water stored at the start of the time period. Several time periods can then be analyzed in series, such that the water stored at the end of one time period becomes the water stored at the start of the next time period. In this water budget analysis, the basic time period is one month.

A water budget analysis was performed for several scenarios, as described in Sections 2.2 and 2.3 of this report. For each scenario, calculations were performed for a 12-month period, running from January through December.

2.2 Climate Scenarios

In order to gain an understanding of the functioning of the irrigation ponds under a wide range of climatic conditions, three climate scenarios were considered: dry year, normal year, and wet year.

In order to obtain precipitation data for the three scenarios, historical data was consulted. The National Oceanic and Atmospheric Administration (NOAA) calculates climate normals based on a 30-year rolling historical data set. The current data set runs from 1971 through 2000 (once data for 2010 is available, the data set will be updated to run from 1981 through 2010). Data from the Albany International Airport weather station, which is available from the NOAA web site, was chosen because it is the closest major weather station to the subject site.

Precipitation data for each year in the current data set was analyzed in order to select years that would be representative of the three desired climate scenarios. Representative years were selected based on their annual rainfall totals, and based on the distribution of rainfall throughout the year. Years with “abnormal” rainfall distributions, such as one or two very wet months in an otherwise dry year, were deliberately not selected. The following table presents the three years selected, as well as their respective annual precipitation totals.

Table 1: Climate Scenario Year Selection

Climate Scenario	Year	Total Precipitation
Dry Year	1985	29.95
Normal Year	1974	38.47
Wet Year	2000	46.92

2.3 Irrigation Scenarios

A golf course requires significantly more water during the "grow-in" phase than once the turf is established. For this reason, both grow-in and established scenarios were considered in this water budget analysis. When combined with the three climate scenarios described above, this brings the total number of scenarios considered to six.

2.4 Description and Modeling of Irrigation Ponds

The Silo Ridge Country Club currently draws water from a system of two ponds to irrigate the existing golf course. These ponds, located in the central portion of the project site, are referred to in this report as the "Island Green Pond" and "Irrigation Pond". Historically, these two ponds have been able to support the irrigation needs of the existing golf course, and no supplemental water has been required from any source, including existing on site wells.

The Island Green Pond is a NYSDEC Class C pond, NYSDEC #1122. It receives inflow from a single unnamed, unclassified small stream, which enters the pond through a submerged culvert. An 18-inch outflow culvert (invert 508.80) drains to the Irrigation Pond and controls the maximum water surface elevation (that is: the maximum water surface elevation outside of a significant storm event, which may temporarily raise the water surface elevation even further.) A secondary outlet pipe (invert 502.50) controls the minimum water surface elevation in the pond. This secondary outlet also drains to the Irrigation pond, and can be manually open or shut with a valve.

The Irrigation Pond is a NYSDEC Class C pond, NYSDEC #1121. It receives inflow directly from the Island Green Pond. An overflow weir (invert 506.00) controls the maximum water surface elevation. Irrigation water is drawn from a wet well hydraulically connected to this pond, with the wet well equalization pipe (reported invert 496.00) controlling the minimum water surface elevation in the pond.

The valve-controlled pipe between the two ponds allows the golf course operators to transfer water from the Island Green Pond to the Irrigation Pond as necessary to sustain irrigation operations. As discussed above, for the purposes of this report, the minimum water surface elevations were taken as 502.50 and 496.00 for the Island Green Pond and Irrigation Pond respectively. It should be noted however that the bottom elevations of the Island Green and Irrigation Ponds were determined to be approximately 500 feet and 458 feet respectively. These elevations were derived from a bathymetric survey conducted by The Chazen Companies in May 2008.

For water budget modeling purposes, the two ponds will be treated as a single entity, and will be generally referred to in this report as "the combined pond". This is made possible by the assumption that the golf course operators will consistently open the valve between the two ponds to ensure that golf course irrigation needs are met. Golf course personnel have indicated that this assumption is valid.

Please refer to Appendix A for detailed pond elevation and storage data.

3.0 DESCRIPTION OF INFLOWS

3.1 Direct Precipitation

A water body receives water via direct rainfall and snowfall. The volume of water received from direct precipitation is calculated by multiplying the water surface area by the depth of precipitation for a given month. For purposes of this water budget, the combined surface area of the ponds at their maximum elevation was used in calculations of the monthly volume of direct precipitation.

Please refer to Appendix A for the water surface area of the ponds, and to Appendix B for the dry year, normal year, and wet year monthly precipitation depths.

3.2 Stormwater Runoff

Precipitation that falls upon the land surrounding and draining to a water body does not necessarily reach that water body. A portion of that precipitation evaporates, is absorbed by vegetation, or infiltrates into the ground. However, during a large storm event, a fraction of the precipitation will become surface runoff and will in fact reach the water body.

