MEMORANDUM

MULLER

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DATE: May 13, 2011 (*Revised September 2, 2011*)

PROJECT: **McMurdo Gulch Reclamation Project**
MEC #07-012.14

RE: **Detention Facility Retrofit Improvements Design**

This memorandum documents the evaluation of retrofit improvements to existing detention facilities in a representative portion of the McMurdo Gulch watershed as a means of controlling peak stormwater flows to levels similar to pre-developed conditions during frequent runoff events. The purpose of the investigation was to demonstrate how watershed-wide full-spectrum detention for new development can help reduce and in some reaches perhaps eliminate impacts on receiving streams, particularly from highly erosive frequent storm events. This work is part of a larger effort focused on implementing a proactive reclamation plan for McMurdo Gulch and shall compliment the previous memo dated February 22, 2011 (*Revised August 30, 2011*), regarding the *McMurdo Gulch Reclamation Project - Stream Reclamation Improvements Design.*

A retrofit plan was evaluated in the McMurdo Gulch watershed to control peak discharges from developed areas to levels similar to or less than historic (pre-development) conditions over the whole spectrum of storm events -- from frequent small events to large flood-producing storms. At the least, it is anticipated that implementing full-spectrum detention in the watershed (and retrofitting existing detention facilities) to control runoff will reduce the level of improvements required for stream stabilization and will slow the pace of degradation such that funding resources can more easily keep up with the required improvements. At best, it may be found that watershed-wide full-spectrum detention may eliminate the need for capital improvements in some stream reaches.

The initial flow-control plan was focused on the Castle Oaks development, since in the near term this community contains the largest concentration of impervious area that will drain into the critical reaches of McMurdo Gulch. In addition, Castle Oaks was designed with a number of large sub-regional detention facilities that comprise good candidates for retrofitting. Eight existing Castle Oaks detention facilities, shown in Figure 1, were evaluated for potential retrofitting. Five of these facilities were originally designed with outlet structures that control the 10 year and 100 year flow rates, one facility was designed to capture and slowly release only the water quality capture volume (WQCV), and two facilities were designed to control the WQCV and the 10 year and 100 year events.

A simple way to retrofit a detention pond designed with a 10 year and 100 year release to a full-spectrum facility is to reduce the size of the 10 year outlet to provide a minimal release rate for the 10-year volume. This is because the UDFCD simplified equation for 10 year detention volume

yields about the same number as the excess urban runoff volume (EURV) required for full-spectrum detention (full-spectrum detention is based on capturing the EURV and draining it slowly -- over a period of up to 72 hours -- to minimize the EURV release rate. This method of retrofitting was the primary approach that was evaluated for the Castle Oaks pond system.

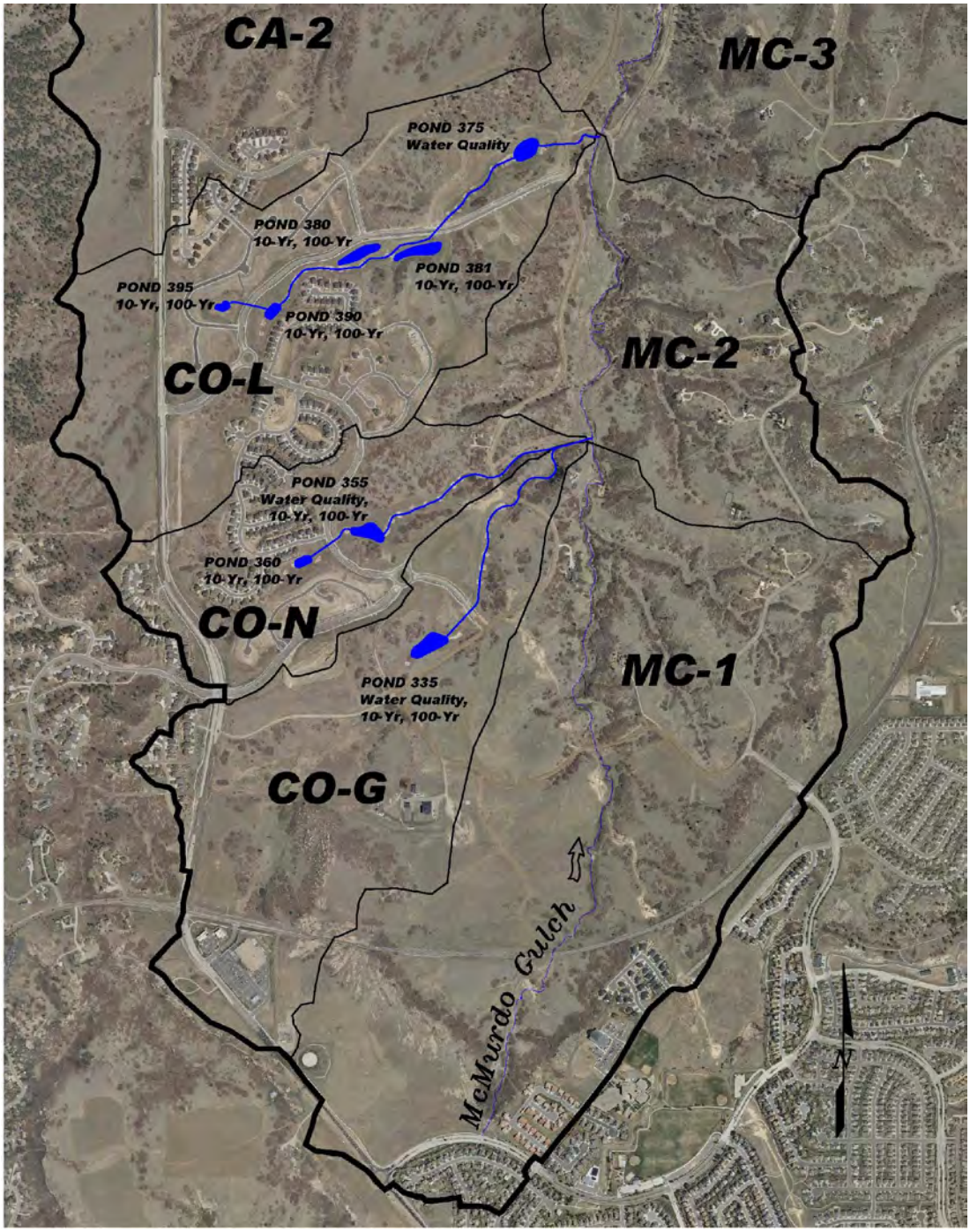


Figure 1. *Eight existing detention facilities in the Castle Oaks development evaluated for retrofit improvements.*

Design plans, design reports, and CUHP and SWMM models were obtained and reviewed for the eight Castle Oaks detention facilities. Quite a bit of time was invested to understand the design intent and modeling of the existing detention facilities. In some cases, the stage/storage and stage/discharge relationships for the ponds were revised to achieve complete consistency with the design plans. Then, various retrofitting options were evaluated, as shown in the following table.

Option	Description	Rationale
1	Ponds 335, 355, 360, 380, 381, 390, and 395 were retrofitted for EURV by assuming an orifice plate would be installed over the existing 10-year openings	All seven ponds that have an existing 10-year opening were assumed to be retrofitted with orifice plates. This option reflects the simplest means of retrofitting and the greatest number of ponds that could be retrofit with orifices.
2	Ponds 335, 355, and 390 were retrofitted for EURV by assuming an orifice plate would be installed over the existing 10-year openings	Just the downstream-most pond in each of the three Castle Oaks tributaries that has an existing 10-year orifice were assumed to be retrofit with orifice plates. This is the minimum number of ponds that would be considered for a retrofit and would eliminate effects of multiple EURV ponds in series.
3	Same as Option 2, except that the spillways of Ponds 335, 355, 390, and 375 were assumed to be raised one foot.	Although more involved than just retrofitting with an orifice plate, the benefits of raising spillways to gain more detention volume was considered
4	Same as Option 2, except that the spillway of Pond 355 was assumed to be raised two feet.	To further reduce release rates from Pond 355, the benefit of raising this pond's spillway two feet was considered.
5	Ponds 335, 355, 360 and 390 were retrofitted for EURV by assuming an orifice plate would be installed over the existing 10-year openings	To reduce release rates from Pond 355 without raising this pond's spillway, retrofitting Pond 360 (upstream of Pond 355) with an orifice plate was considered.

Table 1. *Retrofit Alternatives*

All options were modeled assuming two conditions: 1) the Castle Oaks ponds would remain the only detention facilities in their respective sub-watersheds (no additional detention assumed in upstream offsite developments) and 2) additional detention facilities were assumed to be implemented to serve the offsite developments.

Based on the results of the modeling, the recommended retrofit plan consists of Option 5 -- providing smaller orifices to reduce the 10 year outlets of Ponds 335, 355, 360, and 390. The recommended plan meets the intent of reducing peak discharges to levels similar to or less than pre-developed conditions for a full spectrum of storms, including the frequent events that contribute to stream degradation. This is illustrated in Figure 2, which shows the combined contribution of flow from the three Castle Oaks sub-watersheds to McMurdo Gulch. The light blue and dark blue bars (with and without offsite ponds) show that the combined outflows for the proposed retrofit plan (Option 5) are less than those for the current ponds and less than pre-developed conditions for all events, including the smaller, more frequent storms such as the 2-year. Although additional flow

reductions would be possible by providing additional detention storage volume through raised spillways or excavation, based on the modeling completed these more extensive retrofit measures are not necessary to reduce discharges below pre-developed levels.

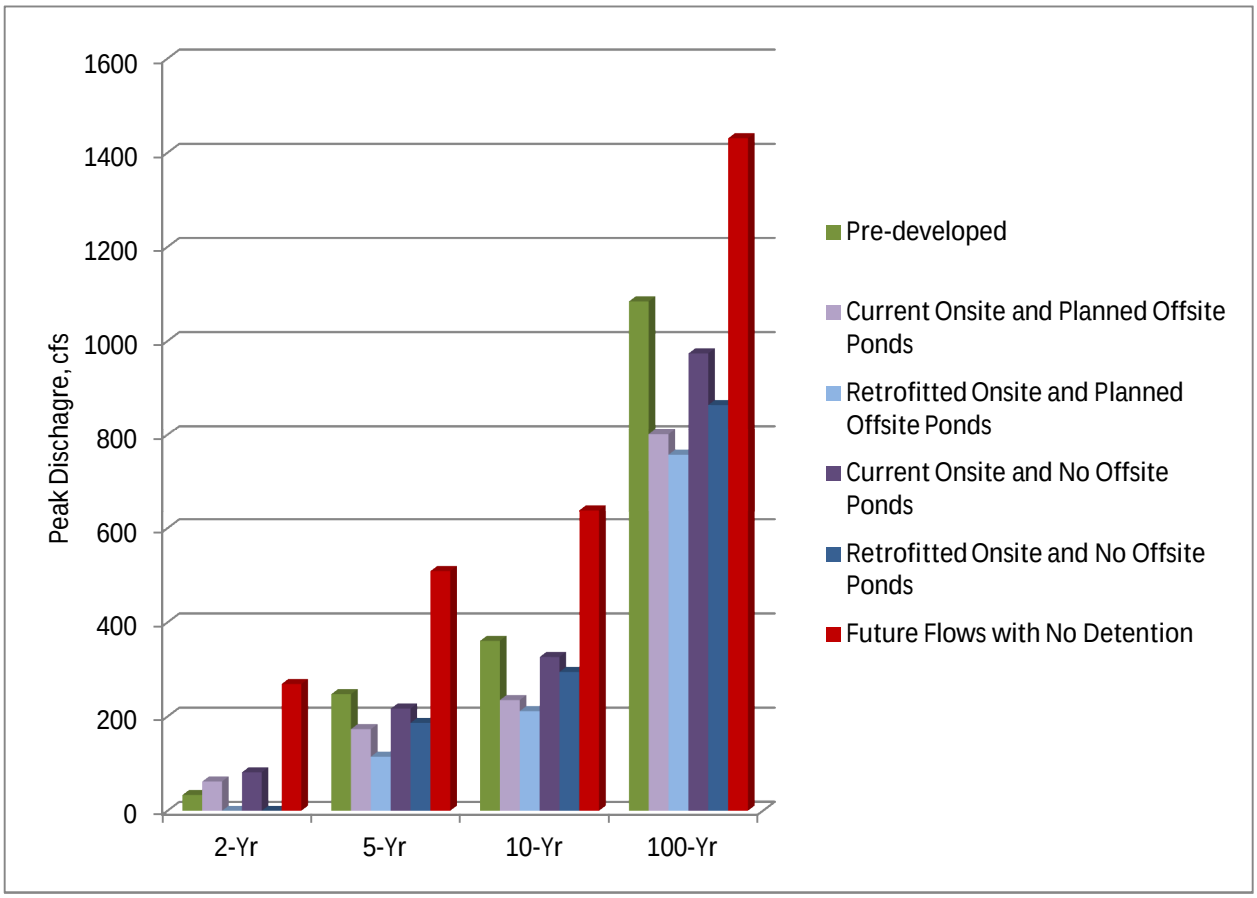


Figure 2. *Results of retrofit evaluation for recommended plan (Option 5) in comparison to pre-developed and future development condition flows without detention*

It is interesting to note the effects of retrofitting EURV in ponds in series (one or more ponds upstream of another pond). As shown in Figure 1, in Castle Oaks one pond exists on the southern tributary, two ponds on the middle tributary, and five ponds on the northern tributary. The recommended Option 5 is comprised of extended detention for EURV (or WQCV for pond 375) in the one pond on the southern tributary, both ponds on the middle tributary, and in two of the five ponds on the northern tributary. Retrofitting all five ponds in the northern tributary was found to be less effective. Therefore, it is necessary to model various combinations of EURV releases when ponds are in series to determine the most effective design.

It was noticed during a field reconnaissance of the detention ponds that the riprap shown in the design plans on the side slopes of the spillways was not clearly evident. This was followed up with more checking in the field by Town staff. As a result, some rehabilitation work may be necessary to be fully assured that the spillways are constructed as designed. This is especially important since the spillways are designed to convey flows in storms much smaller than the 100 year event (any storm in excess of the water quality event for Pond 375 and storms in excess of the 10 year event for the rest of the ponds). The proposed retrofit improvements do not increase the spillway

flow rates in the modeled events; however, the proposed improvements are recommended based on investigations (or remedial repairs) that confirm that the spillways will function as originally designed.

Backup modeling information and results are provided in Appendix A. Sketches of the recommended detention facility retrofit improvements are shown in Appendix B. The retrofit improvements generally consist of installing orifice plates over the existing 10-year outlet pipes and providing finer grating to reduce the likelihood that the control orifices (ranging from 3 inches to 4-1/8 inches in diameter) will become clogged. These improvements are straightforward and could be implemented in a variety of ways. The orifice plates and grating could be field measured, drawn up and fabricated by a metalwork contractor. Installation could potentially be handled by a contractor or perhaps by Town maintenance staff.

The flow control plan discussed herein for the Castle Oaks development could be applied to the remainder of the McMurdo Gulch watershed that will receive high density development. A number of onsite ponds exist in the area along Highway 86 that could be converted to full spectrum detention; however, in certain instances constructing new regional full spectrum facilities to compliment or replace the onsite facilities may provide greater flow reductions and less maintenance burdens. Several sites in the upper watershed seem favorable for regional full-spectrum detention. One is on mainstem McMurdo Gulch just upstream of Highway 86 and another is in the existing detention pond constructed as part of the Civilian Conservation Corps (CCC) effort downstream of Castle Oaks Drive.

It is also recommended that full-spectrum detention be implemented in the Canyons South development that is adjacent to the Castle Oaks development. Canyons South is currently in the design phase. Coordination with Douglas County is recommended to ensure that full spectrum detention is implemented in this community to provide additional flow control to the receiving reaches of McMurdo Gulch.

Beyond this memorandum, the next steps for implementing flow control in the McMurdo Gulch watershed are as follows:

- Complete a final design phase of work for the Castle Oaks development pond facilities. This work includes finalizing the hydrologic analysis started as part of this current phase of work, designing the pond outlet structure modifications, and designing improvements to the existing pond spillways where necessary.

- Coordinate with Douglas County regarding the Canyon South development pond facilities with the intent of implementing full spectrum detention.

- Explore other opportunities to retrofit existing ponds or incorporate new regional ponds downstream of existing developments.

