Arlington Downs
Euclid Avenue and Rohlwing Road
Arlington Heights, Illinois

Phase 2 Improvements
Storm Water Management Report

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PRE-DEVELOPMENT STORM WATER MANAGEMENT

Although not tributary in the pre-development conditions, the Arlington Down development is located on a parcel was included in the design of the Storm Water Management Facility constructed in the early 1980's as a part of the Salt Creek Lane industrial park. As the basin was designed to accommodate the drainage from this site, the site will utilize the storage provided in this Regional basin by re-directing the site drainage to this location. Based on record information received from the MWRD and the Village of Arlington Heights, the following is a short history of the regional detention facility:

> *The original basin was constructed in 1980. The basins were divided into three portions, with the majority of the Industrial Park tributary to the Western Basin, to which the proposed development was included for sizing purposes. This western basin then directed its discharge into the East Basin, located alongside Salt Creek near Euclid Avenue. A second Compensatory Storage Facility was created alongside Salt Creek north of the East Basin to provide compensatory storage for flood plain areas that were re-graded as a part of the Industrial Park construction. Below is a brief summary of the sizing of the original basins.*

>> *West Basin was sized using a discharge of 0.18 cfs/acre, C-value of 0.90 and a tributary area of 46.8 acres using TP40 rainfall data   (10.44 ac-ft)*

>> *North Compensatory Storage Facility – 16.00 Ac-Ft required*

>> *East Basin was sized using the MWRD discharge rate, C-value of 0.90 and a tributary area of 39.9 acres using TP40 rainfall data   (8.57 ac-ft)*

> *In 1982, the regional basins were modified to reduce size of North Compensatory Storage Basin to construct a parking lot within the Compensatory Storage area. In doing so, some of the required Compensatory Volume was relocated to the East Basin and drainage from the watersheds was re-directed to enlarge the tributary to the West Basin.*

>> *West basin was sized using a discharge of 0.18 cfs/acre, C-value of 0.85 and a total tributary area of 69.27 acres using TP40 rainfall data   (15.47 ac-ft)*

>> *North Compensatory Storage Facility – 16.00 Ac-Ft required. A portion of this volume was relocated such that the North Facility contained 9.53 Ac-Ft, with an additional 0.56 Ac-Ft provided on the surface of the parking lot constructed over the Facility. The remaining 5.91 Ac-Ft was relocated to the East Basin.*

>> *East basin was sized using a discharge of 0.18 cfs/acre, although the outlet control was never modified from the original MWRD discharge rate used in the original basin design, C-value of 0.85 and a total tributary area of 12.21 acres using TP40 rainfall data   (2.55 ac-ft)*

> *The 2013 project confirmed the volumes under the MWRD's SPO requirements. In doing so, the tributaries for the Basins were updated to reflect the current as-built condition of the Industrial Park. Additionally, the MWRD and Village of Arlington Heights agreed that any volume of storm water detention provided within this Regional Basin for the Development may be claimed as such.*

West basin was sized using a discharge of 0.18 cfs/acre, C-value of 0.85 and a total tributary area of 71.13 acres using TP40 rainfall data   (15.87 ac-ft)

North Compensatory Storage Facility – 16.00 Ac-Ft required. The 1982 distribution of this volume was maintained: the North Facility contains 9.53 Ac-Ft, with an additional 0.56 Ac-Ft provided on the surface of the parking lot constructed over the Facility. The remaining 5.91 Ac-Ft is located in the East Basin.

East basin was sized using the MWRD discharge rate (the discharge is not tributary to the Village of Arlington Heights) maintaining the original outlet control, C-value of 0.85 and a total tributary area of 15.55 acres using TP40 rainfall data   (2.19 ac-ft)

The design of these original basins used TP40 rainfall data which was the required rainfall at that time (Bulletin 70 was not published until 1989). The Village detention requirements have changed since this time. The 0.18 cfs/acre discharge rate is still the Village requirement however the Village now uses Bulletin 70 rainfall data. The additional Volume required as a result of this change in rainfall data will be provided on the development site.

PROPOSED STORM WATER MANAGEMENT:

As permitted for Phase 1, the entire Arlington Downs campus is tributary to an existing regional detention facility. Per the MWRD permitting for the Phase 1 construction, the Regional Basin was confirmed to contain the necessary volume (under the MWRD SPO) to accommodate the Development at a maximum of 90% impervious area (composite C-value of 0.85). Under the proposed conditions, the 26.82 acre campus has a total impervious coverage of 18.55 acres, for a composite C-Value of 0.72, meaning that no additional storm water detention is required to satisfy MWRD Detention requirements as the full tributary is in conformance with the Regional Basins' design criteria under the SPO. However, the Development creates 12.67 acres of new impervious area. Per the requirements of the WMO, this project will require to provide Volume Control storage for the new impervious areas. The total Volume Control requirement totals 1.05 acre-feet of total Volume Control.

As the Village of Arlington Heights storm water detention criteria are more conservative than that of the MWRDGC, additional volume will be required to be held on-site to satisfy the Village requirements. The Phase 1 improvements included the installation of the central infrastructure for the Development. As such, the Phase 1 construction installed oversized pipes totaling approximately 1.01 ac-ft of storage, while maintaining the two existing surface storage basins to the east and west of the Water Park for an additional 1.10 Ac-Ft of storage as its removal was not necessary for that phase of the Development. The oversized pipes both hold additional storm water detention volume for the Phase 1 construction as well as set the foundation for future storm water detention facilities and campus drainage for future developments.

The proposed Phase 2 improvements will expand on these oversized pipes to provide the necessary added storm water detention volume as required by the Village. Additionally, the MWRD Volume Control storage is also credited toward the Village detention requirement. Because of the Volume Control requirement, minimal additional pipe storage will be required as much of the added volume requirement will be accommodated in the Volume Control facilities.

Because of the topography of the site, the site will be divided into 2 site watersheds, with both being tributary to the West Regional Basin. The majority of the site will be located in the western portion of the site, while a small portion of the property will discharge directly to Salt Creek Lane located east of the Development.

WESTERN SITE AREA

The western portion of the site consists of the vast majority of the Development area. This portion of the site will consist of a tributary area of 26.81 acres containing 15.40 acres of impervious surfaces at the completion of Phase 2. Per the Village Criteria, a total storage of 7.32 acre-feet of detention volume is required for this condition at the allowable release rate of 4.26 cfs. The storage volume provided in the West Regional Basin for this same 26.81 acre area is 5.24 Ac-Ft (at C=85). This leaves a net required storage of 2.08 Ac-Ft to meet the Village's volume requirement.

In addition to meeting the Volume Requirement, the site discharge needs to be compared with the allowed pipe capacity established for the site. Per record documents, the peak allowable discharge to the northern public storm sewer from this Development is 41.64 cfs. Installation of a 22.25" diameter orifice at the Phase 1 outlet control structure will result in a 41.41 cfs discharge and require 2.63 Ac-Ft of total on-site storage required for the West Site Tributary.

The Phase 1 pipe storage constructed contains approximately 1.01 Ac-Ft. Additional pipe storage will be installed bringing the total pipe storage volume to 1.18 Ac-Ft. The remaining 1.45 Ac-Ft of storage will be accommodated at the Volume Control facilities. A series of 7 infiltration areas will be provides throughout the west site area. These will consist of StormTech chamber systems. These plastic arch systems are placed in open graded aggregate to allow for infiltration of storm water. In total, these systems will provide a total of approximately 1.75 Ac-Ft of storage (1.25 VC + 0.50 Detention)

EASTERN SITE AREA

The eastern portion of the site consists of the replacement of the existing paved roadway. The remaining site area will be padded for a future residential building. This portion of the site will consist of a tributary area of 3.15 acres containing 0.90 acres of impervious surfaces at the completion of Phase 2. Per the Village Criteria, a total storage of 0.60 acre-feet of detention volume is required for this condition at the allowable release rate of 0.57 cfs. The storage volume provided in the West Regional Basin for this same 3.15 acre area is 0.70 Ac-Ft (at C=85). This leaves a net required storage of 0 Ac-Ft to meet the Village's volume requirement.