The watershed draining to the subject ponds was analyzed using the Curve Number method, as described in “Technical Release 55 - Urban Hydrology for Small Watersheds” (TR-55), 1986, published by the Natural Resources Conservation Service. Given a daily depth of precipitation, the Curve Number method can be used to calculate the daily depth of runoff. These calculations are dependent on the soils, ground covers, land uses, and slopes found within the watershed. It should be noted that not every storm event produces runoff. Specifically, for the watershed contributing to the subject ponds, the Curve Number method indicates that storm events smaller than approximately three-quarters of an inch will not produce surface runoff.

Daily rainfall data for the three years (dry, normal, and wet) described in Section 2.2 of this report was tabulated, and the corresponding daily runoff values were calculated using the Curve Number method. The appropriate daily runoff depths were summed to give monthly runoff depths. Finally, the volume of runoff reaching the irrigation ponds was calculated by multiplying the watershed surface area by the depth of runoff for a given month.

Please refer to Appendix A for the surface areas and curve numbers of the watersheds contributing to the irrigation ponds; and to Appendix B for the dry year, normal year, and wet year monthly runoff depths.

3.3 Groundwater Contribution

Groundwater contributions can be a significant factor in any water budget analysis. However, it is very difficult and impractical to directly measure groundwater flow rates. In some cases, it is possible to obtain an indirect measurement of groundwater flow into (or out of) a water body by calculating the difference between surface inflows and surface outflows. The subject ponds at the project site have well defined inflow and outflow streams, making such a measurement possible.

Stream flow measurements were taken by TCC personnel on May 15, 2008. The golf course irrigation pumps were not in use at the time the measurements were taken, nor had they been used during the previous night (according to golf course personnel). This means that the irrigations ponds were likely in a “steady state” condition at the time of the flow measurements. The following measurements were made:

- The Island Green Pond was observed to have a surface inflow rate of 0.3 cubic feet per second (cfs), and a surface outflow rate of 0.2 cfs. Therefore, the Island Green Pond appears to “lose” water into the ground at a rate of 0.1 cfs.

- The Irrigation Pond was observed to have a surface inflow rate of 0.2 cfs, and a surface outflow rate of 0.5 cfs. Therefore, the Irrigation Pond appears to “gain” groundwater at a rate of 0.3 cfs.

Looking at both ponds together, there is a net groundwater contribution of 0.2 cfs. Because only one set of measurement was taken, reasonable assumptions were made for seasonal and climatic variations. The monthly volume of groundwater entering the subject ponds was calculated by converting cubic feet per second into gallons per month. The monthly groundwater contribution values, for a dry, normal, and wet year, are presented in Appendix C.

3.4 Stream Inflow

A single stream flows into the Island Green Pond. As described in the previous section, the flow rate for this stream was measured to be 0.3 cfs. Because only one measurement was taken, reasonable assumptions were made for seasonal and climatic variations. The monthly volume of stream inflow entering the irrigation ponds was calculated by converting cubic feet per second into gallons per month. The monthly stream inflow values, for a dry, normal, and wet year, are presented in Appendix C.

3.5 Treated Wastewater & Well Water Supplements

For aesthetic and water conservation reasons, it is proposed that treated wastewater effluent from the proposed 400,000 gallon per day (gpd) wastewater treatment plant to be built for the development be pumped directly into the Island Green Pond. The wastewater will be treated to intermittent stream and recreational contact standards. The reuse of treated wastewater effluent is a sustainable design feature of the project that will assist in the preservation of ground water resources.

Please note that it is assumed that the wastewater treatment plant will not yet be operational during the golf course grow-in period, as such no treated wastewater contribution is included in the water budget models for those scenarios. During this period, raw well water from the existing water supply wells will be diverted to the irrigation ponds if needed to ensure continued irrigation operations. The maximum well water pumping rate has been modeled as 200,000 gallons per day.

For modeling purposes, it was assumed that these waters would be added at a constant daily rate. The quantity of wastewater treatment effluent and well water discharging into the ponds is presented in each one of the water budget calculation sheets found in Appendix F.

4.0 DESCRIPTION OF OUTFLOWS

4.1 Evapotranspiration

A water body loses water through evapotranspiration. The volume of water lost in this fashion is calculated by multiplying the water surface area by the depth of evapotranspiration for a given month. For purposes of this water budget, the combined surface area of the ponds at their maximum elevation was used in calculations of the monthly volume of evapotranspiration, thereby conservatively estimating the water lost during a given month.

Please refer to Appendix A for the water surface area of the ponds, and to Appendix D for the monthly evapotranspiration depths.

4.2 Surface Discharge

Under normal operating conditions, the only surface discharge from the subject ponds is an overflow weir located at the eastern end of the Irrigation Pond. Discharge from this weir flows along a channel bed and into a NYSDEC Wetland designated “AM-15” which is located on site adjacent to NYS Route 22. Any excess water that enters the ponds after they are already full will be discharged in this fashion.