The course of action set forth in this memorandum in combination with construction of the stream reclamation improvements will provide the Town and the Cherry Creek Basin Water Quality Authority a significant step in reclaiming/preserving the McMurdo Gulch corridor as well as the downstream Cherry Creek corridor. It is anticipated that the flow control methods discussed can be used as a model, or template, for other similar basins within the Cherry Creek basin.

Appendix A

Detention Facility Retrofit Modeling Results and Calculations

Mc Murdo Gulch in Castle Rock
SWMM Scenairo Results

Scenario	Description
Pre-developed	Pre-development conditions -- all Impervious Values are 2%
Future (No Ponds)	Future development conditions with no ponds in the Castle Oaks area
Future Castle Oaks Ponds AS IS	Future development conditions with only Castle Oaks ponds with no alterations
Future All Ponds AS IS	Future development conditions with all ponds (including offsite ponds) with no alterations
Opt 1	All Castle Oaks Ponds Retrofitted for EURV
Opt 2	Ponds 335, 355, and 390 retrofitted for EURV
Opt 3	Ponds 335, 355, and 390 embankments and spillway raised 1' and retrofitted for EURV
Opt 4	Ponds 335, and 390 retrofitted for EURV. Pond 355 embankment and spillway raised 2' and retrofitted for EURV
Opt 5	Ponds 335, 355, 360, and 390 retrofitted for EURV

2-Yr

Pond	Outlet Number	Pre-developed	Future (No Ponds)	Future Castle Oaks Ponds AS IS	Future Castle Oaks Ponds EURV Opt 1	Future Castle Oaks Ponds EURV Opt 2	Future Castle Oaks Ponds EURV Opt 3	Future Castle Oaks Ponds EURV Opt 4	Future Castle Oaks Ponds EURV Opt 5	Future All Ponds (AS IS)	Future All Ponds Castle Oaks EURV Opt 1	Future All Ponds Castle Oaks EURV Opt 2	Future All Ponds Castle Oaks EURV Opt 3	Future All Ponds Castle Oaks EURV Opt 4
335	64	9	79	14	2	2	3	2	2	17	2	2	4	2
355	83	6	55	17	2	11	3	3	2	13	2	4	3	3
360	81	2	17	9	0.5	9	9	9	0	5	0	6	6	6
375	103	19	136	50	2	17	9	17	17	32	2	13	7	13
380	115	2	15	9	0.5	9	9	9	9	9	0	9	9	9
381	118	4	26	20	5	20	20	20	20	20	5	14	14	14
390	98	12	53	25	1	1	1	1	1	14	1	1	1	1
395	96	12	26	18	11	18	18	18	18	10	6	10	10	10
Combined outflow (335+355+375)		34	269	82					21	62				

5-Yr

Pond	Outlet Number	Pre-developed	Future (No Ponds)	Future Castle Oaks Ponds AS IS	Future Castle Oaks Ponds EURV Opt 1	Future Castle Oaks Ponds EURV Opt 2	Future Castle Oaks Ponds EURV Opt 3	Future Castle Oaks Ponds EURV Opt 4	Future Castle Oaks Ponds EURV Opt 5	Future All Ponds (AS IS)	Future All Ponds Castle Oaks EURV Opt 1	Future All Ponds Castle Oaks EURV Opt 2	Future (All Ponds with Castle Oaks EURV) - Opt 3	Future (All Ponds with Castle Oaks EURV) - Opt 4
335	64	69	148	63	45	45	23	45	45	45	31	31	15	31
355	83	46	102	41	23	34	23	13	23	38	20	31	19	8
360	81	16	33	11	7	11	11	11	7	7	3	9	9	9
375	103	132	259	113	94	118	61	108	118	90	30	64	52	64
380	115	12	28	12	3	12	12	12	12	12	3	12	12	12
381	118	28	53	38	45	41	41	41	41	39	30	34	34	34
390	98	57	102	35	21	34	20	34	34	26	14	20	14	20
395	96	41	48	27	30	27	27	27	27	15	14	16	16	16
Combined outflow (335+355+375)		248	509	217		187			187	173		115		

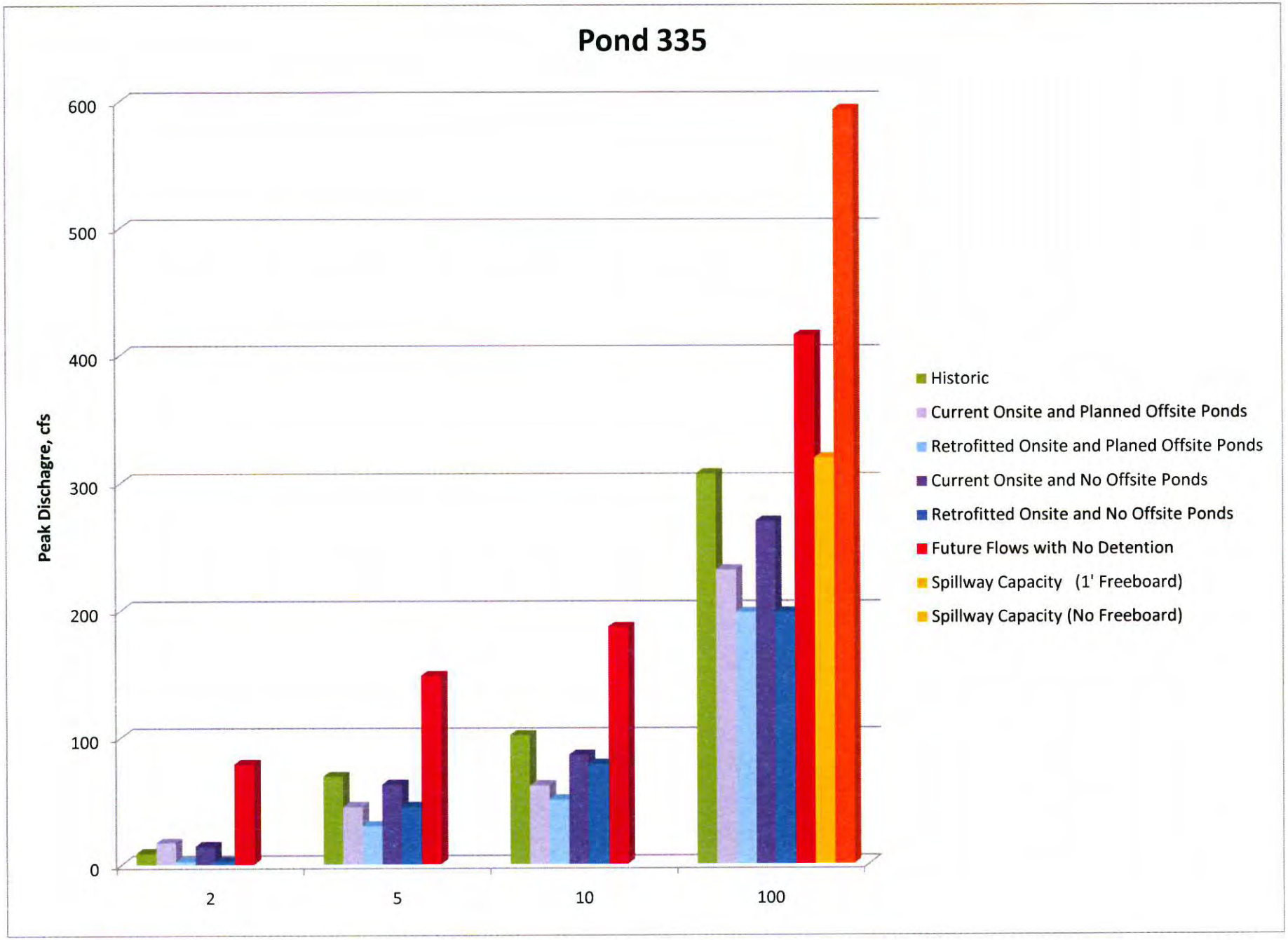
10-Yr

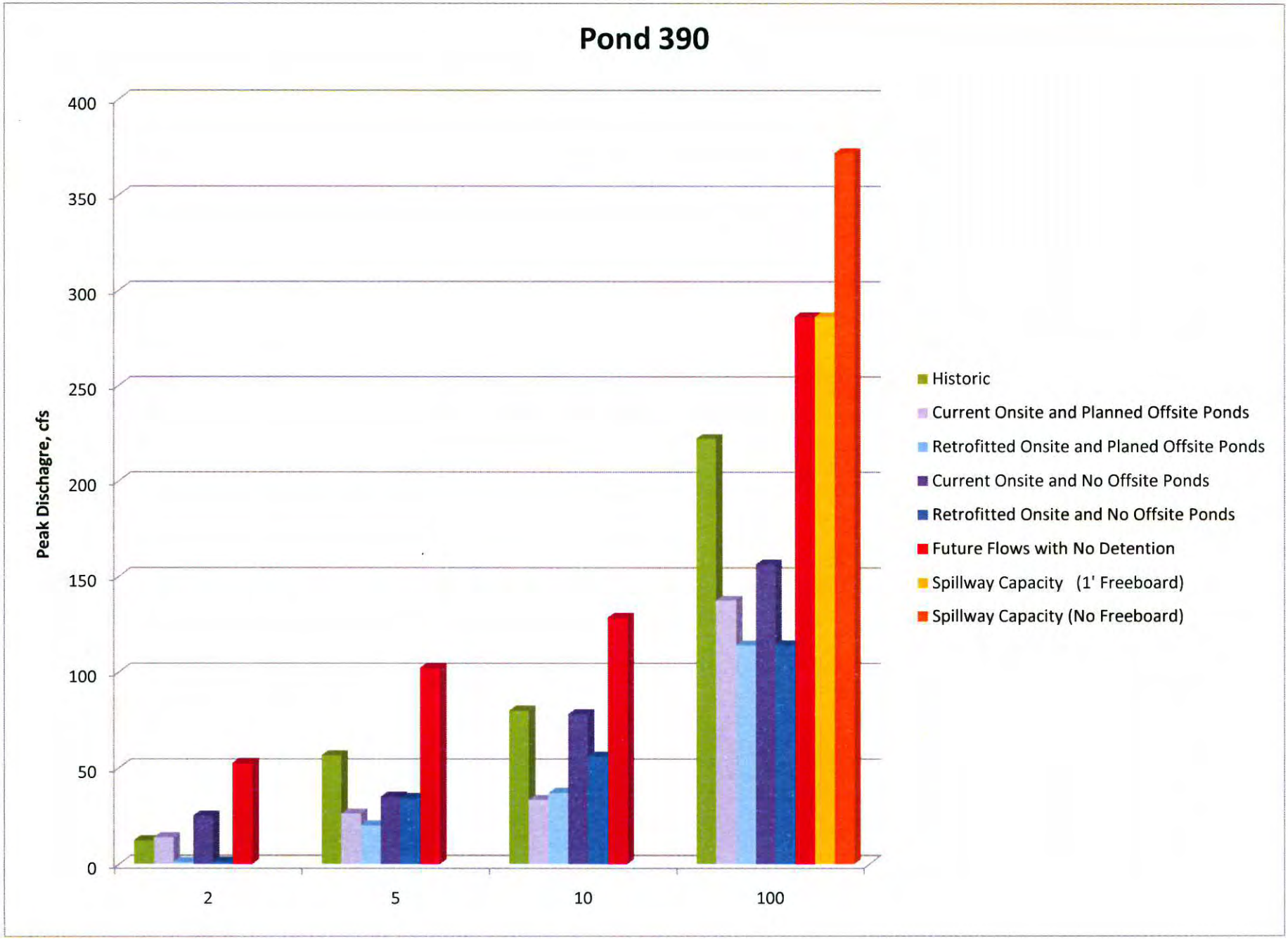
Pond	Outlet Number	Pre-developed	Future (No Ponds)	Future Castle Oaks Ponds AS IS	Future Castle Oaks Ponds EURV Opt 1	Future Castle Oaks Ponds EURV Opt 2	Future Castle Oaks Ponds EURV Opt 3	Future Castle Oaks Ponds EURV Opt 4	Future Castle Oaks Ponds EURV Opt 5	Future All Ponds (AS IS)	Future All Ponds Castle Oaks EURV Opt 1	Future All Ponds Castle Oaks EURV Opt 2	Future (All Ponds with Castle Oaks EURV) - Opt 3	Future (All Ponds with Castle Oaks EURV) - Opt 4
335	64	102	187	86	79	79	56	79	79	62	51	51	38	51
355	83	67	127	58	73	75	57	41	73	52	54	55	42	28
360	81	23	42	19	41	40	40	40	41	9	18	17	17	17
375	103	192	327	183	121	143	105	143	143	121	76	107	82	107
380	115	17	34	13	9	13	13	13	13	14	9	13	13	13
381	118	41	67	44	46	41	41	41	41	46	46	41	41	41
390	98	80	128	78	52	56	20	56	56	33	30	37	20	37
395	96	56	59	38	42	38	38	38	38	18	20	20	20	20
Combined outflow (335+355+375)		361	640	327		295			295	235		212		