In addition to meeting the Volume Requirement, the site discharge needs to be compared with the allowed pipe capacity established for the site. Per record documents, the peak allowable discharge to the Salt Creek Lane public storm sewer from this Development is 9.32 cfs. Installation of a 12.75" diameter orifice will result in a 9.17 cfs discharge and require 0.17 Ac-Ft of total on-site storage required for the East Site Tributary.

The required 0.17 Ac-Ft of storage will be accommodated at the Volume Control facilities. A StormTech chamber system located near the east property line of the site will provide approximately 0.25 Ac-Ft of total storage volume.

FUTURE STORMWATER DETENTION:

The future site improvements include the construction of two new residential towers. One will be located in the extreme northwest corner of the site, with the other located on the eastern portion. This future condition will increase the total site impervious coverage to 22.29 acres for the full 26.81 acre parcel. This increases the composite C value to 0.82 (per MWRD criteria). As the West Regional Basin was sized for a composite C of 0.85, no additional MWRD volume will be required. However, Volume Control will be required for the 16.41 acres of new impervious area. This will result in a total VC storage of 1.40 Ac-Ft.

This 26.81 acre portion of the site will consist of approximately 17.70 acres of impervious surfaces at the completion of Phase 2. Per the Village Criteria, a total storage of 7.82 acre-feet of detention volume is required for this condition at the allowable release rate of 4.26 cfs. The storage volume provided in the West Regional Basin for this same 26.81 acre area is 5.24 Ac-Ft (at C=85). This leaves a net required storage of 2.58 Ac-Ft to meet the Village's volume requirement.

In addition to meeting the Volume Requirement, the site discharge needs to be compared with the allowed pipe capacity established for the site. Per record documents, the peak allowable discharge to the northern public storm sewer from this Development is 41.64 cfs. The 22.25" diameter orifice at the Phase 1 outlet control structure provides a 41.41 cfs discharge and require 2.87 Ac-Ft of total on-site storage required for the West Site Tributary. An additional

Volume Control facility will be needed for the future residential tower area to enable this runoff to be directly tributary to ta Volume Control facility. This facility will be sized to provide 0.25 Ac-Ft of Volume Control for the new residential tower and parking structure as required for the 2.3 acre impervious area.

EASTERN SITE AREA

This 3.15 acre area is anticipated to contain 2.35 acres of impervious surfaces. Per the Village Criteria, a total storage of 0.97 acre-feet of detention volume is required for this condition at the allowable release rate of 0.57 cfs. The storage volume provided in the West Regional Basin for this same 3.15 acre area is 0.70 Ac-Ft (at C=85). This leaves a net required storage of 0.27 Ac-Ft to meet the Village's volume requirement.

In addition to meeting the Volume Requirement, the site discharge needs to be compared with the allowed pipe capacity established for the site. The 12.75" diameter orifice installed as a part of Phase 2 will result in a 9.17 cfs discharge and require 0.28 Ac-Ft of total on-site storage required for the East Site Tributary.

An additional Volume Control facility will be needed for the future residential tower area to enable this runoff to be directly tributary to ta Volume Control facility. This facility will be sized to provide 0.12 Ac-Ft of Volume Control for the new residential tower as required for the 1.45 acre impervious area. This same system will also account for approximately 0.08 Ac-Ft of additional detention storage. This new 0.20 Ac-Ft system, combined with the 0.25 Ac-Ft of storage provided in the current Phase 2, will result in a total storage provided of 0.45 Ac-Ft for the East Site Tributary.

STORM WATER CONVEYANCE:

As with Phase 1, the on-site storm water detention facility will double as the primary site conveyance system. The current phase of construction will connect to the Phase 1 pipe network which conveys storm water to the north site discharge location. The site catch basins and storm sewers have been designed to convey the 100 year flow to this pipe detention system to eliminate the overflow of water to the public Right of Way prior to the 100 year occurrence.

DRAINAGE SUMMARY - WEST WATERSHED

Arlington Downs   04/02/18
Storm Water Master Plan
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Proposed Conditions

Total Property Area =   26.81 acres

Detained Area =	23.66	acres	0.03697 sq mi		
Impervious Area =	15.40	acres	$C_{impervious}=$	0.90	0.95
Native Area =	-	acres	$C_{native}=$	0.15	
Permeable Paver =	-	acres	$C_{pavers}=$	0.75	
Pervious Area =	8.26	acres	$C_{pervious}=$	0.45	0.50
			$C=$	0.74	0.79

(DETAINED AREA)

	MWRD	VILLAGE	
Allowable Release Rate =	0.30	0.18	cfs/Acre
	7.10	4.26	cfs
MAXIMUM RESTRICTOR DIAMETER =	9.07	7.02	in
ACTUAL RESTRICTOR DIAMETER =	**7.00**		**in**
ALLOWABLE RELEASE RATE =	7.10	4.26	cfs
ACTUAL RELEASE RATE =	**4.23**	**4.23**	**cfs**

VOLUME CONTROL IMPERVIOUS AREA =	513000	SF	(New Impervious Only)
VOLUME CONTROL REQUIREMENT =	42750	CF	(1" Per SF of Imp Area)

DETENTION VOLUME REQUIRED =		7.32	Acre*ft
Volume Provided in Regional Basin =	5.24		
NET DETENTION VOLUME REQUIRED =		2.08	Acre*ft
DETENTION VOLUME PROVIDED =		**2.93**	**Acre*ft**

	MWRD	VILLAGE	
100 YR Restrictor Invert=		709.25	
Basin High Water Elevation=	720.00	720.00	
Basin Spill Elevation=		722.85	+/-

RESTRICTOR SIZING CALCULATIONS - WEST WATERSHED

Arlington Downs   04/02/18
Storm Water Master Plan
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MWRD	VILLAGE

100 YEAR RESTRICTOR	100 YEAR RESTRICTOR

High Water Elevation = 720.00

C_D = 0.61 (constant)

G = 32.20 ft/sec^2

Inv. restrictor = 709.25

Base Flood Elevation = 0.00

$Q_{allowable}$ = 7.10 cfs

$\triangle h$ = minimum or HWL - Inv. - 1/2 Dia. Or HWL-BFE

$\triangle h$ = 10.46 ft.

$Q = C_D A (2gh)^{1/2}$

$A_{restrictor} = (Q_{allowable}) / (C_D(2gh)^{1/2})$

$A_{restrictor}$ = 64.56 in^2

$D_{restrictor}$ = 9.067 in

=> Restrictor diameter = 7.000 inches

Release Rate Based on restrictor diameter

$D_{restrictor}$ = 7.000 in.

$A_{restrictor}$ = 38 in^2

$\triangle h$ = 10.46

$Q = C_D A (2gh)^{1/2}$

Q_{100} = 4.23 c.f.s.

High Water Elevation = 720.00

C_D = 0.61 (constant)

G = 32.20 ft/sec^2

Inv. restrictor = 709.25

Base Flood Elevation = 0.00

$Q_{allowable}$ = 4.26 cfs

$\triangle h$ = minimum or HWL - Inv. - 1/2 Dia. Or HWL-BFE

$\triangle h$ = 10.46 ft.

$Q = C_D A (2gh)^{1/2}$

$A_{restrictor} = (Q_{allowable}) / (C_D(2gh)^{1/2})$

$A_{restrictor}$ = 38.74 in^2

$D_{restrictor}$ = 7.023 in

=> Restrictor diameter = 7.000 inches

Release Rate Based on restrictor diameter

$D_{restrictor}$ = 7.000 in.