4.3 Irrigation Usage

Water will be pumped out of the subject ponds in order to irrigate the renovated golf course and other common landscaped areas of the proposed Master Development Plan for the site. Monthly irrigation demand figures for the established golf course in a normal year were provided by the irrigation system designer, Joseph Sarkisian & Associates, Inc. Reasonable assumptions were made for climatic and grow-in variations. It should be noted that the entire golf course and common landscaped areas will not be growing in simultaneously. Therefore the grow-in irrigation demands depicted in the appendices are conservatively overestimating the actual grow-in irrigation needs.

Please refer to Appendix E for irrigation demand data for all scenarios.

5.0 RESULTS AND ANALYSIS

5.1 Irrigation System Water Budget

Water budget calculations were performed to determine how the irrigation ponds would perform under the proposed Master Development Plan conditions for the site during six different scenarios (grow-in and established golf course conditions during dry, normal, and wet years). The detailed calculations are included in Appendix F.

This performance of the irrigation system can most easily be presented by the amount of estimated drawdown that each pond should experience during the scenarios analyzed. The table below depicts the maximum drawdown in water surface elevation that each pond will experience, along with the percentage of desired irrigation volume that the golf course operators can expect to have available for use during those maximum drawdown months.

Table 2: Maximum Drawdown and Fraction of Desired Irrigation Volume Available

Year Type	Parameter	Established Vegetation		Grow-In Vegetation	
		Irrigation Pond	**Island Green Pond**	**Irrigation Pond**	**Island Green Pond**
Dry Year	Maximum Drawdown (feet)	6.36	3.58	10.00	6.30
	Fraction of Desired Irrigation Volume Available During Maximum Drawdown	100%		68%	
Normal Year	Maximum Drawdown (feet)	0.00	0.00	0.00	0.00
	Fraction of Desired Irrigation Volume Available During Maximum Drawdown	100%		100%	
Wet Year	Maximum Drawdown (feet)	0.00	0.00	0.00	0.00
	Fraction of Desired Irrigation Volume Available During Maximum Drawdown	100%		100%	

As depicted in the table, the maximum drawdown occurs during the dry year, grow-in vegetation scenario. During that scenario, both ponds reach their maximum drawdowns. However, even during the period of maximum drawdown, the water budget calculations indicate that 68 percent of the desired irrigation volume should still be available. During the dry year, established vegetation scenario, both ponds experience significant drawdown, but 100 percent of the desired irrigation volume remains available. Under all normal year and wet year scenarios, the ponds do not experience any significant drawdown, and 100 percent of desired irrigation volume is available at all times.

5.2 Wastewater Recycling & the NYSDEC Wetland

Based on an April 22, 2008 meeting with NYSDEC, NYSDEC has expressed concern that the reuse of treated effluent will result in an increase in flow rate and water surface elevation in the DEC regulated wetland AM-15, located to the southeast of the irrigation pond.

Based on field observations described in Section 3.3 of this report, the existing base flow leaving the irrigation ponds is approximately 0.5 cubic feet per second. The maximum capacity of the proposed Waste Water Treatment Plant (WWTP) is 400,000 gallons per day, which corresponds to approximately 0.6 cubic feet per second. Therefore, assuming the WWTP is operating at full capacity, the base flow entering the wetland from the irrigation ponds should increase from 0.5 to 1.1 cubic feet per second.

This change is well within the expected natural seasonal and storm based fluctuations. For comparison purposes, based on hydrologic and hydraulic modeling performed in support of the Stormwater Pollution Prevention Plan for this project, the one-year inflow and outflow from the DEC wetland are approximately 60 and 9 cfs, respectively. Based on the same modeling, the increase in base flow should result in an increase in the base water surface elevation within the wetland of approximately 0.2 feet. This figure is also well within the expected natural fluctuations. It is therefore clear that the wetland's natural characteristics have the capacity to absorb and pass much larger flow rates than those that will result from the reuse of treated effluent.

5.2.1 Discussion of the Overall Water Cycle

Since the inception of the existing golf course, water has been removed from Silo Ridge's deep irrigation pond for irrigation purposes, seasonally intercepting a share of site groundwater and surface water to support an existing 18-hole golf facility. In large measure, this irrigation water has been a net loss to local aquatic environments since irrigation water is normally transpired to the atmosphere by the watered vegetation. The current status of streams and wetlands down gradient of the site is already in equilibrium with the use of this water for irrigation. During seasons when no irrigation is occurring, site runoff and groundwater flow to streams and wetlands along Route 22, and then off-site.