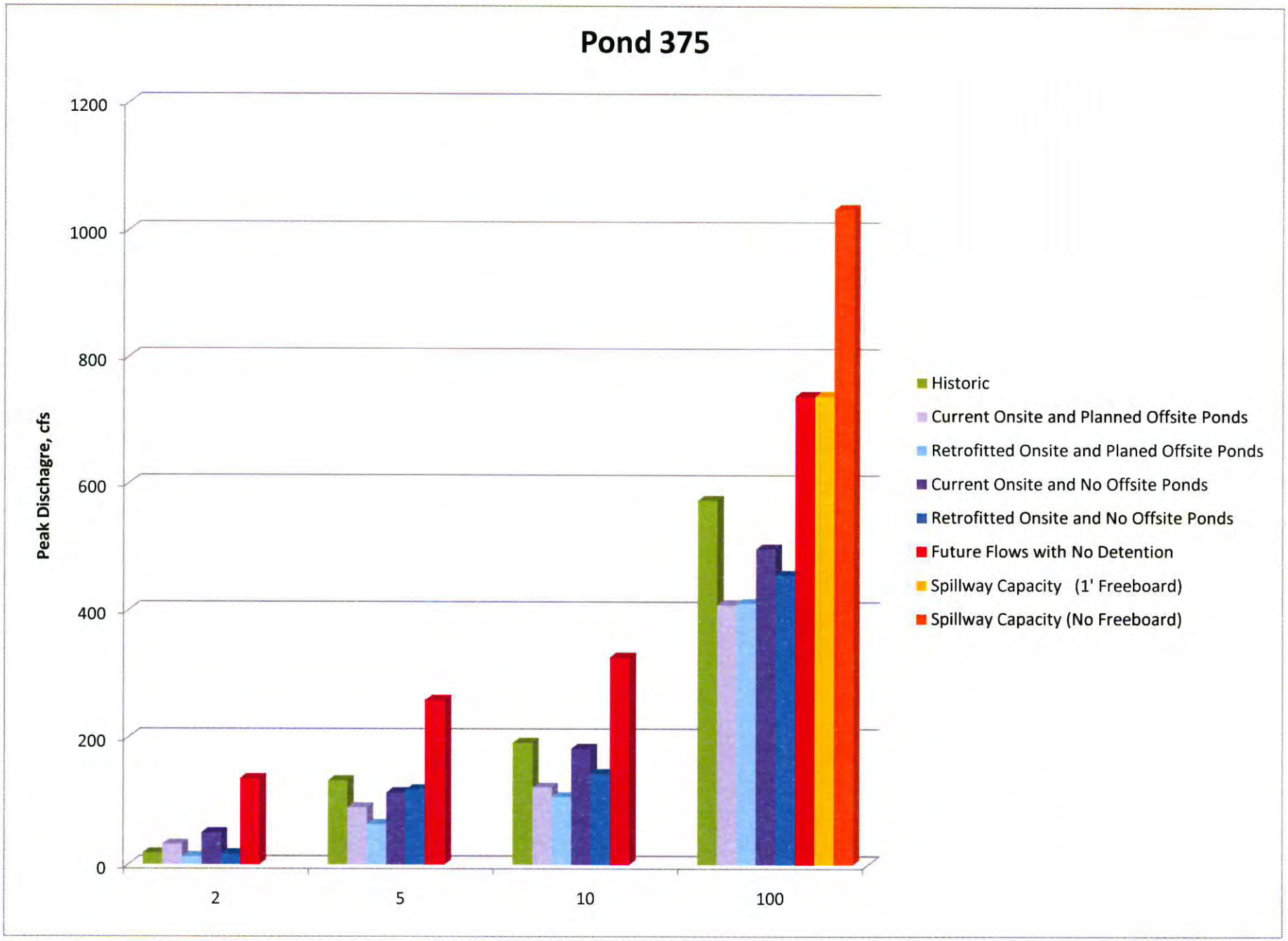
100-Yr

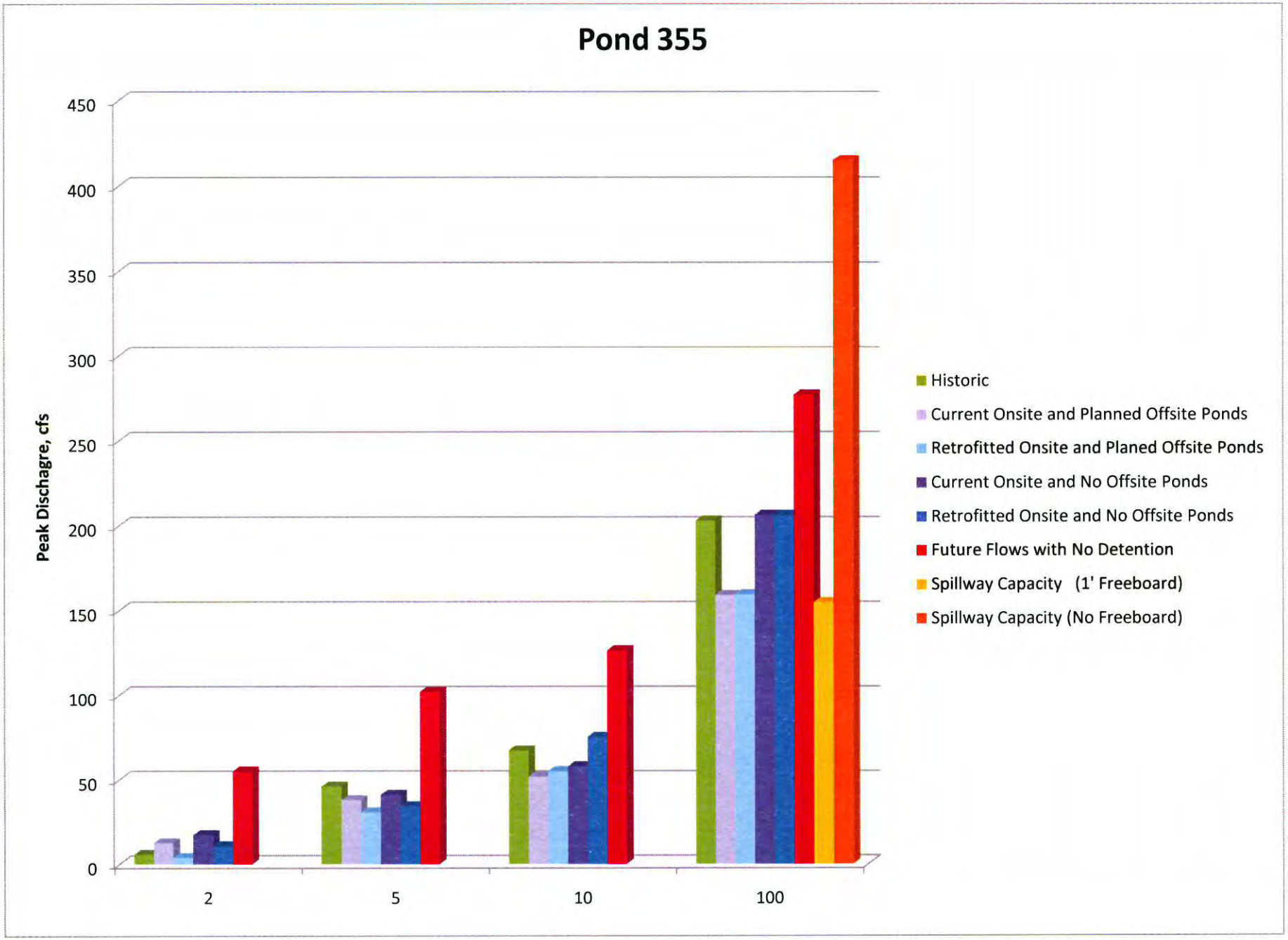
Pond	Outlet Number	Pre-developed	Future (No Ponds)	Future Castle Oaks Ponds AS IS	Future Castle Oaks Ponds EURV Opt 1	Future Castle Oaks Ponds EURV Opt 2	Future Castle Oaks Ponds EURV Opt 3	Future Castle Oaks Ponds EURV Opt 4	Future Castle Oaks Ponds EURV Opt 5	Future All Ponds (AS IS)	Future All Ponds Castle Oaks EURV Opt 1	Future All Ponds Castle Oaks EURV Opt 2	Future All Ponds Castle Oaks EURV Opt 3	Future All Ponds Castle Oaks EURV Opt 4
335	64	307	415	270	198	198	60	198	198	232	198	198	60	198
355	83	203	277	206	210	206	198	161	210	159	147	160	154	144
360	81	69	93	69	73	69	69	69	73	45	48	42	42	42
375	103	574	739	498	452	456	357	456	456	410	475	412	324	412
380	115	53	74	46	48	46	46	46	46	52	48	46	46	46
381	118	124	156	146	145	139	139	139	139	139	145	139	139	139
390	98	222	286	156	114	114	20	114	114	138	114	114	20	114
395	96	140	127	113	115	113	113	113	113	72	76	74	74	74
Combined outflow (335+355+375)		1084	1431	974		864			864	800		757		

Created By: JAM
Muller Engineering Company
P:\07-012.01 Castle Rock On-Call\07-012.14 McMurdo Gulch Final Design\07-012 McMurdo Gulch\excel\SWMM Scenario Results - Option 2.xlsxSWMM Scenario Results - Option 2.xlsx


Pond 335
Peak Dischagre, cfs
600
500
400
300
200
100
0
2
5
10
100
Historic
Current Onsite and Planned Offsite Ponds
Retrofitted Onsite and Planed Offsite Ponds
Current Onsite and No Offsite Ponds
Retrofitted Onsite and No Offsite Ponds
Future Flows with No Detention
Spillway Capacity (1' Freeboard)
Spillway Capacity (No Freeboard)

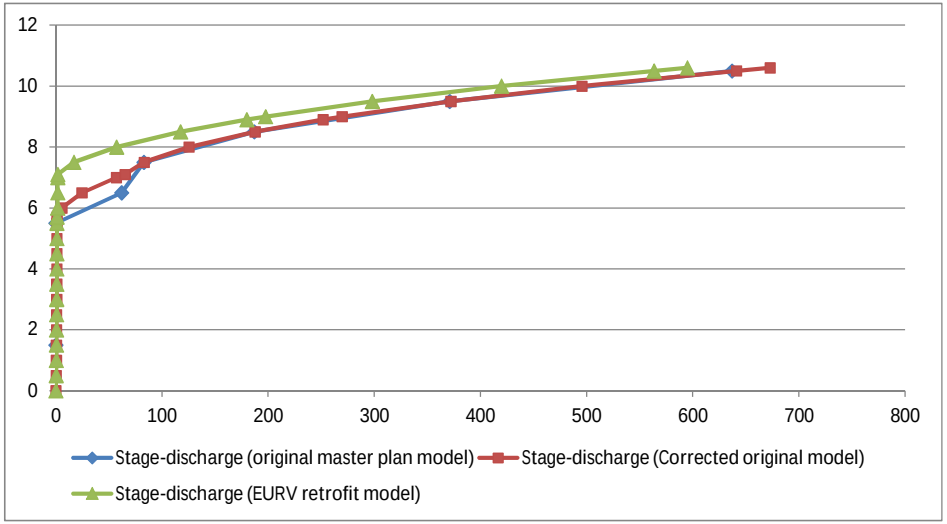

Pond 390
Peak Dischagre, cfs
400
350
300
250
200
150
100
50
0
2
5
10
100
Historic
Current Onsite and Planned Offsite Ponds
Retrofitted Onsite and Planed Offsite Ponds
Current Onsite and No Offsite Ponds
Retrofitted Onsite and No Offsite Ponds
Future Flows with No Detention
Spillway Capacity (1' Freeboard)
Spillway Capacity (No Freeboard)


Pond 375
Peak Dischagre, cfs
1200
1000
800
600
400
200
0
2
5
10
100
Historic
Current Onsite and Planned Offsite Ponds
Retrofitted Onsite and Planed Offsite Ponds
Current Onsite and No Offsite Ponds
Retrofitted Onsite and No Offsite Ponds
Future Flows with No Detention
Spillway Capacity (1' Freeboard)
Spillway Capacity (No Freeboard)


Pond 355
Peak Dischagre, cfs
450
400
350
300
250
200
150
100
50
0
2
5
10
100
Historic
Current Onsite and Planned Offsite Ponds
Retrofitted Onsite and Planed Offsite Ponds
Current Onsite and No Offsite Ponds
Retrofitted Onsite and No Offsite Ponds
Future Flows with No Detention
Spillway Capacity (1' Freeboard)
Spillway Capacity (No Freeboard)

Pond 335

Stage-discharge (original master plan model)			Stage-discharge (Corrected original model)		Stage-discharge (EURV retrofit model)	
1.5	1.5	0	0.00	0.00	0.00	0.00
5.5	5.5	0	0.50	0.32	0.50	0.32
6.5	6.5	62	1.00	0.46	1.00	0.46
7.5	7.5	83	1.50	0.56	1.50	0.56
8.5	8.5	187	2.00	0.65	2.00	0.65
9.5	9.5	371	2.50	0.72	2.50	0.72
10.5	10.5	637	3.00	0.79	3.00	0.79
			3.50	0.86	3.50	0.86
			4.00	0.92	4.00	0.92
			4.50	0.97	4.50	0.97
			5.00	1.02	5.00	1.02
			5.50	1.07	5.50	1.07
			5.70	1.09	5.70	1.09
			6.00	5.69	6.00	1.72
			6.50	24.59	6.50	1.79
			7.00	57.09	7.00	1.86
			7.10	65.31	7.10	1.87
			7.50	83.23	7.50	17.04
			8.00	125.47	8.00	57.25
			8.50	187.68	8.50	117.48
			8.90	251.71	8.90	179.97
			9.00	269.72	9.00	197.60
			9.50	372.14	9.50	298.15
			10.00	495.68	10.00	419.85
			10.50	641.15	10.50	563.54
			10.60	672.95	10.60	594.99



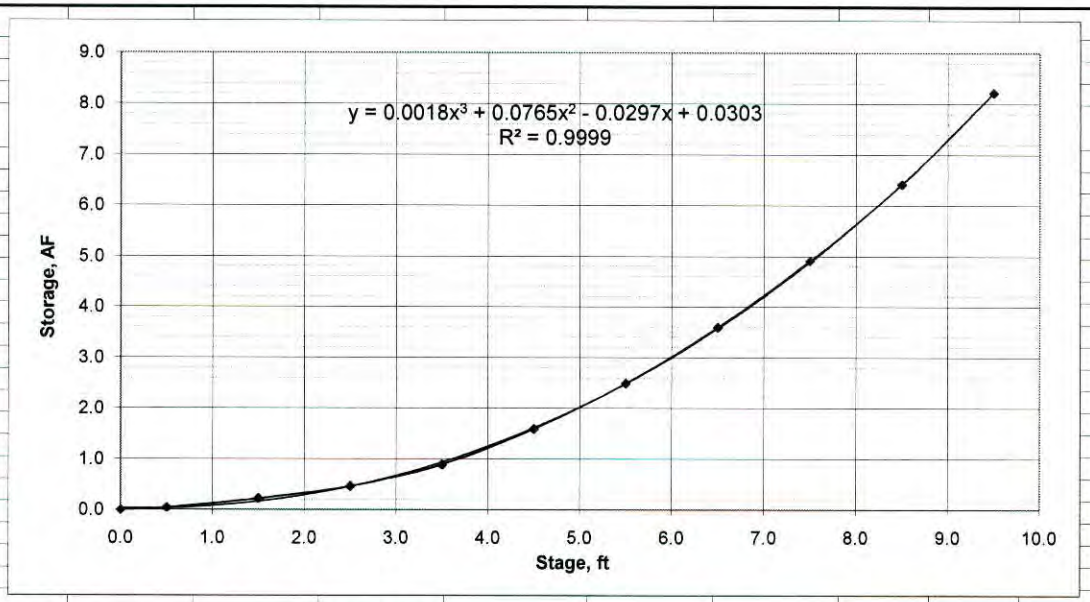
Pond Orifice Sizing

Updated 04/01/11

Castle Oaks POND - 335 ORIGINAL DESIGN

Establish Stage-Storage Curve

Elevation	Stage, ft	Area, SF	Area, ac	Incremental Storage, AF	Cummulative Storage, AF
6457.50	0.00	1518	0.035	0.00	0.00
6458.00	0.50	6679	0.153	0.04	0.04
6459.00	1.50	9,016	0.207	0.18	0.22
6460.00	2.50	12,528	0.288	0.25	0.47
6461.00	3.50	25,000	0.574	0.42	0.89
6462.00	4.50	36,132	0.829	0.70	1.59
6463.00	5.50	42,396	0.973	0.90	2.49
6464.00	6.50	53,860	1.236	1.10	3.59
6465.00	7.50	60,768	1.395	1.31	4.91
6466.00	8.50	70,750	1.624	1.51	6.42
6467.00	9.50	86617	1.988	1.80	8.22



Orifice Parameters

	CL Elev	
Orifice 1	6457.50	
Orifice 2	6457.00	Outlet Pipe of Pond
Orifice 3	6463.20	Box Elevation
Orifice 4	6464.60	Spillway Wier Elevation

Orifice 1 Size WQCV			**Orifice 2 Size**			**Box Wier**			**Spillway Wier**	
Diameter =		in	Diameter =	30	in	C =	3.1		C =	3.1
Width =	3.70	in	Width =		in	Z =	4		Z =	4
Height =	3.70	in	Height =		in	Length (Ang)=	8	ft	Length =	18
Orifice Area =	0.0951	ft²	Orifice Area =	4.9087	ft²					

Pond				WQCV Existing Conditions Orifice 1, EL. = 6457.50		Outlet Pipe of Pond Orifice 2, EL. = 6457.00		Box Wier Orifice 3, EL. = 6463.20		Controlling Flow Element	Spillway Wier Orifice 4, EL. = 6464.60				
Elevation	Stage, ft	Total Storage, AF	Incremental Storage, AF	Stage, ft	Q, cfs	Stage, ft	Q, cfs	Stage, ft	Q, cfs	Q, cfs	Stage, ft	Q, cfs	Total Q, cfs	Drain Time, hr	Total Drain Time, hr	
6457.50	0.00	0.00	0.0000	0.00	0.00	0.50	16.71	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0	
6458.00	0.50	0.03	0.0348	0.50	0.32	1.00	23.64	0.00	0.00	0.00	0.00	0.00	0.32	2.6	2.6	
6458.50	1.00	0.08	0.0441	1.00	0.46	1.50	28.95	0.00	0.00	0.00	0.00	0.00	0.46	1.4	4.0	
6459.00	1.50	0.16	0.0851	1.50	0.56	2.00	33.43	0.00	0.00	0.00	0.00	0.00	0.56	2.0	6.0	
6459.50	2.00	0.29	0.1274	2.00	0.65	2.50	37.37	0.00	0.00	0.00	0.00	0.00	0.65	2.6	8.5	
6460.00	2.50	0.46	0.1710	2.50	0.72	3.00	40.94	0.00	0.00	0.00	0.00	0.00	0.72	3.0	11.6	
6460.50	3.00	0.68	0.2160	3.00	0.79	3.50	44.22	0.00	0.00	0.00	0.00	0.00	0.79	3.4	15.0	
6461.00	3.50	0.94	0.2624	3.50	0.86	4.00	47.27	0.00	0.00	0.00	0.00	0.00	0.86	3.8	18.9	
6461.50	4.00	1.25	0.3101	4.00	0.92	4.50	50.14	0.00	0.00	0.00	0.00	0.00	0.92	4.2	23.1	
6462.00	4.50	1.61	0.3591	4.50	0.97	5.00	52.85	0.00	0.00	0.00	0.00	0.00	0.97	4.6	27.7	
6462.50	5.00	2.02	0.4095	5.00	1.02	5.50	55.43	0.00	0.00	0.00	0.00	0.00	1.02	5.0	32.7	
6463.00	5.50	2.48	0.4613	5.50	1.07	6.00	57.89	0.00	0.00	0.00	0.00	0.00	1.07	5.3	38.0	
6463.20	5.70	2.68	0.1993	5.70	1.09	6.20	58.85	0.00	0.00	0.00	0.00	0.00	1.09	2.2	40.2	WQCV
6463.50	6.00	2.99	0.3151	6.00	1.12	6.50	60.26	0.30	4.56	4.56	0.00	0.00	5.69	1.1	41.3	
6464.00	6.50	3.56	0.5688	6.50	1.17	7.00	62.53	0.80	23.42	23.42	0.00	0.00	24.59	0.5	41.8	
6464.50	7.00	4.19	0.6246	7.00	1.21	7.50	64.73	1.30	55.87	55.87	0.00	0.00	57.09	0.2	42.0	
6464.60	7.10	4.32	0.1317	7.10	1.22	7.60	65.16	1.40	64.09	64.09	0.00	0.00	65.31	0.0	42.0	Spillway
6465.00	7.50	4.87	0.5500	7.50	1.25	8.00	66.85	1.80	103.01	66.85	0.40	15.12	83.23	0.1	42.1	
6465.50	8.00	5.61	0.7403	8.00	1.29	8.50	68.91	2.30	166.09	68.91	0.90	55.27	125.47	0.1	42.2	
6466.00	8.50	6.41	0.8001	8.50	1.33	9.00	70.91	2.80	246.33	70.91	1.40	115.44	187.68	0.1	42.2	
6466.40	8.90	7.09	0.6841	8.90	1.37	9.40	72.46	3.20	323.68	72.46	1.80	177.88	251.71	0.0	42.3	
6466.50	9.00	7.27	0.1772	9.00	1.37	9.50	72.85	3.30	344.91	72.85	1.90	195.50	269.72	0.0	42.3	
6467.00	9.50	8.20	0.9239	9.50	1.41	10.00	74.74	3.80	462.94	74.74	2.40	295.99	372.14	0.0	42.3	
6467.50	10.00	9.18	0.9877	10.00	1.45	10.50	76.59	4.30	601.48	76.59	2.90	417.64	495.68	0.0	42.3	
6468.00	10.50	10.24	1.0530	10.50	1.48	11.00	78.39	4.80	761.55	78.39	3.40	561.28	641.15	0.0	42.4	
6468.10	10.60	10.45	0.2185	10.60	1.49	11.10	78.75	4.90	796.23	78.75	3.50	592.72	672.95	0.0	42.4	