$A_{restrictor}$ = 38 in^2

$\triangle h$ = 10.46

$Q = C_D A (2gh)^{1/2}$

Q_{100} = 4.23 c.f.s.

MWRD DETENTION PROVIDED IN REGIONAL BASIN
FOR DISTURBED AREA (PER 13-016)   WEST

Arlington Downs   04/02/18
Storm Water Master Plan

Total Tributary Area:	23.66 acre	
Release Rate:	0.18 cfs/Acre	
	4.26 cfs	
Runoff Coefficient (C):	0.85 Per 13-016	

100-Year Event (MWRD Method)

RUNOFF FACTOR	STORM DURATION (HRS)	RAINFALL INTENSITY (IN/HR)	DRAINAGE AREA (ACRES)	INFLOW RATE (CFS)	RELEASE RATE (CFS)	STORAGE RATE (CFS)	STORAGE REQUIRED (ACRE-FT)
0.85	0.17	7.60	23.66	152.84	4.26	148.58	2.05
0.85	0.33	5.50	23.66	110.61	4.26	106.35	2.93
0.85	0.42	5.00	23.66	100.56	4.26	96.30	3.32
0.85	0.50	4.40	23.66	88.49	4.26	84.23	3.48
0.85	0.67	3.70	23.66	74.41	4.26	70.15	3.87
0.85	0.75	3.50	23.66	70.39	4.26	66.13	4.10
0.85	0.83	3.20	23.66	64.36	4.26	60.10	4.14
0.85	0.92	3.01	23.66	60.53	4.26	56.28	4.26
0.85	1.00	2.80	23.66	56.31	4.26	52.05	4.30
0.85	1.50	2.10	23.66	42.23	4.26	37.97	4.71
0.85	2.00	1.70	23.66	34.19	4.26	29.93	4.95
0.85	3.00	1.25	23.66	25.14	4.26	20.88	5.18
0.85	4.00	1.00	23.66	20.11	4.26	15.85	5.24
0.85	5.00	0.84	23.66	16.89	4.26	12.63	5.22
0.85	6.00	0.73	23.66	14.68	4.26	10.42	5.17
0.85	8.00	0.58	23.66	11.66	4.26	7.41	4.90
0.85	10.00	0.49	23.66	9.85	4.26	5.60	4.62
0.85	12.00	0.43	23.66	8.65	4.26	4.39	4.35
0.85	18.00	0.31	23.66	6.23	4.26	1.98	2.94
0.85	24.00	0.25	23.66	5.03	4.26	0.77	1.53

Maximum Required Storage:	**5.24 acre-ft**

REQUIRED DETENTION 100-YEAR EVENT
TRIBUTARY AREA   WEST

Arlington Downs   04/02/18
Storm Water Master Plan

Total Tributary Area:	23.66	acre
Total Impervious Area	15.40	acre
Actual Release Rate:	4.23	cfs
Runoff Coefficient (C):	0.79	
100 Year Intensity:	7.00	in Bul 70 100yr - 24hr

100-Year Event, Bulletin 70 Rainfall Data

RUNOFF FACTOR	STORM DURATION (HRS)	RAINFALL INTENSITY (IN/HR)	DRAINAGE AREA (ACRES)	INFLOW RATE (CFS)	RELEASE RATE (CFS)	STORAGE RATE (CFS)	STORAGE REQUIRED (ACRE-FT)
0.79	0.08	10.92	23.66	204.86	4.23	200.63	1.33
0.79	0.17	10.02	23.66	187.98	4.23	183.75	2.58
0.79	0.25	8.20	23.66	153.83	4.23	149.60	3.09
0.79	0.50	5.60	23.66	105.06	4.23	100.83	4.17
0.79	1.00	3.56	23.66	66.79	4.23	62.56	5.17
0.79	1.50	2.63	23.66	49.34	4.23	45.11	5.59
0.79	2.00	2.24	23.66	42.02	4.23	37.79	6.25
0.79	3.00	1.62	23.66	30.39	4.23	26.16	6.49
0.79	4.00	1.40	23.66	26.26	4.23	22.04	7.28
0.79	5.00	1.17	23.66	21.95	4.23	17.72	7.32
0.79	6.00	0.95	23.66	17.82	4.23	13.59	6.74
0.79	7.00	0.83	23.66	15.57	4.23	11.34	6.56
0.79	8.00	0.75	23.66	14.07	4.23	9.84	6.51
0.79	9.00	0.68	23.66	12.76	4.23	8.53	6.34
0.79	10.00	0.63	23.66	11.82	4.23	7.59	6.27
0.79	11.00	0.59	23.66	11.07	4.23	6.84	6.22
0.79	12.00	0.55	23.66	10.32	4.23	6.09	6.04
0.79	13.00	0.52	23.66	9.76	4.23	5.53	5.94
0.79	14.00	0.49	23.66	9.19	4.23	4.96	5.74
0.79	15.00	0.46	23.66	8.63	4.23	4.40	5.46
0.79	16.00	0.43	23.66	8.07	4.23	3.84	5.08
0.79	17.00	0.41	23.66	7.69	4.23	3.46	4.87
0.79	18.00	0.39	23.66	7.32	4.23	3.09	4.59

Required Storage:	**7.32 acre-ft**

REQUIRED DETENTION 100-YEAR EVENT
TRIBUTARY AREA   WEST

Arlington Downs   04/02/18
Storm Water Master Plan

Total Tributary Area:	23.66 acre	
Total Impervious Area	15.40 acre	
Actual Release Rate:	41.41 cfs	
Runoff Coefficient (C):	0.79	
100 Year Intensity:	7.00 in	Bul 70 100yr - 24hr

100-Year Event, Bulletin 70 Rainfall Data

RUNOFF FACTOR	STORM DURATION (HRS)	RAINFALL INTENSITY (IN/HR)	DRAINAGE AREA (ACRES)	INFLOW RATE (CFS)	RELEASE RATE (CFS)	STORAGE RATE (CFS)	STORAGE REQUIRED (ACRE-FT)
0.79	0.08	10.92	23.66	204.86	41.41	163.45	1.08
0.79	0.17	10.02	23.66	187.98	41.41	146.57	2.06
0.79	0.25	8.20	23.66	153.83	41.41	112.42	2.32
0.79	0.50	5.60	23.66	105.06	41.41	63.65	2.63
0.79	1.00	3.56	23.66	66.79	41.41	25.38	2.10
0.79	1.50	2.63	23.66	49.34	41.41	7.93	0.98
0.79	2.00	2.24	23.66	42.02	41.41	0.61	0.10
0.79	3.00	1.62	23.66	30.39	41.41	-11.02	-2.73
0.79	4.00	1.28	23.66	24.01	41.41	-17.40	-5.75
0.79	5.00	1.08	23.66	20.26	41.41	-21.15	-8.74
0.79	6.00	0.95	23.66	17.82	41.41	-23.59	-11.70
0.79	7.00	0.83	23.66	15.57	41.41	-25.84	-14.95
0.79	8.00	0.75	23.66	14.07	41.41	-27.34	-18.08
0.79	9.00	0.68	23.66	12.76	41.41	-28.65	-21.31
0.79	10.00	0.63	23.66	11.82	41.41	-29.59	-24.46
0.79	11.00	0.59	23.66	11.07	41.41	-30.34	-27.58
0.79	12.00	0.55	23.66	10.32	41.41	-31.09	-30.84
0.79	13.00	0.52	23.66	9.76	41.41	-31.65	-34.01
0.79	14.00	0.49	23.66	9.19	41.41	-32.22	-37.28
0.79	15.00	0.46	23.66	8.63	41.41	-32.78	-40.64
0.79	16.00	0.43	23.66	8.07	41.41	-33.34	-44.09
0.79	17.00	0.41	23.66	7.69	41.41	-33.72	-47.37
0.79	18.00	0.39	23.66	7.32	41.41	-34.09	-50.72

Minimum Required Storage:	**2.08 acre-ft**
Maximum Release Rate:	**41.64 cfs**
Required Storage:	**2.63 acre-ft**

DRAINAGE SUMMARY - EAST WATERSHED

Arlington Downs   04/02/18
Storm Water Master Plan
PD

ERIKSSON
ENGINEERING
ASSOCIATES, LTD.