The proposed Silo Ridge project has been designed to minimize disruption to the established water cycle described above by reusing water removed for potable uses as treated effluent for golf course irrigation. In its simplest portrayal, the site's potable water infrastructure simply adds a potable water pre-use cycle ahead of the summer irrigation withdrawal. More than 80 percent of the potable water withdrawal will be returned to the environment near the irrigation pond area. During the non-irrigation seasons, groundwater and runoff will continue to flow to receiving streams and wetlands along Route 22, with a share of the groundwater discharge shifted to a surface water flow with return water from the potable water use. This arrangement will result in little net change to the site's wet-season or dry-season water budgets. Stated another way, the treated wastewater discharge to the island green pond will be almost fully off-set by a reduction in groundwater discharge to surface waters, protecting local streams and wetlands from any flooding increases.

It has been an intentional component of site design to consider and design the potable water needs of the Silo Ridge project as a water pre-use component rather than as a compounding new water use. The reuse of treated effluent generated from the potable water supply use all on the same site significantly minimizes any change to the dry season or wet season water budgets on the site or the budgets of water flowing to offsite streams and wetlands via surface water or groundwater pathways.

Appendix A
Pond Data

The pond storage and surface elevation data presented below is based on bathymetric survey information collected by The Chazen Companies in May 2008.

	Island Green Pond	**Irrigation Pond**	**Combined Pond**
Water Surface Area (SF)	240,802	88,217	329,019
Minimum Allowable WSE	502.50	496.00	n/a
Maximum Allowable WSE	508.80	506.00	n/a
Available Irrigation Storage (1000 Gal)	8,303	5,261	13,564
Watershed Area (Acres)	199.66	22.12	221.78
Watershed Composite Curve Number	69	75	70

Appendix B
Precipitation and Runoff Data

Precipitation data presented below was gathered from official monthly precipitation data published by the National Oceanic and Atmospheric Administration, as reported from the Albany International Airport, New York. Stormwater Runoff data was computed using the official precipitation data through the Curve Number Method as described in "Technical Release 55 - Urban Hydrology for Small Watersheds" (TR-55), 1986, published by the Natural Resources Conservation Service.

	Precipitation (Inches)			**Stormwater Runoff (Inches)**		
	Dry Year	**Normal Year**	**Wet Year**	**Dry Year**	**Normal Year**	**Wet Year**
January	0.81	2.04	3.43	0.00	0.00	0.00
February	3.67	2.12	2.83	0.06	0.00	0.00
March	1.18	3.10	3.80	0.00	0.01	0.00
April	1.44	2.80	4.23	0.00	0.00	0.10
May	2.71	3.47	4.95	0.00	0.08	0.02
June	4.12	3.31	6.69	0.07	0.00	0.89
July	1.86	4.84	4.48	0.00	0.33	0.84
August	2.23	3.53	4.69	0.00	0.00	0.01
September	3.07	5.37	3.06	0.11	0.03	0.00
October	1.81	1.49	2.48	0.00	0.00	0.02
November	5.00	3.83	1.90	0.00	0.00	0.00
December	2.05	2.57	4.38	0.00	0.00	0.60
TOTAL	**29.95**	**38.47**	**46.92**	**0.24**	**0.45**	**2.48**

Appendix C
Groundwater and Stream Base Flow Data

The Groundwater Contribution and Stream Baseflow data presented below was derived from on-site field measurements conducted by TCC personnel on May 15, 2008 with reasonable monthly and climatic variation estimates made applied by using engineering judgment and past water budget report experience.

Year Type	Multiplier
Wet Year	1.1
Dry Year	0.9

	Groundwater Inflow (1000 Gal)			**Stream Baseflow (1000 Gal)**		
	Dry Year	**Normal Year**	**Wet Year**	**Dry Year**	**Normal Year**	**Wet Year**
January	3,839	4,266	4,692	5,759	6,399	7,039
February	3,490	3,878	4,266	5,235	5,817	6,399
March	3,490	3,878	4,266	5,235	5,817	6,399
April	4,188	4,654	5,119	6,282	6,980	7,678
May	3,490	3,878	4,266	5,235	5,817	6,399
June	3,141	3,490	3,839	4,712	5,235	5,759
July	2,792	3,102	3,413	4,188	4,654	5,119
August	2,443	2,715	2,986	3,665	4,072	4,479
September	2,094	2,327	2,559	3,141	3,490	3,839
October	2,443	2,715	2,986	3,665	4,072	4,479
November	2,792	3,102	3,413	4,188	4,654	5,119
December	3,141	3,490	3,839	4,712	5,235	5,759
TOTAL	**37,345**	**41,495**	**45,644**	**56,018**	**62,242**	**68,466**

Appendix D
Evapotranspiration Data

The potential evapotranspiration values presented in the following table are based on Technical Report NWS 33: Evaporation Atlas for the Contiguous 48 United States (published by the NOAA in June 1982) and Technical Report NWS 34: Mean Monthly, Seasonal, and Annual Pan Evaporation for the United States (published by the NOAA in December 1982).