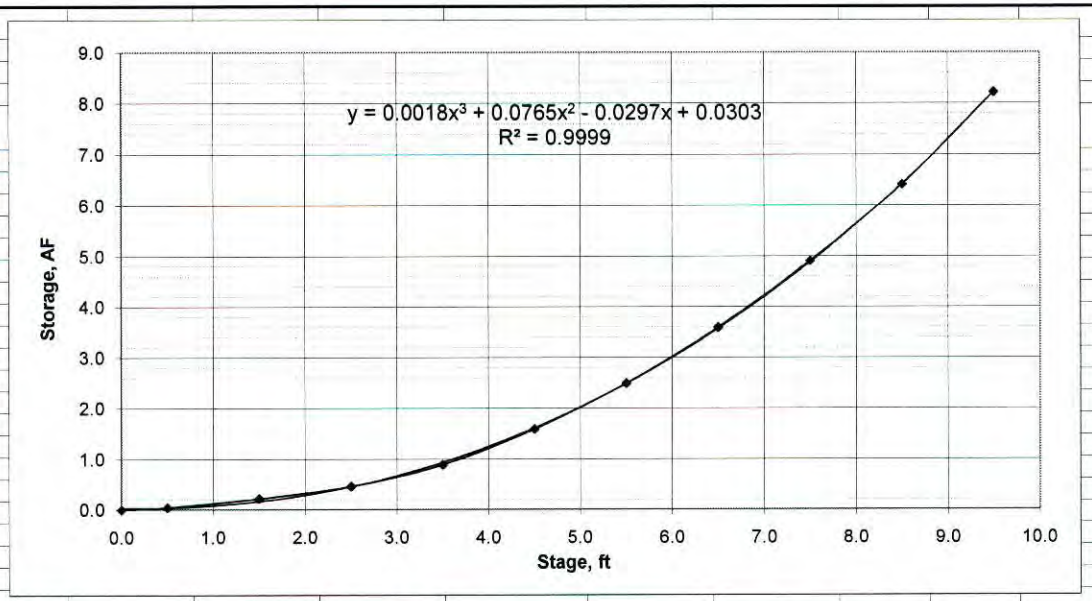
Pond Orifice Sizing

Updated 04/01/11

Castle Oaks POND - 335 EURV DESIGN

Establish Stage-Storage Curve

Elevation	Stage, ft	Area, SF	Area, ac	Incremental Storage, AF	Cummulative Storage, AF
6457.50	0.00	1518	0.035	0.00	0.00
6458.00	0.50	6679	0.153	0.04	0.04
6459.00	1.50	9,016	0.207	0.18	0.22
6460.00	2.50	12,528	0.288	0.25	0.47
6461.00	3.50	25,000	0.574	0.42	0.89
6462.00	4.50	36,132	0.829	0.70	1.59
6463.00	5.50	42,396	0.973	0.90	2.49
6464.00	6.50	53,860	1.236	1.10	3.59
6465.00	7.50	60,768	1.395	1.31	4.91
6466.00	8.50	70,750	1.624	1.51	6.42
6467.00	9.50	86617	1.988	1.80	8.22



Orifice Parameters

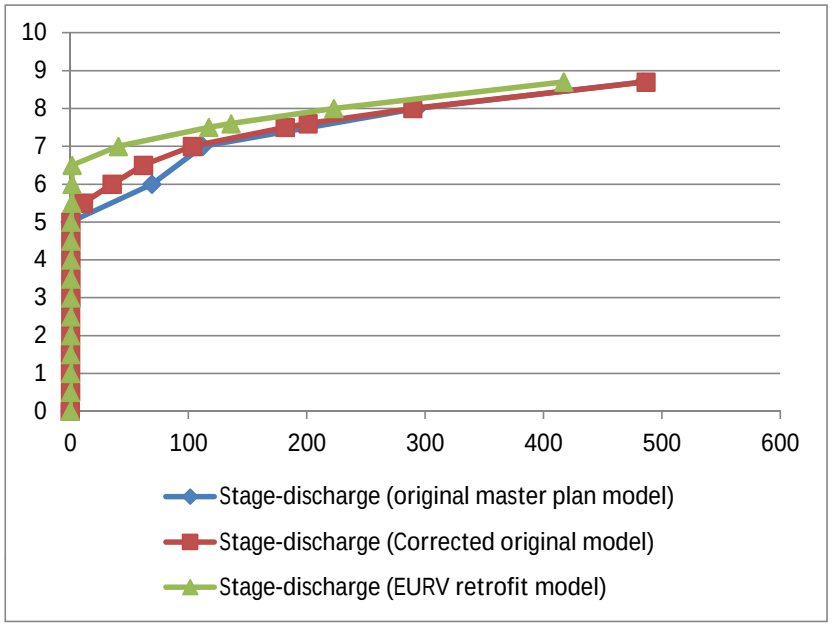
	CL Elev	
Orifice 1	6457.50	
Orifice 2	6457.00	Outlet Pipe of Pond
Orifice 3	6463.20	Box Elevation
Orifice 4	6464.60	Spillway Wier Elevation

Orifice 1 Size WQCV			**Orifice 2 Size**			**Box Wier**			**Spillway Wier**	
Diameter =		in	Diameter =	3.8	in	C =	3.1		C =	3.1
Width =	3.70	in	Width =		in	Z =	4		Z =	4
Height =	3.70	in	Height =		in	Length =	6	ft	Length =	18
Orifice Area =	0.0951	ft²	Orifice Area =	0.0788	ft²					

				WQCV Existing Conditions		Outlet Pipe of Pond		Box Height		Controlling	Spillway Wier				
Pond				**Orifice 1, EL. = 6457.50**		**Orifice 2, EL. = 6457.00**		**Orifice 3, EL. = 6463.20**		**Flow Element**	**Orifice 4, EL. = 6464.60**				
Elevation	**Stage, ft**	**Total Storage, AF**	**Incremental Storage, AF**	**Stage, ft**	**Q, cfs**	**Stage, ft**	**Q, cfs**	**Stage, ft**	**Q, cfs**	**Q, cfs**	**Stage, ft**	**Q, cfs**	**Total Q, cfs**	**Drain Time, hr**	**Total Drain Time, hr**	
6457.50	0.00	0.00	0.0000	0.00	0.00	0.50	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0	
6458.00	0.50	0.03	0.0348	0.50	0.32	1.00	0.38	0.00	0.00	0.00	0.00	0.00	0.32	2.6	2.6	
6458.50	1.00	0.08	0.0441	1.00	0.46	1.50	0.46	0.00	0.00	0.00	0.00	0.00	0.46	1.4	4.0	
6459.00	1.50	0.16	0.0851	1.50	0.56	2.00	0.54	0.00	0.00	0.00	0.00	0.00	0.56	2.0	6.0	
6459.50	2.00	0.29	0.1274	2.00	0.65	2.50	0.60	0.00	0.00	0.00	0.00	0.00	0.65	2.6	8.5	
6460.00	2.50	0.46	0.1710	2.50	0.72	3.00	0.66	0.00	0.00	0.00	0.00	0.00	0.72	3.0	11.6	
6460.50	3.00	0.68	0.2160	3.00	0.79	3.50	0.71	0.00	0.00	0.00	0.00	0.00	0.79	3.4	15.0	
6461.00	3.50	0.94	0.2624	3.50	0.86	4.00	0.76	0.00	0.00	0.00	0.00	0.00	0.86	3.8	18.9	
6461.50	4.00	1.25	0.3101	4.00	0.92	4.50	0.80	0.00	0.00	0.00	0.00	0.00	0.92	4.2	23.1	
6462.00	4.50	1.61	0.3591	4.50	0.97	5.00	0.85	0.00	0.00	0.00	0.00	0.00	0.97	4.6	27.7	
6462.50	5.00	2.02	0.4095	5.00	1.02	5.50	0.89	0.00	0.00	0.00	0.00	0.00	1.02	5.0	32.7	
6463.00	5.50	2.48	0.4613	5.50	1.07	6.00	0.93	0.00	0.00	0.00	0.00	0.00	1.07	5.3	38.0	
6463.20	5.70	2.68	0.1993	5.70	1.09	6.20	0.94	0.00	0.00	0.00	0.00	0.00	1.09	2.2	40.2	WQCV
6463.50	6.00	2.99	0.3151	6.00	1.12	6.50	0.97	0.30	3.55	0.97	0.00	0.00	2.09	2.4	42.6	
6464.00	6.50	3.56	0.5688	6.50	1.17	7.00	1.00	0.80	18.99	1.00	0.00	0.00	2.17	3.2	45.8	
6464.50	7.00	4.19	0.6246	7.00	1.21	7.50	1.04	1.30	46.68	1.04	0.00	0.00	2.25	3.4	49.3	
6464.60	7.10	4.32	0.1317	7.10	1.22	7.60	1.05	1.40	53.82	1.05	0.00	0.00	2.27	0.7	50.0	Spillway
6465.00	7.50	4.87	0.5500	7.50	1.25	8.00	1.07	1.80	88.04	1.07	0.40	15.12	17.45	0.7	50.6	
6465.50	8.00	5.61	0.7403	8.00	1.29	8.50	1.11	2.30	144.46	1.11	0.90	55.27	57.67	0.2	50.9	
6466.00	8.50	6.41	0.8001	8.50	1.33	9.00	1.14	2.80	217.29	1.14	1.40	115.44	117.91	0.1	51.0	
6466.40	8.90	7.09	0.6841	8.90	1.37	9.40	1.16	3.20	288.19	1.16	1.80	177.88	180.40	0.1	51.0	
6466.50	9.00	7.27	0.1772	9.00	1.37	9.50	1.17	3.30	307.75	1.17	1.90	195.50	198.04	0.0	51.1	
6467.00	9.50	8.20	0.9239	9.50	1.41	10.00	1.20	3.80	417.02	1.20	2.40	295.99	298.60	0.0	51.1	
6467.50	10.00	9.18	0.9877	10.00	1.45	10.50	1.23	4.30	546.20	1.23	2.90	417.64	420.32	0.0	51.1	
6468.00	10.50	10.24	1.0530	10.50	1.48	11.00	1.26	4.80	696.35	1.26	3.40	561.28	564.02	0.0	51.2	
6468.10	10.60	10.45	0.2185	10.60	1.49	11.10	1.26	4.90	728.98	1.26	3.50	592.72	595.47	0.0	51.2	

Pond 355

Stage-discharge (original master plan model)			Stage-discharge (Corrected original model)		Stage-discharge (EURV retrofit model)	
1	0	0	0.00	0.00	0.00	0.00
6	5	0	0.50	0.18	0.50	0.18
7	6	69	1.00	0.27	1.00	0.27
8	7	112	1.50	0.34	1.50	0.34
9	8	293	2.00	0.39	2.00	0.39
9.7	8.7	484	2.50	0.44	2.50	0.44
			3.00	0.49	3.00	0.49
			3.50	0.53	3.50	0.53
			4.00	0.56	4.00	0.56
			4.50	0.60	4.50	0.60
			5.00	0.63	5.00	0.63
			5.50	11.19	5.50	1.50
			6.00	35.41	6.00	1.57
			6.50	61.90	6.50	1.63
			7.00	103.19	7.00	40.71
			7.50	181.68	7.50	117.07
			7.60	200.98	7.60	135.95
			8.00	289.45	8.00	222.77
			8.70	486.50	8.70	417.03



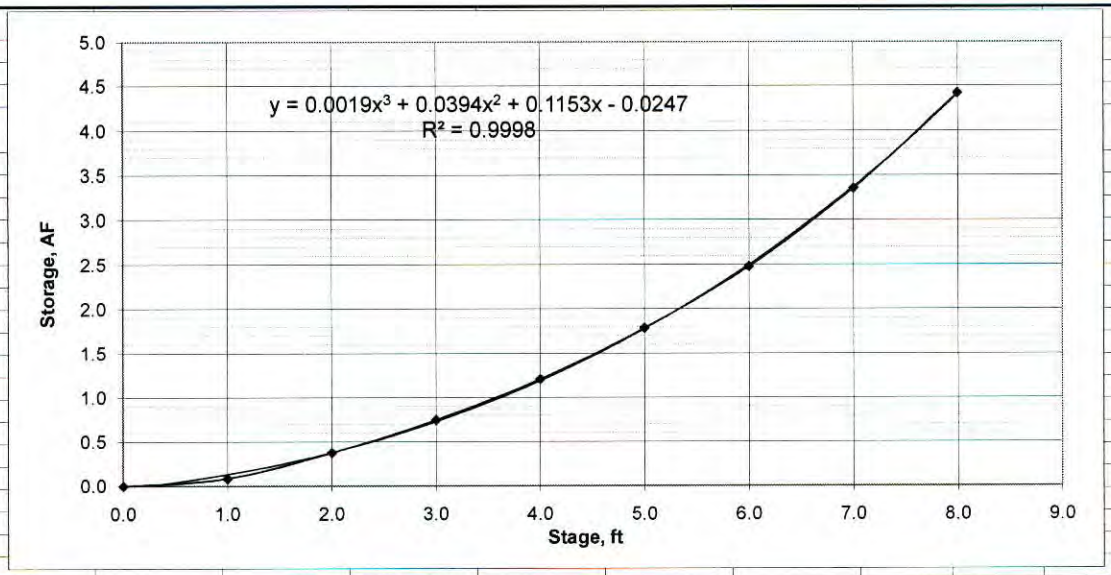
Pond Orifice Sizing

Updated 04/01/2011

Castle Oaks POND 355 - ORIGINAL DESIGN

Establish Stage-Storage Curve

Elevation	Stage, ft	Area, SF	Area, ac	Incremental Storage, AF	Cummulative Storage, AF
6455.00	0.00	0	0.000	0.00	0.00
6456.00	1.00	11191	0.257	0.09	0.09
6457.00	2.00	14270	0.328	0.29	0.38
6458.00	3.00	18003	0.413	0.37	0.75
6459.00	4.00	22429	0.515	0.46	1.21
6460.00	5.00	27704	0.636	0.57	1.78
6461.00	6.00	33096	0.760	0.70	2.48
6462.00	7.00	43386	0.996	0.88	3.36
6463.00	8.00	49275	1.131	1.06	4.42