Proposed Conditions

Total Property Area =   26.81 acres

Detained Area =	3.15 acres	0.00492 sq mi			
Impervious Area =	0.90 acres	$C_{impervious}$=	0.90	0.95	
Native Area =	- acres	C_{native}=	0.15		
Permeable Paver =	- acres	C_{pavers}=	0.75		
Pervious Area =	2.25 acres	$C_{pervious}$=	0.45	0.50	
		$C =$	0.58	0.63	

DETAINED AREA

	MWRD	VILLAGE	
Allowable Release Rate =	0.30	0.18	cfs/Acre
	0.95	0.57	cfs
MAXIMUM RESTRICTOR DIAMETER =	3.29	2.55	in
ACTUAL RESTRICTOR DIAMETER =	**2.50**		**in**
ALLOWABLE RELEASE RATE =	0.95	0.57	cfs
ACTUAL RELEASE RATE =	**0.54**	**0.54**	**cfs**

VOLUME CONTROL IMPERVIOUS AREA =	39000	SF	(New Impervious Only)
VOLUME CONTROL REQUIREMENT =	3250	CF	(1" Per SF of Imp Area)

DETENTION VOLUME REQUIRED =	0.66	0.66	Acre*ft
Volume Provided in Regional Basin =	0.70		
NET DETENTION VOLUME REQUIRED =	-0.03	-0.03	Acre*ft
DETENTION VOLUME PROVIDED =	**0.00**	**0.00 Acre*ft**	

	MWRD	VILLAGE	
100 YR Restrictor Invert=	709.25		
Basin High Water Elevation=	720.00	720.00	
Basin Spill Elevation=	722.85	+/-	`

RESTRICTOR SIZING CALCULATIONS - EAST

Arlington Downs   04/02/18
Storm Water Master Plan
PD

MWRD

100 YEAR RESTRICTOR

High Water Elevation = 720.00
C_D = 0.61 (constant)
G = 32.20 ft/sec^2
Inv. restrictor = 709.25
Base Flood Elevation = 0.00
$Q_{allowable}$ = 0.95 cfs
$\triangle h$ = minimum or HWL - Inv. - 1/2 Dia. Or HWL-BFE
$\triangle h$ = 10.65 ft.

$Q = C_D A (2gh)^{1/2}$

$A_{restrictor} = (Q_{allowable}) / (C_D (2gh)^{1/2})$

$A_{restrictor}$ = 8.52 in^2
$D_{restrictor}$ = 3.294 in

=> Restrictor diameter = 2.500 inches

Release Rate Based on restrictor diameter

$D_{restrictor}$ = 2.500 in.
$A_{restrictor}$ = 5 in^2
$\triangle h$ = 10.65

$Q = C_D A (2gh)^{1/2}$

Q_{100} = 0.54 c.f.s.

VILLAGE

100 YEAR RESTRICTOR

High Water Elevation = 720.00
C_D = 0.61 (constant)
G = 32.20 ft/sec^2
Inv. restrictor = 709.25
Base Flood Elevation = 0.00
$Q_{allowable}$ = 0.57 cfs
$\triangle h$ = minimum or HWL - Inv. - 1/2 Dia. Or HWL-BFE
$\triangle h$ = 10.65 ft.

$Q = C_D A (2gh)^{1/2}$

$A_{restrictor} = (Q_{allowable}) / (C_D (2gh)^{1/2})$

$A_{restrictor}$ = 5.11 in^2
$D_{restrictor}$ = 2.551 in

=> Restrictor diameter = 2.500 inches

Release Rate Based on restrictor diameter

$D_{restrictor}$ = 2.500 in.
$A_{restrictor}$ = 5 in^2
$\triangle h$ = 10.65

$Q = C_D A (2gh)^{1/2}$

Q_{100} = 0.54 c.f.s.

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MWRD DETENTION PROVIDED IN REGIONAL BASIN
FOR DISTURBED AREA (PER 13-016)   EAST

Arlington Downs   04/02/18
Storm Water Master Plan

Total Tributary Area:	3.15	acre
Release Rate:	0.18	cfs/Acre
	0.57	cfs
Runoff Coefficient (C):	0.85	Per 13-016

100-Year Event (MWRD Method)

RUNOFF FACTOR	STORM DURATION (HRS)	RAINFALL INTENSITY (IN/HR)	DRAINAGE AREA (ACRES)	INFLOW RATE (CFS)	RELEASE RATE (CFS)	STORAGE RATE (CFS)	STORAGE REQUIRED (ACRE-FT)
0.85	0.17	7.60	3.15	20.35	0.57	19.78	0.27
0.85	0.33	5.50	3.15	14.73	0.57	14.16	0.39
0.85	0.42	5.00	3.15	13.39	0.57	12.82	0.44
0.85	0.50	4.40	3.15	11.78	0.57	11.21	0.46
0.85	0.67	3.70	3.15	9.91	0.57	9.34	0.51
0.85	0.75	3.50	3.15	9.37	0.57	8.80	0.55
0.85	0.83	3.20	3.15	8.57	0.57	8.00	0.55
0.85	0.92	3.01	3.15	8.06	0.57	7.49	0.57
0.85	1.00	2.80	3.15	7.50	0.57	6.93	0.57
0.85	1.50	2.10	3.15	5.62	0.57	5.06	0.63
0.85	2.00	1.70	3.15	4.55	0.57	3.98	0.66
0.85	3.00	1.25	3.15	3.35	0.57	2.78	0.69
0.85	4.00	1.00	3.15	2.68	0.57	2.11	0.70
0.85	5.00	0.84	3.15	2.25	0.57	1.68	0.70
0.85	6.00	0.73	3.15	1.95	0.57	1.39	0.69
0.85	8.00	0.58	3.15	1.55	0.57	0.99	0.65
0.85	10.00	0.49	3.15	1.31	0.57	0.74	0.62
0.85	12.00	0.43	3.15	1.15	0.57	0.58	0.58
0.85	18.00	0.31	3.15	0.83	0.57	0.26	0.39
0.85	24.00	0.25	3.15	0.67	0.57	0.10	0.20

Maximum Required Storage:	**0.70 acre-ft**

REQUIRED DETENTION 100-YEAR EVENT
TRIBUTARY AREA   EAST

Arlington Downs   04/02/18
Storm Water Master Plan

Total Tributary Area:	3.15	acre	
Total Impervious Area	0.90	acre	
Actual Release Rate:	0.54	cfs	
Runoff Coefficient (C):	0.63		
100 Year Intensity:	7.00	in	Bul 70 100yr - 24hr