The values presented are for Albany, NY.

	Potential Evapotranspiration (inches per day)	**Total Evapotranspiration (inches)**
January	0.02	0.62
February	0.03	0.84
March	0.05	1.55
April	0.10	3.00
May	0.12	3.72
June	0.15	4.50
July	0.16	4.96
August	0.13	4.03
September	0.09	2.70
October	0.06	1.86
November	0.04	1.20
December	0.02	0.62
Total	**n/a**	**29.60**

Appendix E
Irrigation Demand (Page 1 of 2)

Monyhly golf course irrigation demands were provided by irrigation system consultant Joseph Sarkisian & Associated, Inc. The data provided assumed normal climate conditons, and that the vegetation was established. The following multipliers were applied to obtain irrigation demand figures for the other scenarios being considered. For the golf course grow-in scenario, it was further assumed that landscape areas would not yet be online.

Dry year multiplier	1.7
Wet year multiplier	0.8
Golf course grow-in multiplier	1.5

	Irrigation Demand (1000 Gal) - All Vegetation Established								
	Golf Course			Landscaped Common Areas			TOTAL		
	Dry Year	Normal Year	Wet Year	Dry Year	Normal Year	Wet Year	Dry Year	Normal Year	Wet Year
January	0	0	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0	0	0
March	0	0	0	0	0	0	0	0	0
April	0	0	0	0	0	0	0	0	0
May	5,440	3,200	2,560	3,264	1,920	1,536	8,704	5,120	4,096
June	12,434	7,314	5,851	7,460	4,388	3,511	19,894	11,702	9,362
July	17,129	10,076	8,061	10,278	6,046	4,836	27,407	16,122	12,897
August	11,691	6,877	5,502	7,015	4,126	3,301	18,705	11,003	8,803
September	5,265	3,097	2,478	3,159	1,858	1,487	8,424	4,955	3,964
October	0	0	0	0	0	0	0	0	0
November	0	0	0	0	0	0	0	0	0
December	0	0	0	0	0	0	0	0	0
TOTAL	**51,959**	**30,564**	**24,451**	**31,175**	**18,338**	**14,671**	**83,134**	**48,902**	**39,122**

Appendix E
Irrigation Demand (Page 2 of 2)

	Irrigation Demand (1000 Gal) - Golf Course Grow-in Period								
	Golf Course			Landscaped Common Areas			TOTAL		
	Dry Year	Normal Year	Wet Year	Dry Year	Normal Year	Wet Year	Dry Year	Normal Year	Wet Year
January	0	0	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0	0	0
March	0	0	0	0	0	0	0	0	0
April	0	0	0	0	0	0	0	0	0
May	8,160	4,800	3,840	0	0	0	8,160	4,800	3,840
June	18,651	10,971	8,777	0	0	0	18,651	10,971	8,777
July	25,694	15,114	12,091	0	0	0	25,694	15,114	12,091
August	17,536	10,316	8,252	0	0	0	17,536	10,316	8,252
September	7,897	4,646	3,716	0	0	0	7,897	4,646	3,716
October	0	0	0	0	0	0	0	0	0
November	0	0	0	0	0	0	0	0	0
December	0	0	0	0	0	0	0	0	0
TOTAL	**77,938**	**45,846**	**36,677**	**0**	**0**	**0**	**77,938**	**45,846**	**36,677**

Appendix F
Water Budget Calculations (1 of 6)