Orifice Parameters

	CL Elev
Orifice 1	6455.00
Orifice 2	6454.80
Orifice 3	6460.00
Orifice 4	6461.50

Orifice Size			**Orifice 2 Size**			**Box Wier**			**Spillway Wier**		
Diameter =	3.3	in	Diameter =	30	in	C =	3.1		C =	3.1	
Width =		in	Width =		in	Z =	4		Z =	4	
Height =		in	Height =		in	Length =	8	ft	Length =	34	ft
Orifice Area =	0.0594	ft²	Orifice Area =	4.9087	ft²						

Pond				WQCV Existing Conditions		Outlet Pipe of Pond		Box Wier		Controlling	Spillway Wier					
				Orifice 1,	EL. = 6455.00	Orifice 2,	EL. = 6454.80	Orifice 3,	EL. = 6460.00	Flow Element	Orifice 4,	EL. = 6461.50				
Elevation	Stage, ft	Total Storage, AF	Incremental Storage, AF	Stage, ft	Q, cfs	Stage, ft	Q, cfs	Stage, ft	Q, cfs		Stage, ft	Q, cfs	Total Q, cfs	Drain Time, hr	Total Drain Time, hr	
6455.00	0.00	0.00	0.00	0.00	0.00	0.20	10.57	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0	
6455.50	0.50	0.04	0.04	0.50	0.20	0.70	19.77	0.00	0.00	0.00	0.00	0.00	0.20	0.0	0.0	
6456.00	1.00	0.13	0.09	1.00	0.29	1.20	25.89	0.00	0.00	0.00	0.00	0.00	0.29	0.0	0.0	
6456.50	1.50	0.24	0.11	1.50	0.35	1.70	30.82	0.00	0.00	0.00	0.00	0.00	0.35	4.2	4.2	
6457.00	2.00	0.38	0.14	2.00	0.40	2.20	35.06	0.00	0.00	0.00	0.00	0.00	0.40	4.3	8.6	
6457.50	2.50	0.54	0.16	2.50	0.45	2.70	38.84	0.00	0.00	0.00	0.00	0.00	0.45	4.5	13.1	
6458.00	3.00	0.73	0.19	3.00	0.50	3.20	42.28	0.00	0.00	0.00	0.00	0.00	0.50	4.8	17.9	
6458.50	3.50	0.94	0.22	3.50	0.54	3.70	45.46	0.00	0.00	0.00	0.00	0.00	0.54	5.1	23.0	
6459.00	4.00	1.19	0.25	4.00	0.57	4.20	48.44	0.00	0.00	0.00	0.00	0.00	0.57	5.4	28.4	
6459.50	4.50	1.47	0.28	4.50	0.61	4.70	51.24	0.00	0.00	0.00	0.00	0.00	0.61	5.7	34.0	
6460.00	5.00	1.77	0.31	5.00	0.64	5.20	53.90	0.00	0.00	0.00	0.00	0.00	0.64	6.0	40.0	WQCV
6460.50	5.50	2.12	0.34	5.50	0.67	5.70	56.43	0.50	10.52	10.52	0.00	0.00	11.19	0.7	40.7	
6461.00	6.00	2.50	0.38	6.00	0.70	6.20	58.85	1.00	34.72	34.72	0.00	0.00	35.42	0.2	40.9	
6461.50	6.50	2.91	0.42	6.50	0.73	6.70	61.18	1.50	72.90	61.18	0.00	0.00	61.91	0.1	41.0	
6462.00	7.00	3.36	0.45	7.00	0.76	7.20	63.42	2.00	126.26	63.42	0.50	39.02	103.20	0.1	41.1	
6462.50	7.50	3.86	0.49	7.50	0.78	7.70	65.59	2.50	196.06	65.59	1.00	115.32	181.69	0.0	41.1	
6462.60	7.60	3.96	0.10	7.60	0.79	7.80	66.01	2.60	212.10	66.01	1.10	134.19	200.99	0.0	41.2	Spillway
6463.00	8.00	4.39	0.43	8.00	0.81	8.20	67.68	3.00	283.50	67.68	1.50	220.97	289.46	0.0	41.2	
6463.70	8.70	5.21	0.82	8.70	0.84	8.90	70.51	3.70	437.73	70.51	2.20	415.15	486.50	0.0	41.2	

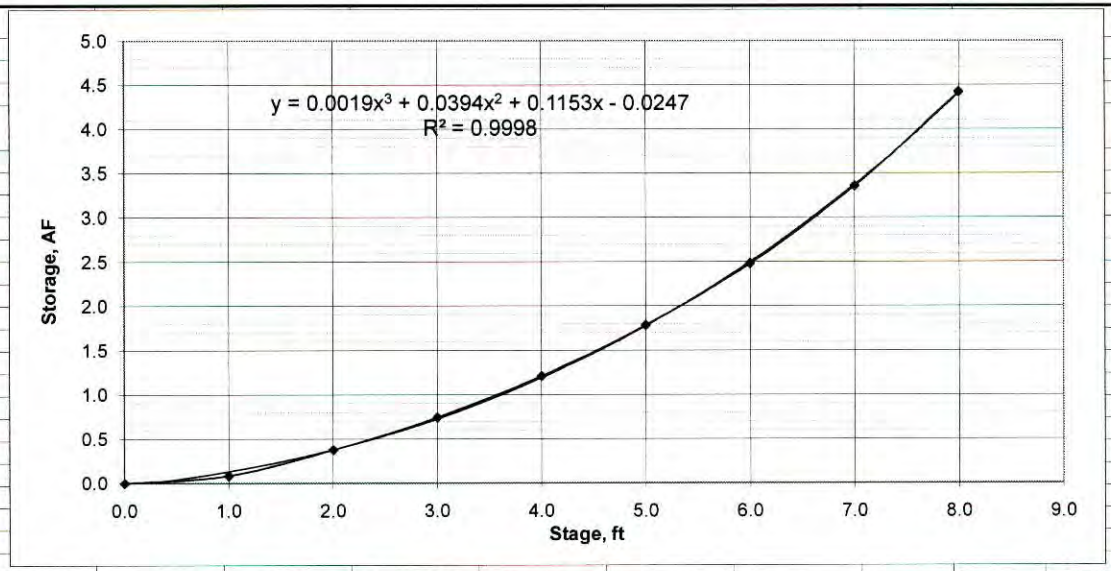
Pond Orifice Sizing

Updated 04/01/2011

Castle Oaks POND 355 - EURV DESIGN

Establish Stage-Storage Curve

Elevation	Stage, ft	Area, SF	Area, ac	Incremental Storage, AF	Cummulative Storage, AF
6455.00	0.00	0	0.000	0.00	0.00
6456.00	1.00	11191	0.257	0.09	0.09
6457.00	2.00	14270	0.328	0.29	0.38
6458.00	3.00	18003	0.413	0.37	0.75
6459.00	4.00	22429	0.515	0.46	1.21
6460.00	5.00	27704	0.636	0.57	1.78
6461.00	6.00	33096	0.760	0.70	2.48
6462.00	7.00	43386	0.996	0.88	3.36
6463.00	8.00	49275	1.131	1.06	4.42



Orifice Parameters

	CL Elev
Orifice 1	6455.00
Orifice 2	6454.80
Orifice 3	6460.00
Orifice 4	6461.50

Orifice Size			**Orifice 2 Size**			**Box Wier**			**Spillway Wier**		
Diameter =	3.3	in	Diameter =	3.65	in	C =	3.1		C =	3.1	
Width =		in	Width =		in	Z =	4		Z =	4	
Height =		in	Height =		in	Length =	8	ft	Length =	34	ft
Orifice Area =	0.0594	ft²	Orifice Area =	0.0727	ft²						

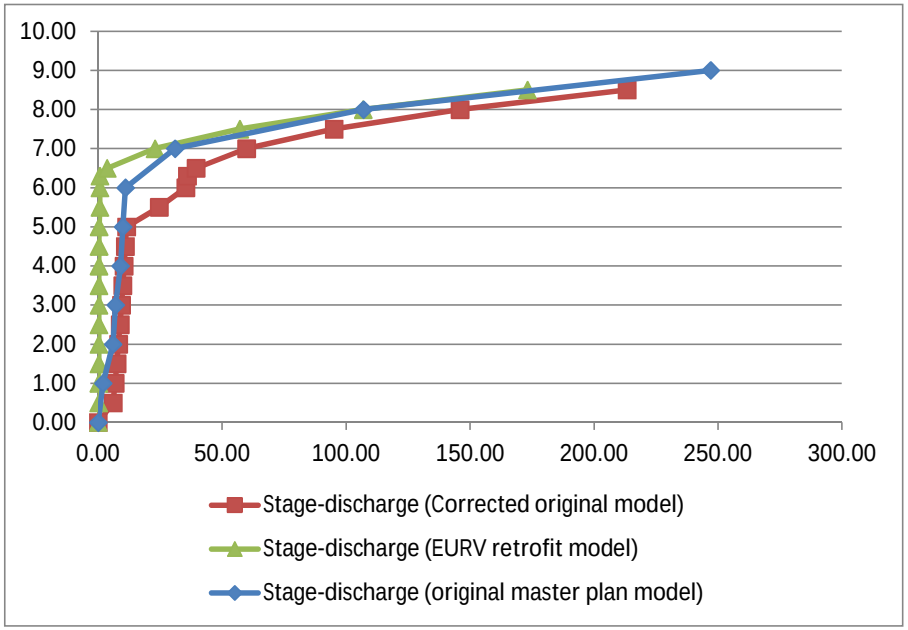
				WQCV Existing Conditions		Outlet Pipe of Pond		Box Wier		Controlling	Spillway Wier					
Pond				**Orifice 1, EL. = 6455.00**		**Orifice 2, EL. = 6454.80**		**Orifice 3, EL. = 6460.00**		**Flow Element**	**Orifice 4, EL. = 6461.50**					
Elevation	**Stage, ft**	**Total Storage, AF**	**Incremental Storage, AF**	**Stage, ft**	**Q, cfs**	**Stage, ft**	**Q, cfs**	**Stage, ft**	**Q, cfs**		**Stage, ft**	**Q, cfs**	**Total Q, cfs**	**Drain Time, hr**	**Total Drain Time, hr**	
6455.00	0.00	0.00	0.00	0.00	0.00	0.20	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0	
6455.50	0.50	0.04	0.04	0.50	0.20	0.70	0.29	0.00	0.00	0.00	0.00	0.00	0.20	0.0	0.0	
6456.00	1.00	0.13	0.09	1.00	0.29	1.20	0.38	0.00	0.00	0.00	0.00	0.00	0.29	0.0	0.0	
6456.50	1.50	0.24	0.11	1.50	0.35	1.70	0.46	0.00	0.00	0.00	0.00	0.00	0.35	4.2	4.2	
6457.00	2.00	0.38	0.14	2.00	0.40	2.20	0.52	0.00	0.00	0.00	0.00	0.00	0.40	4.3	8.6	
6457.50	2.50	0.54	0.16	2.50	0.45	2.70	0.57	0.00	0.00	0.00	0.00	0.00	0.45	4.5	13.1	
6458.00	3.00	0.73	0.19	3.00	0.50	3.20	0.63	0.00	0.00	0.00	0.00	0.00	0.50	4.8	17.9	
6458.50	3.50	0.94	0.22	3.50	0.54	3.70	0.67	0.00	0.00	0.00	0.00	0.00	0.54	5.1	23.0	
6459.00	4.00	1.19	0.25	4.00	0.57	4.20	0.72	0.00	0.00	0.00	0.00	0.00	0.57	5.4	28.4	
6459.50	4.50	1.47	0.28	4.50	0.61	4.70	0.76	0.00	0.00	0.00	0.00	0.00	0.61	5.7	34.0	
6460.00	5.00	1.77	0.31	5.00	0.64	5.20	0.80	0.00	0.00	0.00	0.00	0.00	0.64	6.0	40.0	WQCV
6460.50	5.50	2.12	0.34	5.50	0.67	5.70	0.84	0.50	10.52	0.84	0.00	0.00	1.51	3.9	43.9	
6461.00	6.00	2.50	0.38	6.00	0.70	6.20	0.87	1.00	34.72	0.87	0.00	0.00	1.57	3.0	46.9	
6461.50	6.50	2.91	0.42	6.50	0.73	6.70	0.91	1.50	72.90	0.91	0.00	0.00	1.63	3.1	50.0	Spillway
6462.00	7.00	3.36	0.45	7.00	0.76	7.20	0.94	2.00	126.26	0.94	0.50	39.02	40.71	0.3	50.3	
6462.50	7.50	3.86	0.49	7.50	0.78	7.70	0.97	2.50	196.06	0.97	1.00	115.32	117.07	0.1	50.3	
6462.60	7.60	3.96	0.10	7.60	0.79	7.80	0.98	2.60	212.10	0.98	1.10	134.19	135.95	0.0	50.4	
6463.00	8.00	4.39	0.43	8.00	0.81	8.20	1.00	3.00	283.50	1.00	1.50	220.97	222.78	0.0	50.4	
6463.70	8.70	5.21	0.82	8.70	0.84	8.90	1.04	3.70	437.73	1.04	2.20	415.15	417.04	0.0	50.4	

Pond 360

Stage-discharge (original master plan model)		
0	0	0
1	1	2
2	2	6
3	3	7
4	4	9
5	5	10
6	6	11
7	7	31
8	8	107
9	9	247

Stage-discharge (Corrected original model)	
0.00	0.00
0.50	5.97
1.00	6.79
1.50	7.52
2.00	8.19
2.50	8.80
3.00	9.38
3.50	9.92
4.00	10.43
4.50	10.92
5.00	11.39
5.50	24.56
6.00	35.27
6.30	35.99
6.50	39.41
7.00	59.84
7.50	95.14
8.00	145.92
8.50	213.26

Stage-discharge (EURV retrofit model)	
0.00	0.00
0.50	0.17
1.00	0.20
1.50	0.22
2.00	0.24
2.50	0.26
3.00	0.27
3.50	0.29
4.00	0.30
4.50	0.32
5.00	0.33
5.50	0.62
6.00	0.64
6.30	0.65
6.50	3.61
7.00	22.91
7.50	57.10
8.00	106.82
8.50	173.11



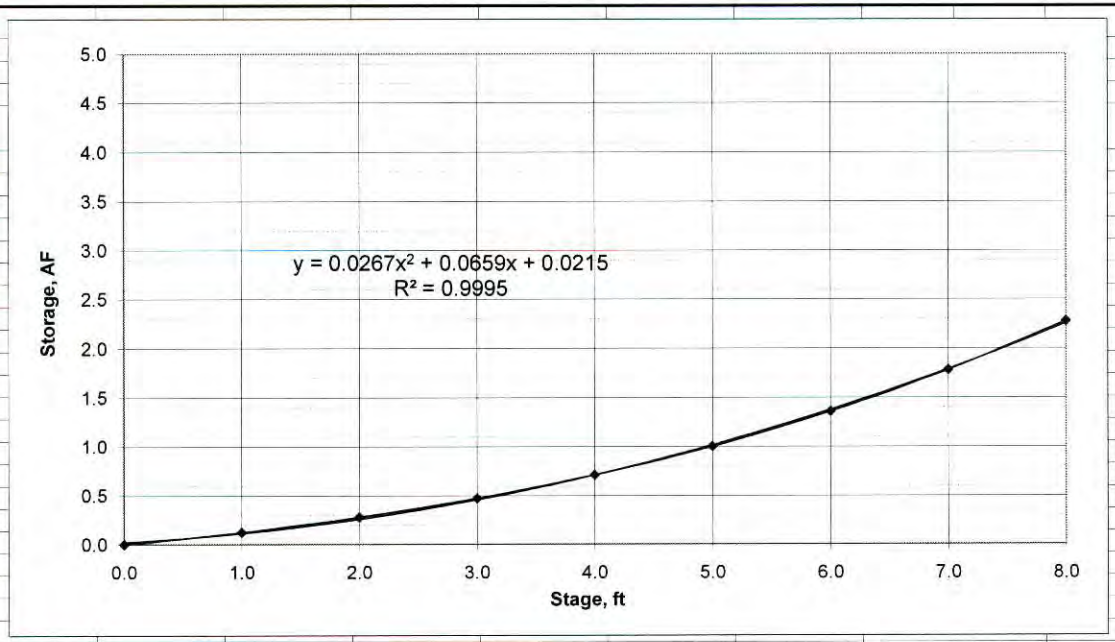
Pond Orifice Sizing

Updated 04/01/2011

Castle Oaks POND 360 - ORIGINAL DESIGN

Establish Stage-Storage Curve

Elevation	Stage, ft	Area, SF	Area, ac	Incremental Storage, AF	Cummulative Storage, AF
6474.00	0.00	4690	0.108	0.00	0.00
6475.00	1.00	6133	0.141	0.12	0.12
6476.00	2.00	7,569	0.174	0.16	0.28
6477.00	3.00	9,387	0.215	0.19	0.48
6478.00	4.00	11,300	0.259	0.24	0.71
6479.00	5.00	14,020	0.322	0.29	1.00
6480.00	6.00	16,984	0.390	0.36	1.36
6481.00	7.00	20,116	0.462	0.43	1.78
6482.00	8.00	23,092	0.530	0.50	2.28