100-Year Event, Bulletin 70 Rainfall Data

RUNOFF FACTOR	STORM DURATION (HRS)	RAINFALL INTENSITY (IN/HR)	DRAINAGE AREA (ACRES)	INFLOW RATE (CFS)	RELEASE RATE (CFS)	STORAGE RATE (CFS)	STORAGE REQUIRED (ACRE-FT)
0.63	0.08	10.92	3.15	21.62	0.54	21.08	0.14
0.63	0.17	10.02	3.15	19.84	0.54	19.30	0.27
0.63	0.25	8.20	3.15	16.24	0.54	15.69	0.32
0.63	0.50	5.60	3.15	11.09	0.54	10.54	0.44
0.63	1.00	3.56	3.15	7.05	0.54	6.50	0.54
0.63	1.50	2.63	3.15	5.21	0.54	4.66	0.58
0.63	2.00	2.24	3.15	4.44	0.54	3.89	0.64
0.63	3.00	1.62	3.15	3.21	0.54	2.66	0.66
0.63	4.00	1.28	3.15	2.53	0.54	1.99	0.66
0.63	5.00	1.08	3.15	2.14	0.54	1.59	0.66
0.63	6.00	0.95	3.15	1.88	0.54	1.34	0.66
0.63	7.00	0.83	3.15	1.64	0.54	1.10	0.64
0.63	8.00	0.75	3.15	1.49	0.54	0.94	0.62
0.63	9.00	0.68	3.15	1.35	0.54	0.80	0.60
0.63	10.00	0.63	3.15	1.25	0.54	0.70	0.58
0.63	11.00	0.59	3.15	1.17	0.54	0.62	0.57
0.63	12.00	0.55	3.15	1.09	0.54	0.54	0.54
0.63	13.00	0.52	3.15	1.03	0.54	0.49	0.52
0.63	14.00	0.49	3.15	0.97	0.54	0.43	0.49
0.63	15.00	0.46	3.15	0.91	0.54	0.37	0.45
0.63	16.00	0.43	3.15	0.85	0.54	0.31	0.41
0.63	17.00	0.41	3.15	0.81	0.54	0.27	0.38
0.63	18.00	0.39	3.15	0.77	0.54	0.23	0.34

Required Storage:	**0.66 acre-ft**

REQUIRED DETENTION 100-YEAR EVENT
TRIBUTARY AREA   EAST

Arlington Downs   04/02/18
Storm Water Master Plan

Total Tributary Area:	3.15 acre	
Total Impervious Area	0.90 acre	
Actual Release Rate:	8.00 cfs	
Runoff Coefficient (C):	0.63	
100 Year Intensity:	7.00 in	Bul 70 100yr - 24hr

100-Year Event, Bulletin 70 Rainfall Data

RUNOFF FACTOR	STORM DURATION (HRS)	RAINFALL INTENSITY (IN/HR)	DRAINAGE AREA (ACRES)	INFLOW RATE (CFS)	RELEASE RATE (CFS)	STORAGE RATE (CFS)	STORAGE REQUIRED (ACRE-FT)
0.63	0.08	10.92	3.15	21.62	8.00	13.62	0.09
0.63	0.17	10.02	3.15	19.84	8.00	11.84	0.17
0.63	0.25	8.20	3.15	16.24	8.00	8.24	0.17
0.63	0.50	5.60	3.15	11.09	8.00	3.09	0.13
0.63	1.00	3.56	3.15	7.05	8.00	-0.95	-0.08
0.63	1.50	2.63	3.15	5.21	8.00	-2.79	-0.35
0.63	2.00	2.24	3.15	4.44	8.00	-3.56	-0.59
0.63	3.00	1.62	3.15	3.21	8.00	-4.79	-1.19
0.63	4.00	1.28	3.15	2.53	8.00	-5.47	-1.81
0.63	5.00	1.08	3.15	2.14	8.00	-5.86	-2.42
0.63	6.00	0.95	3.15	1.88	8.00	-6.12	-3.03
0.63	7.00	0.83	3.15	1.64	8.00	-6.36	-3.68
0.63	8.00	0.75	3.15	1.49	8.00	-6.52	-4.31
0.63	9.00	0.68	3.15	1.35	8.00	-6.65	-4.95
0.63	10.00	0.63	3.15	1.25	8.00	-6.75	-5.58
0.63	11.00	0.59	3.15	1.17	8.00	-6.83	-6.21
0.63	12.00	0.55	3.15	1.09	8.00	-6.91	-6.85
0.63	13.00	0.52	3.15	1.03	8.00	-6.97	-7.49
0.63	14.00	0.49	3.15	0.97	8.00	-7.03	-8.13
0.63	15.00	0.46	3.15	0.91	8.00	-7.09	-8.79
0.63	16.00	0.43	3.15	0.85	8.00	-7.15	-9.45
0.63	17.00	0.41	3.15	0.81	8.00	-7.19	-10.10
0.63	18.00	0.39	3.15	0.77	8.00	-7.23	-10.75

Minimum Required Storage:	**-0.03 acre-ft**
Maximum Release Rate:	**9.32 cfs**
Required Storage:	**0.17 acre-ft**

Arlington Downs
Euclid Avenue and Rohlwing Road
Arlington Heights, Illinois

Phase 2 Improvements
Storm Water Management Report

April 04, 2018

Prepared By: Pat Dimmer

Eriksson Engineering Associates, Ltd.
145 Commerce Drive, Suite A
Grayslake, IL 60030

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PRE-DEVELOPMENT STORM WATER MANAGEMENT

Although not tributary in the pre-development conditions, the Arlington Down development is located on a parcel was included in the design of the Storm Water Management Facility constructed in the early 1980's as a part of the Salt Creek Lane industrial park. As the basin was designed to accommodate the drainage from this site, the site will utilize the storage provided in this Regional basin by re-directing the site drainage to this location. Based on record information received from the MWRD and the Village of Arlington Heights, the following is a short history of the regional detention facility:

> The original basin was constructed in 1980. The basins were divided into three portions, with the majority of the Industrial Park tributary to the Western Basin, to which the proposed development was included for sizing purposes. This western basin then directed its discharge into the East Basin, located alongside Salt Creek near Euclid Avenue. A second Compensatory Storage Facility was created alongside Salt Creek north of the East Basin to provide compensatory storage for flood plain areas that were re-graded as a part of the Industrial Park construction. Below is a brief summary of the sizing of the original basins.

>> West Basin was sized using a discharge of 0.18 cfs/acre, C-value of 0.90 and a tributary area of 46.8 acres using TP40 rainfall data   (10.44 ac-ft)

>> North Compensatory Storage Facility – 16.00 Ac-Ft required

>> East Basin was sized using the MWRD discharge rate, C-value of 0.90 and a tributary area of 39.9 acres using TP40 rainfall data   (8.57 ac-ft)

> In 1982, the regional basins were modified to reduce size of North Compensatory Storage Basin to construct a parking lot within the Compensatory Storage area. In doing so, some of the required Compensatory Volume was relocated to the East Basin and drainage from the watersheds was re-directed to enlarge the tributary to the West Basin.

>> West basin was sized using a discharge of 0.18 cfs/acre, C-value of 0.85 and a total tributary area of 69.27 acres using TP40 rainfall data   (15.47 ac-ft)

>> North Compensatory Storage Facility – 16.00 Ac-Ft required. A portion of this volume was relocated such that the North Facility contained 9.53 Ac-Ft, with an additional 0.56 Ac-Ft provided on the surface of the parking lot constructed over the Facility. The remaining 5.91 Ac-Ft was relocated to the East Basin.

>> East basin was sized using a discharge of 0.18 cfs/acre, although the outlet control was never modified from the original MWRD discharge rate used in the original basin design, C-value of 0.85 and a total tributary area of 12.21 acres using TP40 rainfall data   (2.55 ac-ft)

> The 2013 project confirmed the volumes under the MWRD's SPO requirements. In doing so, the tributaries for the Basins were updated to reflect the current as-built condition of the Industrial Park. Additionally, the MWRD and Village of Arlington Heights agreed that any volume of storm water detention provided within this Regional Basin for the Development may be claimed as such.

West basin was sized using a discharge of 0.18 cfs/acre, C-value of 0.85 and a total tributary area of 71.13 acres using TP40 rainfall data   (15.87 ac-ft)

North Compensatory Storage Facility – 16.00 Ac-Ft required. The 1982 distribution of this volume was maintained: the North Facility contains 9.53 Ac-Ft, with an additional 0.56 Ac-Ft provided on the surface of the parking lot constructed over the Facility. The remaining 5.91 Ac-Ft is located in the East Basin.