Irrigation Scenario: **Established**
Climate Scenario: **Dry Year**

	Irrigation Pond Drawdown	Island Green Pond Drawdown	Available Pond Volume	Desired Irrigation Usage	INFLOWS							OUTFLOWS				
					Direct Precipitation	Stormwater Runoff	Groundwater Contribution	Stream Base flow	Wastewater Treatment Plant Effluent Contribution	Well Water Supplement (Grow-in only)	Total Inflows	Evaporation	Surface Discharge	Actual Irrigation Usage		Total Outflows
	(Feet)	(Feet)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(Fraction of Desired)	1000 Gal
January	0.00	0.00	13,564	0	166	0	3,839	5,759	12,400	0	22,164	127	22,037	0	n/a	22,164
February	0.00	0.00	13,564	0	753	361	3,490	5,235	11,200	0	21,040	172	20,867	0	n/a	21,040
March	0.00	0.00	13,564	0	242	0	3,490	5,235	12,400	0	21,368	318	21,050	0	n/a	21,368
April	0.00	0.00	13,564	0	295	0	4,188	6,282	12,000	0	22,766	615	22,151	0	n/a	22,766
May	0.00	0.00	13,564	8,704	556	0	3,490	5,235	12,400	0	21,681	763	12,214	8,704	100%	21,681
June	0.00	0.00	13,564	19,894	845	422	3,141	4,712	12,000	0	21,120	923	302	19,894	100%	21,120
July	0.00	0.00	13,564	27,407	381	0	2,792	4,188	12,400	0	19,762	1,017	0	27,407	100%	28,424
August	5.88	3.30	4,902	18,705	457	0	2,443	3,665	12,400	0	18,965	827	0	18,705	100%	19,532
September	6.36	3.58	4,335	8,424	630	662	2,094	3,141	12,000	0	18,527	554	321	8,424	100%	9,298
October	0.00	0.00	13,564	0	371	0	2,443	3,665	12,400	0	18,879	381	18,498	0	n/a	18,879
November	0.00	0.00	13,564	0	1,026	0	2,792	4,188	12,000	0	20,006	246	19,760	0	n/a	20,006
December	0.00	0.00	13,564	0	420	0	3,141	4,712	12,400	0	20,673	127	20,546	0	n/a	20,673
TOTAL	**n/a**	**n/a**	**n/a**	**83,134**	**6,143**	**1,445**	**37,345**	**56,018**	**146,000**	**0**	**246,951**	**6,071**	**157,746**	**83,134**	**n/a**	**246,951**

Appendix F
Water Budget Calculations (2 of 6)

Irrigation Scenario: Established
Climate Scenario: Normal Year

	Irrigation Pond Drawdown	Island Green Pond Drawdown	Available Pond Volume	Desired Irrigation Usage	INFLOWS							OUTFLOWS				
					Direct Precipitation	Stormwater Runoff	Groundwater Contribution	Stream Base flow	Wastewater Treatment Plant Effluent Contribution	Well Water Supplement (Grow-in only)	Total Inflows	Evaporation	Surface Discharge	Actual Irrigation Usage		Total Outflows
	(Feet)	(Feet)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(Fraction of Desired)	1000 Gal
January	0.00	0.00	13,564	0	418	0	4,266	6,399	12,400	0	23,483	127	23,356	0	n/a	23,483
February	0.00	0.00	13,564	0	435	0	3,878	5,817	11,200	0	21,330	172	21,158	0	n/a	21,330
March	0.00	0.00	13,564	0	636	60	3,878	5,817	12,400	0	22,791	318	22,473	0	n/a	22,791
April	0.00	0.00	13,564	0	574	0	4,654	6,980	12,000	0	24,208	615	23,593	0	n/a	24,208
May	0.00	0.00	13,564	5,120	712	482	3,878	5,817	12,400	0	23,288	763	17,406	5,120	100%	23,288
June	0.00	0.00	13,564	11,702	679	0	3,490	5,235	12,000	0	21,404	923	8,779	11,702	100%	21,404
July	0.00	0.00	13,564	16,122	993	1,987	3,102	4,654	12,400	0	23,136	1,017	5,997	16,122	100%	23,136
August	0.00	0.00	13,564	11,003	724	0	2,715	4,072	12,400	0	19,911	827	8,081	11,003	100%	19,911
September	0.00	0.00	13,564	4,955	1,101	181	2,327	3,490	12,000	0	19,099	554	13,590	4,955	100%	19,099
October	0.00	0.00	13,564	0	306	0	2,715	4,072	12,400	0	19,492	381	19,111	0	n/a	19,492
November	0.00	0.00	13,564	0	786	0	3,102	4,654	12,000	0	20,542	246	20,295	0	n/a	20,542
December	0.00	0.00	13,564	0	527	0	3,490	5,235	12,400	0	21,653	127	21,525	0	n/a	21,653
TOTAL	**n/a**	**n/a**	**n/a**	**48,902**	**7,890**	**2,710**	**41,495**	**62,242**	**146,000**	**0**	**260,337**	**6,071**	**205,363**	**48,902**	**n/a**	**260,337**

Appendix F
Water Budget Calculations (3 of 6)