Orifice Parameters

	CL Elev
Orifice 1	6472.80
Orifice 2	6472.70
Orifice 3	6479.00
Orifice 4	6480.30

Orifice Size			**Orifice 2 Size**			**Box Wier**			**Spillway Wier**		
Diameter =	13.2	in	Diameter =	18	in	C =	3.1		C =	3.1	
Width =		in	Width =		in	Z =	4		Z =	4	
Height =		in	Height =		in	Length =	10	ft	Length =	10	ft
Orifice Area =	0.9503	ft^2	Orifice Area =	1.7671	ft^2						

Pond				10-Year Orifice 1, EL. = 6472.80		Outlet Pipe of Pond Orifice 2, EL. = 6472.70		Box Wier Orifice 3, EL. = 6479.00		Controlling Flow	Spillway Wier Orifice 4, EL. = 6480.30					
Elevation	**Stage, ft**	**Total Storage, AF**	**Incremental Storage, AF**	**Stage, ft**	**Q, cfs**	**Stage, ft**	**Q, cfs**	**Stage, ft**	**Q, cfs**	**Q, cfs**	**Stage, ft**	**Q, cfs**	**Total Q, cfs**	**Drain Time, hr**	**Total Drain Time, hr**	
6474.00	0.00	0.00	0.0000	0.00	0.00	1.30	9.70	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0	
6474.50	0.50	0.06	0.0611	1.70	5.97	1.80	11.42	0.00	0.00	0.00	0.00	0.00	5.97	0.0	0.0	
6475.00	1.00	0.11	0.0530	2.20	6.79	2.30	12.90	0.00	0.00	0.00	0.00	0.00	6.79	0.0	0.0	
6475.50	1.50	0.18	0.0663	2.70	7.52	2.80	14.24	0.00	0.00	0.00	0.00	0.00	7.52	0.1	0.1	
6476.00	2.00	0.26	0.0797	3.20	8.19	3.30	15.46	0.00	0.00	0.00	0.00	0.00	8.19	0.1	0.2	
6476.50	2.50	0.35	0.0930	3.70	8.80	3.80	16.59	0.00	0.00	0.00	0.00	0.00	8.80	0.1	0.4	
6477.00	3.00	0.46	0.1064	4.20	9.38	4.30	17.64	0.00	0.00	0.00	0.00	0.00	9.38	0.1	0.5	
6477.50	3.50	0.58	0.1197	4.70	9.92	4.80	18.64	0.00	0.00	0.00	0.00	0.00	9.92	0.2	0.7	
6478.00	4.00	0.71	0.1331	5.20	10.43	5.30	19.59	0.00	0.00	0.00	0.00	0.00	10.43	0.2	0.8	
6478.50	4.50	0.86	0.1464	5.70	10.92	5.80	20.49	0.00	0.00	0.00	0.00	0.00	10.92	0.2	1.0	
6479.00	5.00	1.02	0.1598	6.20	11.39	6.30	21.36	0.00	0.00	0.00	0.00	0.00	11.39	0.2	1.2	
6479.50	5.50	1.19	0.1731	6.70	11.84	6.80	22.19	0.50	12.71	12.71	0.00	0.00	24.56	0.1	1.3	
6480.00	6.00	1.38	0.1865	7.20	12.28	7.30	22.99	1.00	40.92	22.99	0.00	0.00	35.27	0.1	1.3	
6480.30	6.30	1.50	0.1183	7.50	12.53	7.60	23.46	1.30	65.06	23.46	0.00	0.00	35.99	0.0	1.4	Spillway
6480.50	6.50	1.58	0.0815	7.70	12.70	7.80	23.76	1.50	84.29	23.76	0.20	2.95	39.41	0.0	1.4	
6481.00	7.00	1.79	0.2132	8.20	13.10	8.30	24.51	2.00	143.80	24.51	0.70	22.22	59.84	0.1	1.5	
6481.50	7.50	2.02	0.2265	8.70	13.50	8.80	25.24	2.50	220.57	25.24	1.20	56.40	95.14	0.0	1.5	
6482.00	8.00	2.26	0.2399	9.20	13.88	9.30	25.95	3.00	315.72	25.95	1.70	106.09	145.92	0.0	1.5	
6482.50	8.50	2.51	0.2532	9.70	14.25	9.80	26.64	3.50	430.33	26.64	2.20	172.37	213.26	0.0	1.5	

Green -- Required WQCV @ El. 5752.82 with 20% sediment storage

Yellow - Provided WQCV @ 5752.85

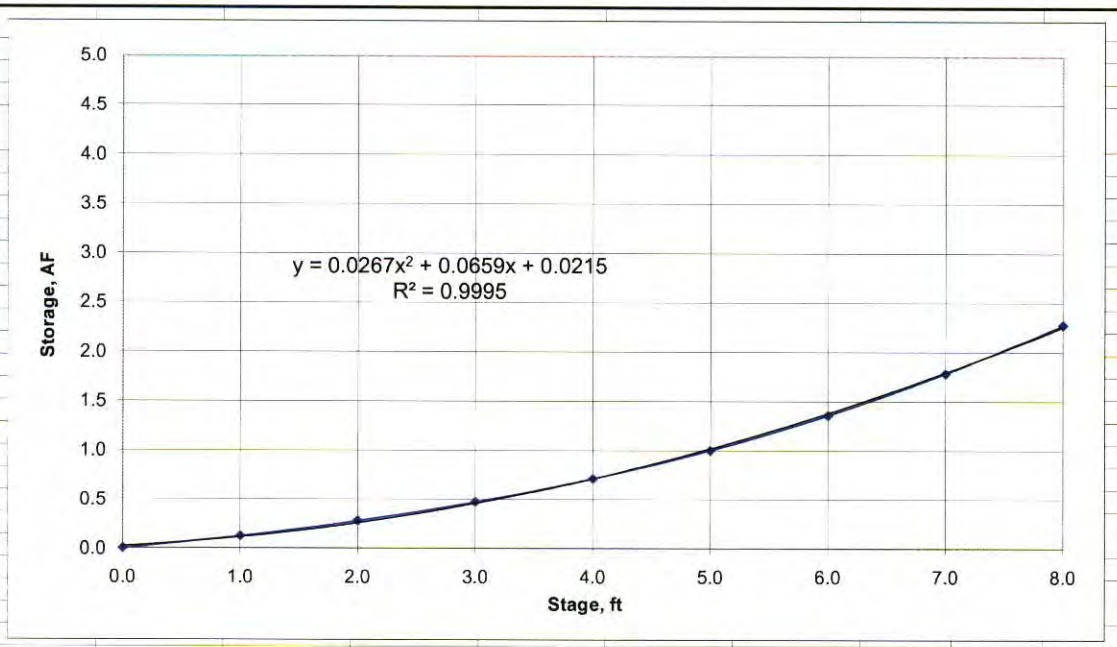
Pond Orifice Sizing

Updated 04/01/2011

Castle Oaks POND 360 - EURV DESIGN

Establish Stage-Storage Curve

Elevation	Stage, ft	Area, SF	Area, ac	Incremental Storage, AF	Cummulative Storage, AF
6474.00	0.00	4690	0.108	0.00	0.00
6475.00	1.00	6133	0.141	0.12	0.12
6476.00	2.00	7569	0.174	0.16	0.28
6477.00	3.00	9387	0.215	0.19	0.48
6478.00	4.00	11300	0.259	0.24	0.71
6479.00	5.00	14020	0.322	0.29	1.00
6480.00	6.00	16984	0.390	0.36	1.36
6481.00	7.00	20116	0.462	0.43	1.78
6482.00	8.00	23092	0.530	0.50	2.28



Orifice Parameters

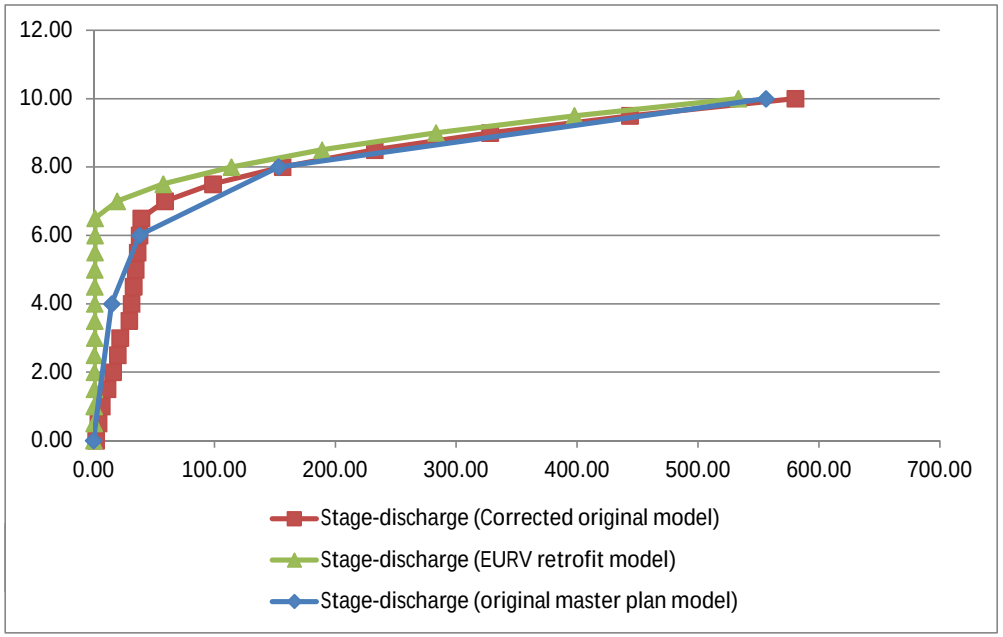
	CL Elev
Orifice 1	6472.80
Orifice 2	6472.70
Orifice 3	6479.00
Orifice 4	6480.30

Orifice Size			**Orifice 2 Size**			**Box Wier**			**Spillway Wier**		
Diameter =	2.25	in	Diameter =	3.5	in	C =	3.1		C =	3.1	
Width =		in	Width =		in	Z =	4		Z =	4	
Height =		in	Height =		in	Length =	10	ft	Length =	10	ft
Orifice Area =	0.0276	ft²	Orifice Area =	0.0668	ft²						

Pond				10-Year Orifice 1, EL. = 6472.80		Outlet Pipe of Pond Orifice 2, EL. = 6472.70		Box Wier Orifice 3, EL. = 6479.00		Controlling Flow	Spillway Wier Orifice 4, EL. = 6480.30					
Elevation	Stage, ft	Total Storage, AF	Incremental Storage, AF	Stage, ft	Q, cfs	Stage, ft	Q, cfs	Stage, ft	Q, cfs	Q, cfs	Stage, ft	Q, cfs	Total Q, cfs	Drain Time, hr	Total Drain Time, hr	
6474.00	0.00	0.00	0.0000	0.00	0.00	1.30	0.37	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0	
6474.50	0.50	0.06	0.0611	1.70	0.17	1.80	0.43	0.00	0.00	0.00	0.00	0.00	0.17	0.0	0.0	
6475.00	1.00	0.11	0.0530	2.20	0.20	2.30	0.49	0.00	0.00	0.00	0.00	0.00	0.20	0.0	0.0	
6475.50	1.50	0.18	0.0663	2.70	0.22	2.80	0.54	0.00	0.00	0.00	0.00	0.00	0.22	3.9	3.9	
6476.00	2.00	0.26	0.0797	3.20	0.24	3.30	0.58	0.00	0.00	0.00	0.00	0.00	0.24	4.2	8.1	
6476.50	2.50	0.35	0.0930	3.70	0.26	3.80	0.63	0.00	0.00	0.00	0.00	0.00	0.26	4.6	12.6	
6477.00	3.00	0.46	0.1064	4.20	0.27	4.30	0.67	0.00	0.00	0.00	0.00	0.00	0.27	4.9	17.5	
6477.50	3.50	0.58	0.1197	4.70	0.29	4.80	0.70	0.00	0.00	0.00	0.00	0.00	0.29	5.2	22.7	
6478.00	4.00	0.71	0.1331	5.20	0.30	5.30	0.74	0.00	0.00	0.00	0.00	0.00	0.30	5.4	28.1	
6478.50	4.50	0.86	0.1464	5.70	0.32	5.80	0.77	0.00	0.00	0.00	0.00	0.00	0.32	5.7	33.8	
6479.00	5.00	1.02	0.1598	6.20	0.33	6.30	0.81	0.00	0.00	0.00	0.00	0.00	0.33	6.0	39.8	WQCV
6479.50	5.50	1.19	0.1731	6.70	0.34	6.80	0.84	0.50	12.71	0.84	0.00	0.00	1.18	2.8	42.6	
6480.00	6.00	1.38	0.1865	7.20	0.36	7.30	0.87	1.00	40.92	0.87	0.00	0.00	1.23	1.9	44.4	
6480.30	6.30	1.50	0.1183	7.50	0.36	7.60	0.89	1.30	65.06	0.89	0.00	0.00	1.25	1.2	45.6	Spillway
6480.50	6.50	1.58	0.0815	7.70	0.37	7.80	0.90	1.50	84.29	0.90	0.20	2.95	4.22	0.4	46.0	
6481.00	7.00	1.79	0.2132	8.20	0.38	8.30	0.93	2.00	143.80	0.93	0.70	22.22	23.53	0.2	46.2	
6481.50	7.50	2.02	0.2265	8.70	0.39	8.80	0.95	2.50	220.57	0.95	1.20	56.40	57.75	0.1	46.2	
6482.00	8.00	2.26	0.2399	9.20	0.40	9.30	0.98	3.00	315.72	0.98	1.70	106.09	107.48	0.0	46.3	
6482.50	8.50	2.51	0.2532	9.70	0.41	9.80	1.01	3.50	430.33	1.01	2.20	172.37	173.79	0.0	46.3	

Pond 390

Stage-discharge (original master plan model)			Stage-discharge (Corrected original model)		Stage-discharge (EURV retrofit model)	
0	0	0	0.00	2.00	0.00	0.24
2	4	15	0.50	4.00	0.50	0.40
4	6	38	1.00	6.80	1.00	0.51
6	8	153	1.50	11.50	1.50	0.60
8	10	556	2.00	16.00	2.00	0.67
			2.50	20.00	2.50	0.74
			3.00	22.00	3.00	0.81
			3.50	29.49	3.50	0.87
			4.00	31.37	4.00	0.92
			4.50	33.14	4.50	0.97
			5.00	34.82	5.00	1.02
			5.50	36.43	5.50	1.07
			6.00	37.97	6.00	1.12
			6.50	39.45	6.50	1.16
			7.00	59.06	7.00	19.40
			7.50	98.67	7.50	57.66
			8.00	156.34	8.00	114.04
			8.50	232.51	8.50	188.96
			9.00	327.97	9.00	283.19
			9.50	443.61	9.50	397.65
			10.00	580.37	10.00	533.25