East basin was sized using the MWRD discharge rate (the discharge is not tributary to the Village of Arlington Heights) maintaining the original outlet control, C-value of 0.85 and a total tributary area of 15.55 acres using TP40 rainfall data   (2.19 ac-ft)

The design of these original basins used TP40 rainfall data which was the required rainfall at that time (Bulletin 70 was not published until 1989). The Village detention requirements have changed since this time. The 0.18 cfs/acre discharge rate is still the Village requirement however the Village now uses Bulletin 70 rainfall data. The additional Volume required as a result of this change in rainfall data will be provided on the development site.

PROPOSED STORM WATER MANAGEMENT:

As permitted for Phase 1, the entire Arlington Downs campus is tributary to an existing regional detention facility. Per the MWRD permitting for the Phase 1 construction, the Regional Basin was confirmed to contain the necessary volume (under the MWRD SPO) to accommodate the Development at a maximum of 90% impervious area (composite C-value of 0.85). Under the proposed conditions, the 26.82 acre campus has a total impervious coverage of 18.55 acres, for a composite C-Value of 0.72, meaning that no additional storm water detention is required to satisfy MWRD Detention requirements as the full tributary is in conformance with the Regional Basins' design criteria under the SPO. However, the Development creates 12.67 acres of new impervious area. Per the requirements of the WMO, this project will require to provide Volume Control storage for the new impervious areas. The total Volume Control requirement totals 1.05 acre-feet of total Volume Control.

As the Village of Arlington Heights storm water detention criteria are more conservative than that of the MWRDGC, additional volume will be required to be held on-site to satisfy the Village requirements. The Phase 1 improvements included the installation of the central infrastructure for the Development. As such, the Phase 1 construction installed oversized pipes totaling approximately 1.01 ac-ft of storage, while maintaining the two existing surface storage basins to the east and west of the Water Park for an additional 1.10 Ac-Ft of storage as its removal was not necessary for that phase of the Development. The oversized pipes both hold additional storm water detention volume for the Phase 1 construction as well as set the foundation for future storm water detention facilities and campus drainage for future developments.

The proposed Phase 2 improvements will expand on these oversized pipes to provide the necessary added storm water detention volume as required by the Village. Additionally, the MWRD Volume Control storage is also credited toward the Village detention requirement. Because of the Volume Control requirement, minimal additional pipe storage will be required as much of the added volume requirement will be accommodated in the Volume Control facilities.

Because of the topography of the site, the site will be divided into 2 site watersheds, with both being tributary to the West Regional Basin. The majority of the site will be located in the western portion of the site, while a small portion of the property will discharge directly to Salt Creek Lane located east of the Development.

WESTERN SITE AREA

The western portion of the site consists of the vast majority of the Development area. This portion of the site will consist of a tributary area of 26.81 acres containing 15.40 acres of impervious surfaces at the completion of Phase 2. Per the Village Criteria, a total storage of 7.32 acre-feet of detention volume is required for this condition at the allowable release rate of 4.26 cfs. The storage volume provided in the West Regional Basin for this same 26.81 acre area is 5.24 Ac-Ft (at C=85). This leaves a net required storage of 2.08 Ac-Ft to meet the Village's volume requirement.

In addition to meeting the Volume Requirement, the site discharge needs to be compared with the allowed pipe capacity established for the site. Per record documents, the peak allowable discharge to the northern public storm sewer from this Development is 41.64 cfs. Installation of a 22.25" diameter orifice at the Phase 1 outlet control structure will result in a 41.41 cfs discharge and require 2.63 Ac-Ft of total on-site storage required for the West Site Tributary.

The Phase 1 pipe storage constructed contains approximately 1.01 Ac-Ft. Additional pipe storage will be installed bringing the total pipe storage volume to 1.18 Ac-Ft. The remaining 1.45 Ac-Ft of storage will be accommodated at the Volume Control facilities. A series of 7 infiltration areas will be provides throughout the west site area. These will consist of StormTech chamber systems. These plastic arch systems are placed in open graded aggregate to allow for infiltration of storm water. In total, these systems will provide a total of approximately 1.75 Ac-Ft of storage (1.25 VC + 0.50 Detention)

EASTERN SITE AREA

The eastern portion of the site consists of the replacement of the existing paved roadway. The remaining site area will be padded for a future residential building. This portion of the site will consist of a tributary area of 3.15 acres containing 0.90 acres of impervious surfaces at the completion of Phase 2. Per the Village Criteria, a total storage of 0.60 acre-feet of detention volume is required for this condition at the allowable release rate of 0.57 cfs. The storage volume provided in the West Regional Basin for this same 3.15 acre area is 0.70 Ac-Ft (at C=85). This leaves a net required storage of 0 Ac-Ft to meet the Village's volume requirement.

In addition to meeting the Volume Requirement, the site discharge needs to be compared with the allowed pipe capacity established for the site. Per record documents, the peak allowable discharge to the Salt Creek Lane public storm sewer from this Development is 9.32 cfs. Installation of a 12.75" diameter orifice will result in a 9.17 cfs discharge and require 0.17 Ac-Ft of total on-site storage required for the East Site Tributary.

The required 0.17 Ac-Ft of storage will be accommodated at the Volume Control facilities. A StormTech chamber system located near the east property line of the site will provide approximately 0.25 Ac-Ft of total storage volume.

FUTURE STORMWATER DETENTION:

The future site improvements include the construction of two new residential towers. One will be located in the extreme northwest corner of the site, with the other located on the eastern portion. This future condition will increase the total site impervious coverage to 22.29 acres for the full 26.81 acre parcel. This increases the composite C value to 0.82 (per MWRD criteria). As the West Regional Basin was sized for a composite C of 0.85, no additional MWRD volume will be required. However, Volume Control will be required for the 16.41 acres of new impervious area. This will result in a total VC storage of 1.40 Ac-Ft.

This 26.81 acre portion of the site will consist of approximately 17.70 acres of impervious surfaces at the completion of Phase 2. Per the Village Criteria, a total storage of 7.82 acre-feet of detention volume is required for this condition at the allowable release rate of 4.26 cfs. The storage volume provided in the West Regional Basin for this same 26.81 acre area is 5.24 Ac-Ft (at C=85). This leaves a net required storage of 2.58 Ac-Ft to meet the Village's volume requirement.

In addition to meeting the Volume Requirement, the site discharge needs to be compared with the allowed pipe capacity established for the site. Per record documents, the peak allowable discharge to the northern public storm sewer from this Development is 41.64 cfs. The 22.25" diameter orifice at the Phase 1 outlet control structure provides a 41.41 cfs discharge and require 2.87 Ac-Ft of total on-site storage required for the West Site Tributary. An additional

Volume Control facility will be needed for the future residential tower area to enable this runoff to be directly tributary to ta Volume Control facility. This facility will be sized to provide 0.25 Ac-Ft of Volume Control for the new residential tower and parking structure as required for the 2.3 acre impervious area.

EASTERN SITE AREA

This 3.15 acre area is anticipated to contain 2.35 acres of impervious surfaces. Per the Village Criteria, a total storage of 0.97 acre-feet of detention volume is required for this condition at the allowable release rate of 0.57 cfs. The storage volume provided in the West Regional Basin for this same 3.15 acre area is 0.70 Ac-Ft (at C=85). This leaves a net required storage of 0.27 Ac-Ft to meet the Village's volume requirement.

In addition to meeting the Volume Requirement, the site discharge needs to be compared with the allowed pipe capacity established for the site. The 12.75" diameter orifice installed as a part of Phase 2 will result in a 9.17 cfs discharge and require 0.28 Ac-Ft of total on-site storage required for the East Site Tributary.