Irrigation Scenario: **Established**
Climate Scenario: **Wet Year**

	Irrigation Pond Drawdown	Island Green Pond Drawdown	Available Pond Volume	Desired Irrigation Usage	INFLOWS: Direct Precipitation	Stormwater Runoff	Groundwater Contribution	Stream Base flow	Wastewater Treatment Plant Effluent Contribution	Well Water Supplement (Grow-in only)	Total Inflows	OUTFLOWS: Evaporation	Surface Discharge	Actual Irrigation Usage		Total Outflows
	(Feet)	(Feet)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(Fraction of Desired)	1000 Gal
January	0.00	0.00	13,564	0	704	0	4,692	7,039	12,400	0	24,834	127	24,707	0	n/a	24,834
February	0.00	0.00	13,564	0	580	0	4,266	6,399	11,200	0	22,445	172	22,273	0	n/a	22,445
March	0.00	0.00	13,564	0	779	0	4,266	6,399	12,400	0	23,844	318	23,526	0	n/a	23,844
April	0.00	0.00	13,564	0	868	602	5,119	7,678	12,000	0	26,267	615	25,652	0	n/a	26,267
May	0.00	0.00	13,564	4,096	1,015	120	4,266	6,399	12,400	0	24,200	763	19,341	4,096	100%	24,200
June	0.00	0.00	13,564	9,362	1,372	5,360	3,839	5,759	12,000	0	28,330	923	18,045	9,362	100%	28,330
July	0.00	0.00	13,564	12,897	919	5,059	3,413	5,119	12,400	0	26,909	1,017	12,995	12,897	100%	26,909
August	0.00	0.00	13,564	8,803	962	60	2,986	4,479	12,400	0	20,887	827	11,258	8,803	100%	20,887
September	0.00	0.00	13,564	3,964	628	0	2,559	3,839	12,000	0	19,026	554	14,508	3,964	100%	19,026
October	0.00	0.00	13,564	0	509	120	2,986	4,479	12,400	0	20,494	381	20,113	0	n/a	20,494
November	0.00	0.00	13,564	0	390	0	3,413	5,119	12,000	0	20,921	246	20,675	0	n/a	20,921
December	0.00	0.00	13,564	0	898	3,613	3,839	5,759	12,400	0	26,510	127	26,383	0	n/a	26,510
TOTAL	**n/a**	**n/a**	**n/a**	**39,122**	**9,623**	**14,935**	**45,644**	**68,466**	**146,000**	**0**	**284,669**	**6,071**	**239,476**	**39,122**	**n/a**	**284,669**

Appendix F
Water Budget Calculations (4 of 6)

Irrigation Scenario: Grow-in
Climate Scenario: Dry Year

	Irrigation Pond Drawdown	Island Green Pond Drawdown	Available Pond Volume	Desired Irrigation Usage	INFLOWS: Direct Precipitation	INFLOWS: Stormwater Runoff	INFLOWS: Groundwater Contribution	INFLOWS: Stream Base flow	INFLOWS: Wastewater Treatment Plant Effluent Contribution	INFLOWS: Well Water Supplement (Grow-in only)	INFLOWS: Total Inflows	OUTFLOWS: Evaporation	OUTFLOWS: Surface Discharge	OUTFLOWS: Actual Irrigation Usage		OUTFLOWS: Total Outflows
	(Feet)	(Feet)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(Fraction of Desired)	1000 Gal
January	0.00	0.00	13,564	0	166	0	3,839	5,759	0	6,200	15,964	127	15,837	0	n/a	15,964
February	0.00	0.00	13,564	0	753	361	3,490	5,235	0	5,600	15,440	172	15,267	0	n/a	15,440
March	0.00	0.00	13,564	0	242	0	3,490	5,235	0	6,200	15,168	318	14,850	0	n/a	15,168
April	0.00	0.00	13,564	0	295	0	4,188	6,282	0	6,000	16,766	615	16,151	0	n/a	16,766
May	0.00	0.00	13,564	8,160	556	0	3,490	5,235	0	6,200	15,481	763	6,558	8,160	100%	15,481
June	0.00	0.00	13,564	18,651	845	422	3,141	4,712	0	6,000	15,120	923	0	18,651	100%	19,574
July	2.84	1.60	9,110	25,694	381	0	2,792	4,188	0	6,200	13,562	1,017	0	21,655	84%	22,672
August	10.00	6.30	0	17,536	457	0	2,443	3,665	0	6,200	12,765	827	0	11,939	68%	12,765
September	10.00	6.30	0	7,897	630	662	2,094	3,141	0	6,000	12,527	554	0	7,897	100%	8,451
October	6.60	3.70	4,076	0	371	0	2,443	3,665	0	6,200	12,679	381	2,810	0	n/a	3,191
November	0.00	0.00	13,564	0	1,026	0	2,792	4,188	0	6,000	14,006	246	13,760	0	n/a	14,006
December	0.00	0.00	13,564	0	420	0	3,141	4,712	0	6,200	14,473	127	14,346	0	n/a	14,473
TOTAL	**n/a**	**n/a**	**n/a**	**77,938**	**6,143**	**1,445**	**37,345**	**56,018**	**0**	**73,000**	**173,951**	**6,071**	**99,579**	**68,301**	**n/a**	**173,951**

Appendix F
Water Budget Calculations (5 of 6)