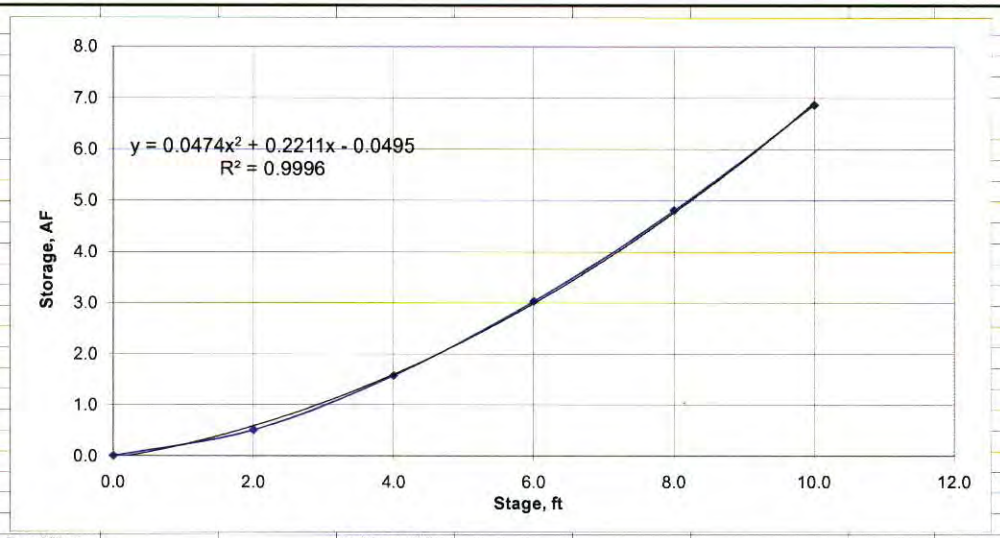
Pond Orifice Sizing

Updated 04/17/11

Castle Oaks POND 390 - ORIGINAL DESIGN

Establish Stage-Storage Curve

Elevation	Stage, ft	Area, SF	Area, ac	Incremental Storage, AF	Cummulative Storage, AF
6442.00	0.00	4755	0.109	0.00	0.00
6444.00	2.00	18725	0.430	0.50	0.50
6446.00	4.00	28053	0.644	1.07	1.57
6448.00	6.00	35657	0.819	1.46	3.03
6450.00	8.00	41507	0.953	1.77	4.80
6452.00	10.00	48565	1.115	2.07	6.86



Orifice Parameters

	CL Elev
Orifice 1	6441.70
Orifice 2	6454.00
Orifice 3	6454.00
Orifice 4	6448.50

Orifice Size			**Orifice 2 Size**			**Box Wier**			**Spillway Wier**		
Diameter =	24	in	Diameter =	18	in	C =	3.1		C =	3.1	
Width =		in	Width =		in	Z =	4		Z =	4	
Height =		in	Height =		in	Length =	6	ft	Length =	15	ft
Orifice Area =	3.1416	ft²	Orifice Area =	1.7671	ft²						

Pond				10-Year Orifice 1, EL. = 6441.70		Outlet Pipe of Pond Orifice 2, EL. = 6454.00		Box Wier Orifice 3, EL. = 6454.00		Controlling Flow	Spillway Wier Orifice 4, EL. = 6448.50				
Elevation	Stage, ft	Total Storage, AF	Incremental Storage, AF	Stage, ft	Q, cfs	Stage, ft	Q, cfs	Stage, ft	Q, cfs	Q, cfs	Stage, ft	Q, cfs	Total Q, cfs	Drain Time, hr	Total Drain Time, hr	
6442.00	0.00	0.00	0.00	0.30	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.0	0.0	
6442.50	0.50	0.07	0.07	0.80	4.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.00	0.3	0.3	
6443.00	1.00	0.22	0.15	1.30	6.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.80	0.3	0.6	
6443.50	1.50	0.39	0.17	1.80	11.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.50	0.2	0.8	
6444.00	2.00	0.58	0.19	2.30	16.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.00	0.2	1.0	
6444.50	2.50	0.80	0.22	2.80	20.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.00	0.1	1.2	
6445.00	3.00	1.04	0.24	3.30	22.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.00	0.1	1.3	
6445.50	3.50	1.31	0.26	3.80	29.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.49	0.1	1.4	
6446.00	4.00	1.59	0.29	4.30	31.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	31.37	0.1	1.5	10-Year WS
6446.50	4.50	1.91	0.31	4.80	33.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	33.14	0.1	1.7	
6447.00	5.00	2.24	0.34	5.30	34.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	34.82	0.1	1.8	
6447.50	5.50	2.60	0.36	5.80	36.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	36.43	0.1	1.9	
6448.00	6.00	2.98	0.38	6.30	37.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	37.97	0.1	2.0	
6448.50	6.50	3.39	0.41	6.80	39.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	39.45	0.1	2.2	Spillway
6449.00	7.00	3.82	0.43	7.30	40.87	0.00	0.00	0.00	0.00	0.00	0.50	18.19	59.06	0.1	2.3	
6449.50	7.50	4.28	0.45	7.80	42.25	0.00	0.00	0.00	0.00	0.00	1.00	56.42	98.67	0.1	2.3	
6450.00	8.00	4.75	0.48	8.30	43.58	0.00	0.00	0.00	0.00	0.00	1.50	112.76	156.34	0.0	2.4	
6450.50	8.50	5.25	0.50	8.80	44.87	0.00	0.00	0.00	0.00	0.00	2.00	187.64	232.51	0.0	2.4	
6451.00	9.00	5.78	0.53	9.30	46.13	0.00	0.00	0.00	0.00	0.00	2.50	281.84	327.97	0.0	2.4	
6451.50	9.50	6.33	0.55	9.80	47.35	0.00	0.00	0.00	0.00	0.00	3.00	396.26	443.61	0.0	2.4	
6452.00	10.00	6.90	0.57	10.30	48.55	0.00	0.00	0.00	0.00	0.00	3.50	531.82	580.37	0.0	2.5	

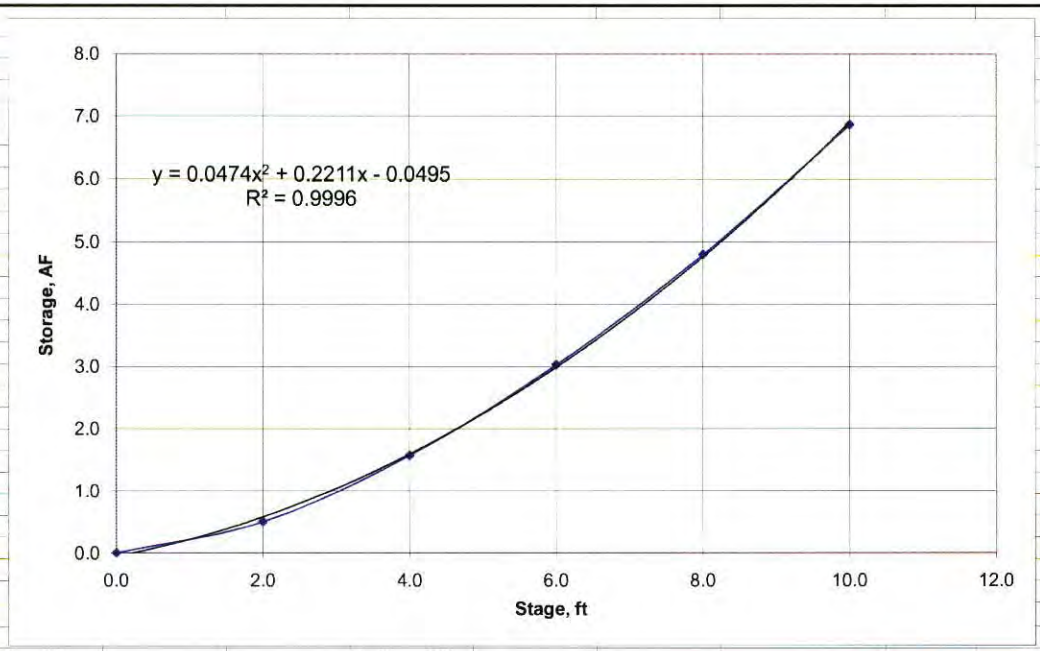
Pond Orifice Sizing

Updated 04/17/11

Castle Oaks POND 390 - EURV DESIGN

Establish Stage-Storage Curve

Elevation	Stage, ft	Area, SF	Area, ac	Incremental Storage, AF	Cummulative Storage, AF
6442.00	0.00	4755	0.109	0.00	0.00
6444.00	2.00	18725	0.430	0.50	0.50
6446.00	4.00	28053	0.644	1.07	1.57
6448.00	6.00	35657	0.819	1.46	3.03
6450.00	8.00	41507	0.953	1.77	4.80
6452.00	10.00	48565	1.115	2.07	6.86



Orifice Parameters

	CL Elev
Orifice 1	6441.70
Orifice 2	6454.00
Orifice 3	6454.00
Orifice 4	6448.50

Orifice Size

Width =		in
Height =		in
Orifice Area =	0.000	ft²

Orifice Size			**Orifice 2 Size**			**Box Wier**			**Spillway Wier**		
Diameter =	4.115	in	Diameter =	18	in	C =	3.1		C =	3.1	
Width =		in	Width =		in	Z =	4		Z =	4	
Height =		in	Height =		in	Length =	6	ft	Length =	15	ft
Orifice Area =	0.0924	ft²	Orifice Area =	1.7671	ft²						

Pond				10-Year Orifice 1, EL. = 6441.70		Outlet Pipe of Pond Orifice 2, EL. = 6454.00		Box Wier Orifice 3, EL. = 6454.00		Controlling Flow	Spillway Wier Orifice 4, EL. = 6448.50					
Elevation	Stage, ft	Total Storage, AF	Incremental Storage, AF	Stage, ft	Q, cfs	Stage, ft	Q, cfs	Stage, ft	Q, cfs	Q, cfs	Stage, ft	Q, cfs	Total Q, cfs	Drain Time, hr	Total Drain Time, hr	
6442.00	0.00	0.00	0.00	0.30	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.0	0.0	
6442.50	0.50	0.07	0.07	0.80	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40	2.8	2.8	
6443.00	1.00	0.22	0.15	1.30	0.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.51	3.9	6.7	
6443.50	1.50	0.39	0.17	1.80	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60	3.7	10.4	
6444.00	2.00	0.58	0.19	2.30	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.67	3.7	14.1	
6444.50	2.50	0.80	0.22	2.80	0.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.74	3.7	17.8	
6445.00	3.00	1.04	0.24	3.30	0.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.81	3.8	21.5	
6445.50	3.50	1.31	0.26	3.80	0.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.87	3.8	25.4	
6446.00	4.00	1.59	0.29	4.30	0.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.92	3.9	29.3	
6446.50	4.50	1.91	0.31	4.80	0.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.97	4.0	33.2	
6447.00	5.00	2.24	0.34	5.30	1.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.02	4.1	37.3	
6447.50	5.50	2.60	0.36	5.80	1.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.07	4.2	41.5	
6448.00	6.00	2.98	0.38	6.30	1.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.12	4.2	45.7	
6448.50	6.50	3.39	0.41	6.80	1.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.16	4.3	50.0	Spillway
6449.00	7.00	3.82	0.43	7.30	1.20	0.00	0.00	0.00	0.00	0.00	0.50	18.19	19.40	0.5	50.5	
6449.50	7.50	4.28	0.45	7.80	1.24	0.00	0.00	0.00	0.00	0.00	1.00	56.42	57.66	0.1	50.7	
6450.00	8.00	4.75	0.48	8.30	1.28	0.00	0.00	0.00	0.00	0.00	1.50	112.76	114.04	0.1	50.7	
6450.50	8.50	5.25	0.50	8.80	1.32	0.00	0.00	0.00	0.00	0.00	2.00	187.64	188.96	0.0	50.8	
6451.00	9.00	5.78	0.53	9.30	1.36	0.00	0.00	0.00	0.00	0.00	2.50	281.84	283.19	0.0	50.8	
6451.50	9.50	6.33	0.55	9.80	1.39	0.00	0.00	0.00	0.00	0.00	3.00	396.26	397.65	0.0	50.8	
6452.00	10.00	6.90	0.57	10.30	1.43	0.00	0.00	0.00	0.00	0.00	3.50	531.82	533.25	0.0	50.8	

Appendix B

Sketches Showing Recommended Detention Facility Modifications

42" RCP AND OUTLET PROTECTION BY OTHERS. SEE CASTLE OAKS ESTATES FILING 1, PHASE 1 DISTRICT PLAN SET.

42" RCP AND OUTLET PROTECTION BT OTHERS. SEE CASTLE OAKS ESTATES FILING 1, PHASE 1 DISTRICT PLAN SET FOR DETAILS OF ROADWAY AND CULVERT CONSTRUCTION.

AUTUM SAGE STREET

T.O. SPILLWAY 6461.5

SPILLWAY AND POND OUTLET DROP STRUCTURES SEE SHEET D8

PROFILE AT CENTERLINE OF TRICKLE CHANNEL SEE SHEET DB6

CULVERT OUTLET PROTECTION SEE SHEET D3, DETAIL 4

TYPE M RIPRAP

POND WATER QUALITY OUTLET STRUCTURE SEE SHEET D9

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2%

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4+00

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30" RCP W/ FES AT OUTLET

CULVERT OUTLET PROTECTION SEE SHEET D3, DETAIL 4

SEE SHEET C8

SEE SHEET C8

24" RCP W/ FES EACH END

DROP STRUCTURE H9 SEE SHEET C30

NORTH

0 10 20 40
(GRAPHIC SCALE IN FEET)

12' ACCESS TRAIL SEE SHEET D4, DETAIL 1

OUTLET MODIFICATION SEE SHEET D9

TOWN OF CASTLE ROCK APPROVALS
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APPROVED BY:

DEVELOPMENT SERVICES DIRECTOR _____ DATE _____

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ENGINEER _____ P.E. NO. _____ DATE _____

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LAKEWOOD, COLORADO 80226
PHONE 303-935-6505
FAX 303-935-6515

REVISIONS			
NO.	DESCRIPTION	DATE	BY
1	DROP H9 REFERENCE	12/03/03	NHS
2	SPILLWAY GRADING	11/24/04	NHS

CITY CASTLE ROCK
COUNTY DOUGLAS
STATE COLORADO

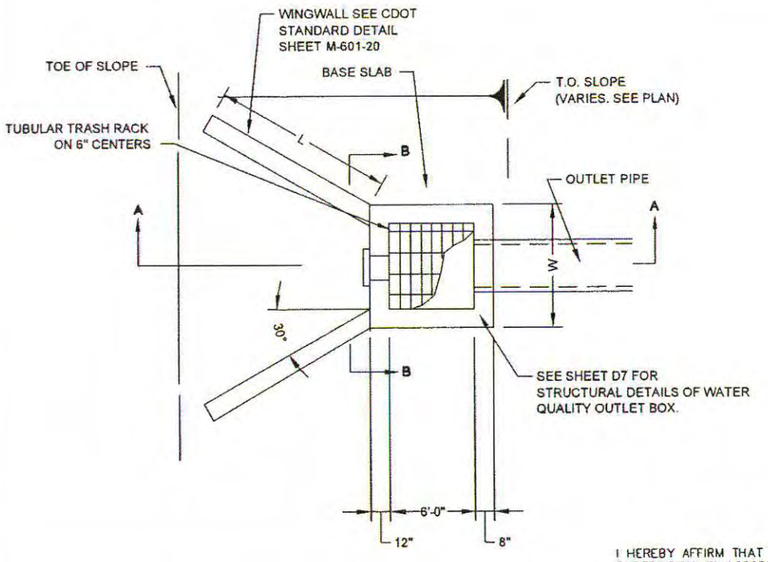
DESIGNED BY: REP
CHECKED BAC
DATE 5/11/03
PROJECT NO. 02-020.000

CASTLE OAKS ESTATES FILING NO. 1
POND 355 - PLAN

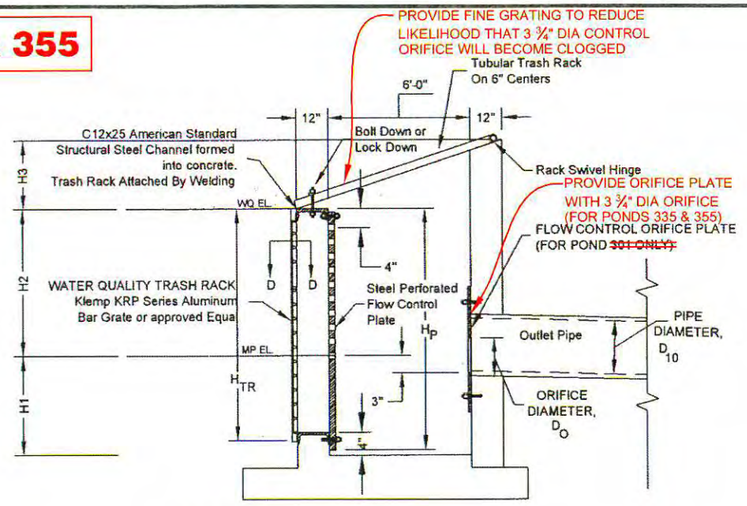
SHEET
DB5

NAME: P:\07-012\01 Castle Rock On-Call\07-012.14 McMurdo Gulch Final Design\CAD\Castle Oaks\Plan Views.dwg
DATE: MAY 16, 2011 TIME: 4:31 PM