An additional Volume Control facility will be needed for the future residential tower area to enable this runoff to be directly tributary to ta Volume Control facility. This facility will be sized to provide 0.12 Ac-Ft of Volume Control for the new residential tower as required for the 1.45 acre impervious area. This same system will also account for approximately 0.08 Ac-Ft of additional detention storage. This new 0.20 Ac-Ft system, combined with the 0.25 Ac-Ft of storage provided in the current Phase 2, will result in a total storage provided of 0.45 Ac-Ft for the East Site Tributary.

<u>**STORM WATER CONVEYANCE**</u>:

As with Phase 1, the on-site storm water detention facility will double as the primary site conveyance system. The current phase of construction will connect to the Phase 1 pipe network which conveys storm water to the north site discharge location. The site catch basins and storm sewers have been designed to convey the 100 year flow to this pipe detention system to eliminate the overflow of water to the public Right of Way prior to the 100 year occurrence.

DRAINAGE SUMMARY - WEST WATERSHED

Arlington Downs   04/02/18
Storm Water Master Plan
PD

EE
ERIKSSON
ENGINEERING
ASSOCIATES, LTD.

Proposed Conditions

Total Property Area =   26.81   acres

DETAINED AREA

Detained Area =	23.66	acres	0.03697	sq mi	
Impervious Area =	15.40	acres	$C_{impervious}=$	0.90	0.95
Native Area =	-	acres	$C_{native}=$	0.15	
Permeable Paver =	-	acres	$C_{pavers}=$	0.75	
Pervious Area =	8.26	acres	$C_{pervious}=$	0.45	0.50
			$C=$	0.74	0.79

	MWRD	VILLAGE	
Allowable Release Rate =	0.30	0.18	cfs/Acre
	7.10	4.26	cfs
MAXIMUM RESTRICTOR DIAMETER =	9.07	7.02	in
ACTUAL RESTRICTOR DIAMETER =	**7.00**		**in**
ALLOWABLE RELEASE RATE =	7.10	4.26	cfs
ACTUAL RELEASE RATE =	**4.23**	**4.23**	**cfs**

VOLUME CONTROL IMPERVIOUS AREA =	513000	SF	(New Impervious Only)
VOLUME CONTROL REQUIREMENT =	42750	CF	(1" Per SF of Imp Area)

DETENTION VOLUME REQUIRED =		7.32	Acre*ft
Volume Provided in Regional Basin =	5.24		
NET DETENTION VOLUME REQUIRED =		2.08	Acre*ft
DETENTION VOLUME PROVIDED =		**2.93**	**Acre*ft**

	MWRD	VILLAGE	
100 YR Restrictor Invert=		709.25	
Basin High Water Elevation=	720.00	720.00	
Basin Spill Elevation=		722.85	+/-

RESTRICTOR SIZING CALCULATIONS - WEST WATERSHED

Arlington Downs 04/02/18
Storm Water Master Plan
PD

MWRD	VILLAGE
100 YEAR RESTRICTOR	**100 YEAR RESTRICTOR**

MWRD

High Water Elevation = 720.00
C_D = 0.61 (constant)
G = 32.20 ft/sec^2
Inv. restrictor = 709.25
Base Flood Elevation = 0.00
$Q_{allowable}$ = 7.10 cfs
$\triangle h$ = minimum or HWL - Inv. - 1/2 Dia. Or HWL-BFE
$\triangle h$ = 10.46 ft.

$Q = C_D A (2gh)^{1/2}$

$A_{restrictor} = (Q_{allowable}) / (C_D(2gh)^{1/2})$

$A_{restrictor}$ = 64.56 in^2
$D_{restrictor}$ = 9.067 in

=> Restrictor diameter = 7.000 inches

Release Rate Based on restrictor diameter

$D_{restrictor}$ = 7.000 in.
$A_{restrictor}$ = 38 in^2
$\triangle h$ = 10.46

$Q = C_D A (2gh)^{1/2}$

Q_{100} = 4.23 c.f.s.

VILLAGE

High Water Elevation = 720.00
C_D = 0.61 (constant)
G = 32.20 ft/sec^2
Inv. restrictor = 709.25
Base Flood Elevation = 0.00
$Q_{allowable}$ = 4.26 cfs
$\triangle h$ = minimum or HWL - Inv. - 1/2 Dia. Or HWL-BFE
$\triangle h$ = 10.46 ft.

$Q = C_D A (2gh)^{1/2}$

$A_{restrictor} = (Q_{allowable}) / (C_D(2gh)^{1/2})$

$A_{restrictor}$ = 38.74 in^2
$D_{restrictor}$ = 7.023 in

=> Restrictor diameter = 7.000 inches

Release Rate Based on restrictor diameter

$D_{restrictor}$ = 7.000 in.
$A_{restrictor}$ = 38 in^2
$\triangle h$ = 10.46

$Q = C_D A (2gh)^{1/2}$

Q_{100} = 4.23 c.f.s.

MWRD DETENTION PROVIDED IN REGIONAL BASIN
FOR DISTURBED AREA (PER 13-016)   WEST

Arlington Downs   04/02/18
Storm Water Master Plan

Total Tributary Area:	23.66 acre	
Release Rate:	0.18 cfs/Acre	
	4.26 cfs	
Runoff Coefficient (C):	0.85 Per 13-016	

100-Year Event (MWRD Method)

RUNOFF FACTOR	STORM DURATION (HRS)	RAINFALL INTENSITY (IN/HR)	DRAINAGE AREA (ACRES)	INFLOW RATE (CFS)	RELEASE RATE (CFS)	STORAGE RATE (CFS)	STORAGE REQUIRED (ACRE-FT)
0.85	0.17	7.60	23.66	152.84	4.26	148.58	2.05
0.85	0.33	5.50	23.66	110.61	4.26	106.35	2.93
0.85	0.42	5.00	23.66	100.56	4.26	96.30	3.32
0.85	0.50	4.40	23.66	88.49	4.26	84.23	3.48
0.85	0.67	3.70	23.66	74.41	4.26	70.15	3.87
0.85	0.75	3.50	23.66	70.39	4.26	66.13	4.10
0.85	0.83	3.20	23.66	64.36	4.26	60.10	4.14
0.85	0.92	3.01	23.66	60.53	4.26	56.28	4.26
0.85	1.00	2.80	23.66	56.31	4.26	52.05	4.30
0.85	1.50	2.10	23.66	42.23	4.26	37.97	4.71
0.85	2.00	1.70	23.66	34.19	4.26	29.93	4.95
0.85	3.00	1.25	23.66	25.14	4.26	20.88	5.18
0.85	4.00	1.00	23.66	20.11	4.26	15.85	5.24
0.85	5.00	0.84	23.66	16.89	4.26	12.63	5.22
0.85	6.00	0.73	23.66	14.68	4.26	10.42	5.17
0.85	8.00	0.58	23.66	11.66	4.26	7.41	4.90
0.85	10.00	0.49	23.66	9.85	4.26	5.60	4.62
0.85	12.00	0.43	23.66	8.65	4.26	4.39	4.35
0.85	18.00	0.31	23.66	6.23	4.26	1.98	2.94
0.85	24.00	0.25	23.66	5.03	4.26	0.77	1.53

Maximum Required Storage:	5.24 acre-ft

REQUIRED DETENTION 100-YEAR EVENT
TRIBUTARY AREA   WEST

Arlington Downs   04/02/18
Storm Water Master Plan

Total Tributary Area:	23.66	acre
Total Impervious Area	15.40	acre
Actual Release Rate:	4.23	cfs
Runoff Coefficient (C):	0.79	
100 Year Intensity:	7.00	in	Bul 70 100yr - 24hr