Irrigation Scenario: **Grow-in**
Climate Scenario: **Normal Year**

	Irrigation Pond Drawdown	Island Green Pond Drawdown	Available Pond Volume	Desired Irrigation Usage	INFLOWS: Direct Precipitation	Stormwater Runoff	Groundwater Contribution	Stream Base flow	Wastewater Treatment Plant Effluent Contribution	Well Water Supplement (Grow-in only)	Total Inflows	OUTFLOWS: Evaporation	Surface Discharge	Actual Irrigation Usage		Total Outflows
	(Feet)	(Feet)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(Fraction of Desired)	1000 Gal
January	0.00	0.00	13,564	0	418	0	4,266	6,399	0	6,200	17,283	127	17,156	0	n/a	17,283
February	0.00	0.00	13,564	0	435	0	3,878	5,817	0	5,600	15,730	172	15,558	0	n/a	15,730
March	0.00	0.00	13,564	0	636	60	3,878	5,817	0	6,200	16,591	318	16,273	0	n/a	16,591
April	0.00	0.00	13,564	0	574	0	4,654	6,980	0	6,000	18,208	615	17,593	0	n/a	18,208
May	0.00	0.00	13,564	4,800	712	482	3,878	5,817	0	6,200	17,088	763	11,526	4,800	100%	17,088
June	0.00	0.00	13,564	10,971	679	0	3,490	5,235	0	6,000	15,404	923	3,510	10,971	100%	15,404
July	0.00	0.00	13,564	15,114	993	1,987	3,102	4,654	0	6,200	16,936	1,017	805	15,114	100%	16,936
August	0.00	0.00	13,564	10,316	724	0	2,715	4,072	0	6,200	13,711	827	2,568	10,316	100%	13,711
September	0.00	0.00	13,564	4,646	1,101	181	2,327	3,490	0	6,000	13,099	554	7,900	4,646	100%	13,099
October	0.00	0.00	13,564	0	306	0	2,715	4,072	0	6,200	13,292	381	12,911	0	n/a	13,292
November	0.00	0.00	13,564	0	786	0	3,102	4,654	0	6,000	14,542	246	14,295	0	n/a	14,542
December	0.00	0.00	13,564	0	527	0	3,490	5,235	0	6,200	15,453	127	15,325	0	n/a	15,453
TOTAL	**n/a**	**n/a**	**n/a**	**45,846**	**7,890**	**2,710**	**41,495**	**62,242**	**0**	**73,000**	**187,337**	**6,071**	**135,420**	**45,846**	**n/a**	**187,337**

Appendix F
Water Budget Calculations (6 of 6)

Irrigation Scenario: Grow-in
Climate Scenario: Wet Year

					INFLOWS							OUTFLOWS				
	Irrigation Pond Drawdown	Island Green Pond Drawdown	Available Pond Volume	Desired Irrigation Usage	Direct Precipitation	Stormwater Runoff	Groundwater Contribution	Stream Base flow	Wastewater Treatment Plant Effluent Contribution	Well Water Supplement (Grow-in only)	Total Inflows	Evaporation	Surface Discharge	Actual Irrigation Usage		Total Outflows
	(Feet)	(Feet)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(1000 Gal)	(Fraction of Desired)	1000 Gal
January	0.00	0.00	13,564	0	704	0	4,692	7,039	0	6,200	18,634	127	18,507	0	n/a	18,634
February	0.00	0.00	13,564	0	580	0	4,266	6,399	0	5,600	16,845	172	16,673	0	n/a	16,845
March	0.00	0.00	13,564	0	779	0	4,266	6,399	0	6,200	17,644	318	17,326	0	n/a	17,644
April	0.00	0.00	13,564	0	868	602	5,119	7,678	0	6,000	20,267	615	19,652	0	n/a	20,267
May	0.00	0.00	13,564	3,840	1,015	120	4,266	6,399	0	6,200	18,000	763	13,397	3,840	100%	18,000
June	0.00	0.00	13,564	8,777	1,372	5,360	3,839	5,759	0	6,000	22,330	923	12,630	8,777	100%	22,330
July	0.00	0.00	13,564	12,091	919	5,059	3,413	5,119	0	6,200	20,709	1,017	7,601	12,091	100%	20,709
August	0.00	0.00	13,564	8,252	962	60	2,986	4,479	0	6,200	14,687	827	5,608	8,252	100%	14,687
September	0.00	0.00	13,564	3,716	628	0	2,559	3,839	0	6,000	13,026	554	8,756	3,716	100%	13,026
October	0.00	0.00	13,564	0	509	120	2,986	4,479	0	6,200	14,294	381	13,913	0	n/a	14,294
November	0.00	0.00	13,564	0	390	0	3,413	5,119	0	6,000	14,921	246	14,675	0	n/a	14,921
December	0.00	0.00	13,564	0	898	3,613	3,839	5,759	0	6,200	20,310	127	20,183	0	n/a	20,310
TOTAL	**n/a**	**n/a**	**n/a**	**36,677**	**9,623**	**14,935**	**45,644**	**68,466**	**0**	**73,000**	**211,669**	**6,071**	**168,921**	**36,677**	**n/a**	**211,669**