PONDS 335 & 355



Plan View-Outlet Box and Wingwalls



Section A-A

OUTLET DIMENSION SCHEDULE

	POND 301	POND 335	POND 355	POND 375
H1	2'-4"	2'-4"	2'-4"	2'-4"
H2	2.5'	5.7'	4.9'	6.4'
D10	18"	30"	30"	18"
BBD	1 1/4" x 3/16"	2" x 3/16"	2" x 3/16"	2" x 3/16"
L	13.3'	33.6'	30.9'	36.0
W	6'-0"	8'-0"	10'-0"	6'0"
Wconc	6"	18"	12"	24"
Wplate	12"	24"	16"	30"
SBB	11/16"	1-3/16"	1-3/16"	1-3/16"
SCR	2"	2"	2"	2"
MP EL.	6471.75	6457.5	6455.1	6341.6
WQ EL.	6474.2	6463.2	6460.0	6348.0
DO	1.0"	NA	NA	NA
T	1/4"	1/4"	1/4"	1/4"
H3	2.67'	2.67'	2.67'	2.67'
Wgrate	3'-6"	4'-0"	3'-6"	4'-0"
Wo	11/16"	1-5/16"	1-3/16"	1 5/8"
Wh	2'-6"	3'-0"	2'-6"	3'-0"
H_P	4'-8"	7'-10 1/2"	7'-1"	8'-7"
H_{TR}	4'-8"	7'-10 1/2"	7'-1"	8'-7"
N_R	5	17	15	19
N_C	1	1	1	1
S_H	NA	NA	NA	NA

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ENGINEER P.E. NO. DATE

TOWN OF CASTLE ROCK APPROVALS
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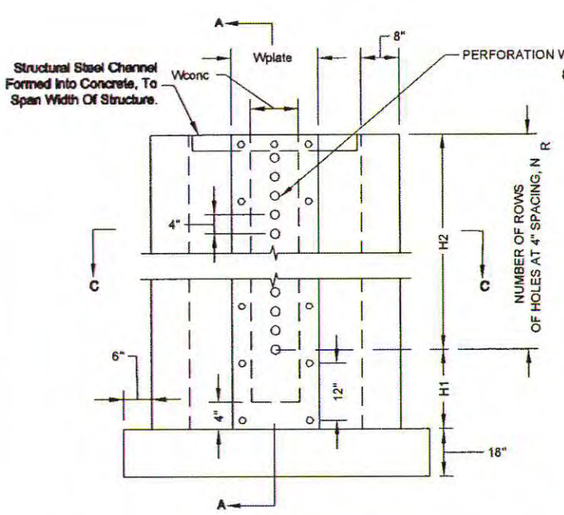
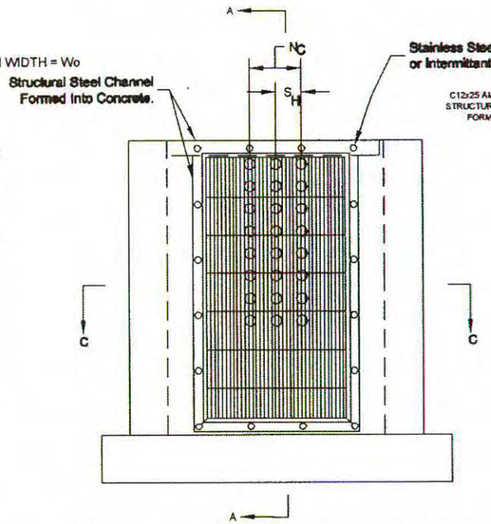
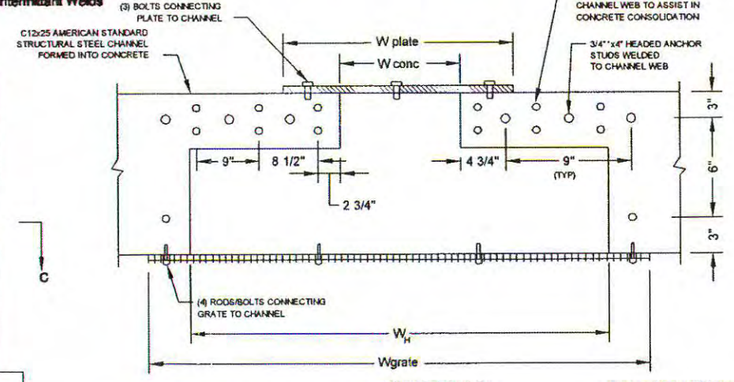
DEVELOPMENT SERVICES DIRECTOR DATE



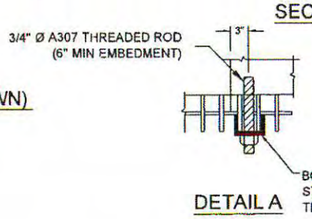
Section B-B (WATER QUALITY TRASH RACK NOT SHOWN)



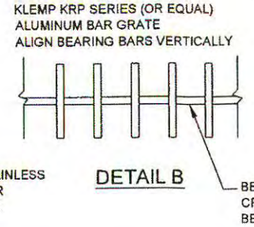
Section B-B (WATER QUALITY TRASH RACK SHOWN)



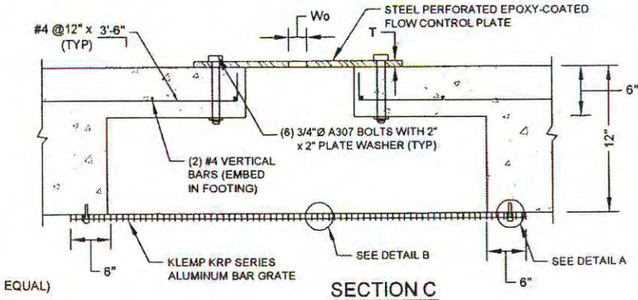
SECTION B



DETAIL A



DETAIL B



SECTION C

NOTES:

1. ALL OUTLET PLATE OPENINGS ARE RECTANGULAR.
2. HEIGHT OF ALL RECTANGULAR OPENINGS = 2 INCHES
3. TYPICAL REINFORCEMENT NOT SHOWN. ONLY ADDITIONAL REINFORMCEMENT SHOWN IN THIS VIEW.

amec
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LAKEWOOD, COLORADO 80226 FAX 303-935-6515

REVISIONS			
NO.	DESCRIPTION	DATE	BY

CITY CASTLE ROCK
COUNTY DOUGLAS
STATE COLORADO

DESIGNED BY: REP
CHECKED BAC
DATE 6/10/03
PROJECT NO. 02-020.000

CASTLE OAKS ESTATES FILING NO. 1
POND WATER QUALITY OUTLET STRUCTURE - DETAILS

SHEET D9

AMBER SUN DRIVE

OUTLET MODIFICATION
SEE SHEET D11

12' ACCESS TRAIL
SEE SHEET D4,
DETAIL 1

POND SPILLWAY
AND OUTLET
DROP
STRUCTURES.
SHEET D8.

T.O. SPILLWAY
6480.3

SEE SHEET C8

DROP STRUCTURE H11 AND H12
SEE SHEET C30

PROFILE AT CENTERLINE OF
TRICKLE CHANNEL. SEE SHEET
DB8.

WINGWALLS AND
APRON. SEE SHEET D6.

MODIFIED TYPE D INLET. SEE CDOT STANDARD DETAIL M-604-11. AN 18" DIAMETER HOLE WILL BE KNOCKED OUT OF THE MIDDLE OF THE "LONG SIDE" OF THE INLET AND AN ORIFICE PLATE AND TRASH RACK WILL BE PLACED OVER HOLE. SEE SHEET D11 DETAILS 2 AND 3 FOR DETAILS OF THE ORIFICE PLATE AND TRASH RACK, RESEPECTIVELY. ELEVATIONS FOR TYPE D INLET ARE PROVIDED IN TABLE 1 OF SHEET D11.

CULVERT OUTLET
PROTECTION
SEE SHEET D3,
DETAIL 4

18" RCP W/ FES
ON OUTLET
AND HEADWALL
WITH WINGWALLS
ON INLET

SEE CASTLE
OAKS FILING 1,
PHASE 1
DISTRICT PLAN
SET FOR DETAILS
OF ROADWAY
AND CULVERT.

AUTUMSAGE STREET

PAINT PONY DRIVE

NORTH
0 20 40
(GRAPHIC SCALE IN FEET)

TOWN OF CASTLE ROCK APPROVALS
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DEVELOPMENT SERVICES DIRECTOR — DATE

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ENGINEER — P.E. NO. — DATE

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REVISIONS			
NO.	DESCRIPTION	DATE	BY
1	NOTE	12/03/03	NHS

CITY CASTLE ROCK
COUNTY DOUGLAS
STATE COLORADO

DESIGNED BY: REP
CHECKED BAC
DATE 5/11/03
PROJECT NO. 02-020.000

CASTLE OAKS ESTATES FILING NO. 1
POND 360 - PLAN

SHEET
DB7

OUTLET MODIFICATION
SEE SHEET D11

PROFILE AT CENTERLINE OF TRICKLE CHANNEL SEE SHEET DB16

POND SPILLWAY AND OUTLET DROP STRUCTURES SEE SHEET D8

WINGWALLS AND APRON SEE SHEET D6

HEADWALL SEE CDOT STANDARD DETAIL M-601-10

TRASH RACK SEE SHEET D11 DETAIL 1

12' WIDE ACCESS TRAIL SEE SHEET D4, DETAIL1

24" RCP

SEE SHEET C17

SEE SHEET C17

48" RCP

48" RCP AND OUTLET PROTECTION BY OTHERS. SEE CASTLE OAKS ESTATES FILING 1, PHASE 1 DISTRICT PLAN SET.

CULVERT OUTLET PROTECTION SEE SHEET D3, DETAIL 4

AUTUMN SAGE DRIVE

12" WATER

8" SAN.

1.5%

1.5%

6440 6445 6450 6455 6460

0+00 1+00 2+00 3+00 4+00 5+00 6+00

DB16 A DB16 B DB16 A DB16 B

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ENGINEERING DIVISION APPROVED BY: _____ DATE _____

DEVELOPMENT SERVICES DIRECTOR _____ DATE _____

NORTH

0 20 40
(GRAPHIC SCALE IN FEET)

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ENGINEER _____ P.E. NO. _____ DATE _____

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REVISIONS			
NO.	DESCRIPTION	DATE	BY
1	PROFILE LABEL AND SECTION	12/03/03	NHS
	CALLOUTS		
2	NO INLET PIPE	11/30/04	NHS

CITY CASTLE ROCK
COUNTY DOUGLAS
STATE COLORADO

DESIGNED BY: REP
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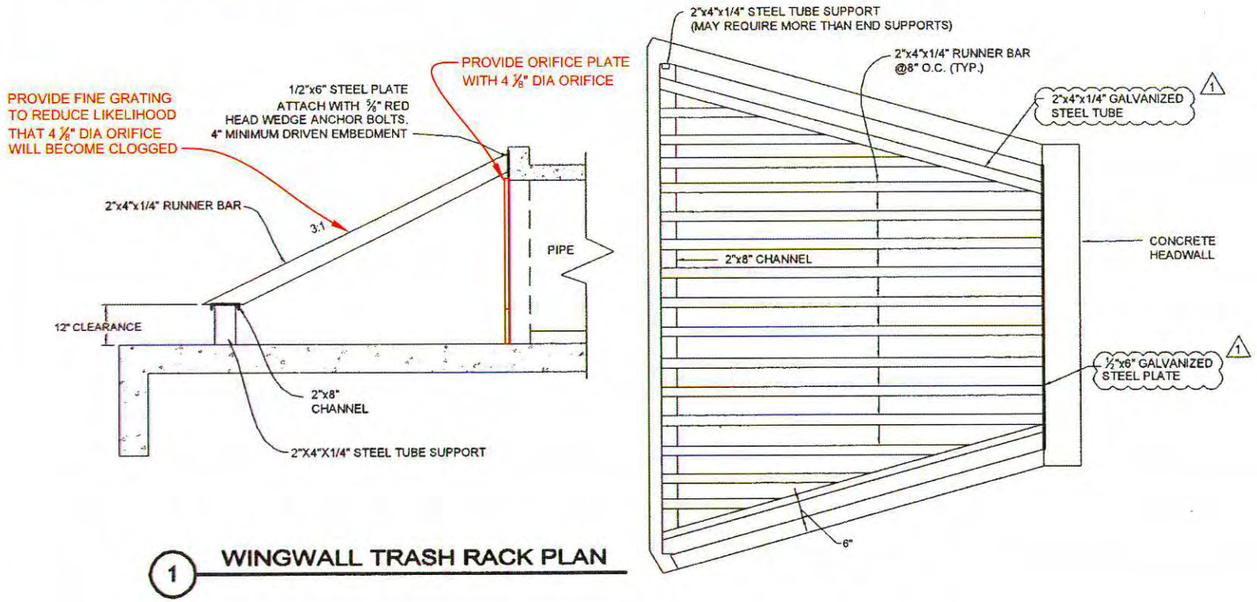
DATE 5/11/03
PROJECT NO. 02-020.000

CASTLE OAKS ESTATES FILING NO. 1
POND 390 - PLAN

SHEET
DB15

POND 390



1 **WINGWALL TRASH RACK PLAN**

TOWN OF CASTLE ROCK APPROVALS
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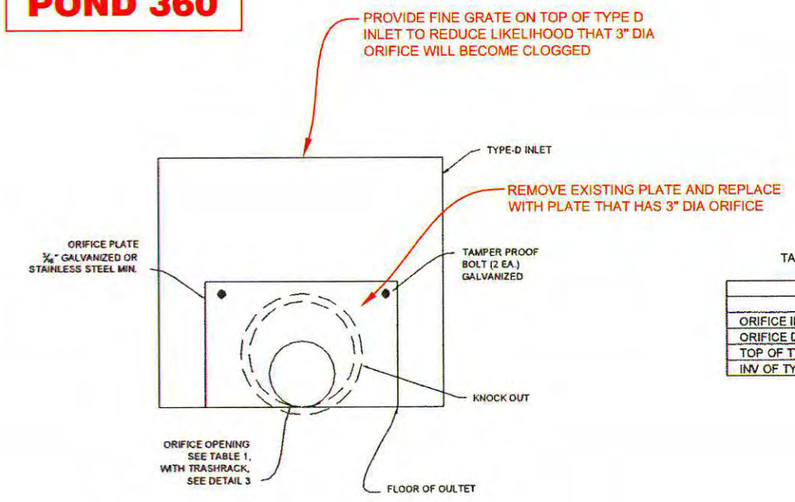
RECOMMENDED APPROVAL:

ENGINEERING DIVISION _____ DATE _____
APPROVED BY:

DEVELOPMENT SERVICES DIRECTOR _____ DATE _____

POND 360



2 **ORIFICE PLATE**

TABLE 1: ORIFICE DIMENSIONS FOR FOR TYPE-D INLETS

	POND	
	360	380
ORIFICE INVERT	6472.8	6412.9
ORIFICE DIAMETER	1.1'	1.3'
TOP OF TYPE-D INLET	6479.0	6417.8
INV OF TYPE-D INLET	6472.7	6412.8

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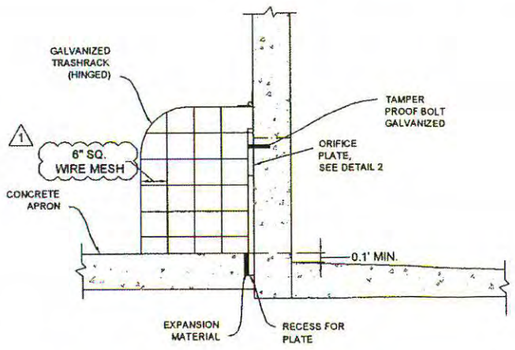

3 **ORIFICE TRASH RACK**

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FAX 303-935-6515

REVISIONS			
NO.	DESCRIPTION	DATE	BY
1	NOTES	10/25/04	NHS

CITY CASTLE ROCK
COUNTY DOUGLAS
STATE COLORADO

DESIGNED BY: REP
CHECKED BAC
DATE 4/21/03
PROJECT NO. 02-020.000

CASTLE OAKS ESTATES FILING NO. 1
DETAILS - INLET TRASH RACKS

SHEET
D11