100-Year Event, Bulletin 70 Rainfall Data

RUNOFF FACTOR	STORM DURATION (HRS)	RAINFALL INTENSITY (IN/HR)	DRAINAGE AREA (ACRES)	INFLOW RATE (CFS)	RELEASE RATE (CFS)	STORAGE RATE (CFS)	STORAGE REQUIRED (ACRE-FT)
0.79	0.08	10.92	23.66	204.86	4.23	200.63	1.33
0.79	0.17	10.02	23.66	187.98	4.23	183.75	2.58
0.79	0.25	8.20	23.66	153.83	4.23	149.60	3.09
0.79	0.50	5.60	23.66	105.06	4.23	100.83	4.17
0.79	1.00	3.56	23.66	66.79	4.23	62.56	5.17
0.79	1.50	2.63	23.66	49.34	4.23	45.11	5.59
0.79	2.00	2.24	23.66	42.02	4.23	37.79	6.25
0.79	3.00	1.62	23.66	30.39	4.23	26.16	6.49
0.79	4.00	1.40	23.66	26.26	4.23	22.04	7.28
0.79	5.00	1.17	23.66	21.95	4.23	17.72	7.32
0.79	6.00	0.95	23.66	17.82	4.23	13.59	6.74
0.79	7.00	0.83	23.66	15.57	4.23	11.34	6.56
0.79	8.00	0.75	23.66	14.07	4.23	9.84	6.51
0.79	9.00	0.68	23.66	12.76	4.23	8.53	6.34
0.79	10.00	0.63	23.66	11.82	4.23	7.59	6.27
0.79	11.00	0.59	23.66	11.07	4.23	6.84	6.22
0.79	12.00	0.55	23.66	10.32	4.23	6.09	6.04
0.79	13.00	0.52	23.66	9.76	4.23	5.53	5.94
0.79	14.00	0.49	23.66	9.19	4.23	4.96	5.74
0.79	15.00	0.46	23.66	8.63	4.23	4.40	5.46
0.79	16.00	0.43	23.66	8.07	4.23	3.84	5.08
0.79	17.00	0.41	23.66	7.69	4.23	3.46	4.87
0.79	18.00	0.39	23.66	7.32	4.23	3.09	4.59

Required Storage:	**7.32 acre-ft**

REQUIRED DETENTION 100-YEAR EVENT
TRIBUTARY AREA   WEST

Arlington Downs   04/02/18
Storm Water Master Plan

Total Tributary Area:	23.66 acre		
Total Impervious Area	15.40 acre		
Actual Release Rate:	41.41 cfs		
Runoff Coefficient (C):	0.79		
100 Year Intensity:	7.00 in	Bul 70 100yr - 24hr	

100-Year Event, Bulletin 70 Rainfall Data

RUNOFF FACTOR	STORM DURATION (HRS)	RAINFALL INTENSITY (IN/HR)	DRAINAGE AREA (ACRES)	INFLOW RATE (CFS)	RELEASE RATE (CFS)	STORAGE RATE (CFS)	STORAGE REQUIRED (ACRE-FT)
0.79	0.08	10.92	23.66	204.86	41.41	163.45	1.08
0.79	0.17	10.02	23.66	187.98	41.41	146.57	2.06
0.79	0.25	8.20	23.66	153.83	41.41	112.42	2.32
0.79	0.50	5.60	23.66	105.06	41.41	63.65	2.63
0.79	1.00	3.56	23.66	66.79	41.41	25.38	2.10
0.79	1.50	2.63	23.66	49.34	41.41	7.93	0.98
0.79	2.00	2.24	23.66	42.02	41.41	0.61	0.10
0.79	3.00	1.62	23.66	30.39	41.41	-11.02	-2.73
0.79	4.00	1.28	23.66	24.01	41.41	-17.40	-5.75
0.79	5.00	1.08	23.66	20.26	41.41	-21.15	-8.74
0.79	6.00	0.95	23.66	17.82	41.41	-23.59	-11.70
0.79	7.00	0.83	23.66	15.57	41.41	-25.84	-14.95
0.79	8.00	0.75	23.66	14.07	41.41	-27.34	-18.08
0.79	9.00	0.68	23.66	12.76	41.41	-28.65	-21.31
0.79	10.00	0.63	23.66	11.82	41.41	-29.59	-24.46
0.79	11.00	0.59	23.66	11.07	41.41	-30.34	-27.58
0.79	12.00	0.55	23.66	10.32	41.41	-31.09	-30.84
0.79	13.00	0.52	23.66	9.76	41.41	-31.65	-34.01
0.79	14.00	0.49	23.66	9.19	41.41	-32.22	-37.28
0.79	15.00	0.46	23.66	8.63	41.41	-32.78	-40.64
0.79	16.00	0.43	23.66	8.07	41.41	-33.34	-44.09
0.79	17.00	0.41	23.66	7.69	41.41	-33.72	-47.37
0.79	18.00	0.39	23.66	7.32	41.41	-34.09	-50.72

Minimum Required Storage:	**2.08 acre-ft**
Maximum Release Rate:	**41.64 cfs**
Required Storage:	**2.63 acre-ft**

DRAINAGE SUMMARY - EAST WATERSHED

Arlington Downs   04/02/18
Storm Water Master Plan
PD

ERIKSSON ENGINEERING ASSOCIATES, LTD.

Proposed Conditions

Total Property Area =   26.81   acres

DETAINED AREA

Detained Area =	3.15	acres	0.00492 sq mi		
Impervious Area =	0.90	acres	$C_{impervious}$=	0.90	0.95
Native Area =	-	acres	C_{native}=	0.15	
Permeable Paver =	-	acres	C_{pavers}=	0.75	
Pervious Area =	2.25	acres	$C_{pervious}$=	0.45	0.50
			$C =$	0.58	0.63

	MWRD	VILLAGE	
Allowable Release Rate =	0.30	0.18	cfs/Acre
	0.95	0.57	cfs
MAXIMUM RESTRICTOR DIAMETER =	3.29	2.55	in
ACTUAL RESTRICTOR DIAMETER =	**2.50**		**in**
ALLOWABLE RELEASE RATE =	0.95	0.57	cfs
ACTUAL RELEASE RATE =	**0.54**	**0.54**	**cfs**

VOLUME CONTROL IMPERVIOUS AREA =	39000	SF	(New Impervious Only)
VOLUME CONTROL REQUIREMENT =	3250	CF	(1" Per SF of Imp Area)

	MWRD	VILLAGE	
DETENTION VOLUME REQUIRED =	0.66	0.66	Acre*ft
Volume Provided in Regional Basin =	0.70		
NET DETENTION VOLUME REQUIRED =	-0.03	-0.03	Acre*ft
DETENTION VOLUME PROVIDED =	**0.00**	**0.00**	**Acre*ft**

	MWRD	VILLAGE	
100 YR Restrictor Invert=	709.25		
Basin High Water Elevation=	720.00	720.00	
Basin Spill Elevation=	722.85	+/-	`

RESTRICTOR SIZING CALCULATIONS - EAST

Arlington Downs   04/02/18
Storm Water Master Plan
PD

MWRD	VILLAGE
100 YEAR RESTRICTOR	**100 YEAR RESTRICTOR**

<table>
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High Water Elevation = 720.00
C_D = 0.61   (constant)
G = 32.20   ft/sec^2
Inv. restrictor = 709.25
Base Flood Elevation = 0.00
$Q_{allowable}$ = 0.95   cfs
$\triangle h$ = minimum or HWL - Inv. - 1/2 Dia. Or HWL-BFE
$\triangle h$ = 10.65   ft.

$Q = C_D A(2gh)^{1/2}$

$A_{restrictor} = (Q_{allowable}) / (C_D(2gh)^{1/2})$
$A_{restrictor}$ = 8.52   in^2
$D_{restrictor}$ = 3.294   in

=> Restrictor diameter = 2.500   inches

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High Water Elevation = 720.00
C_D = 0.61   (constant)
G = 32.20   ft/sec^2
Inv. restrictor = 709.25
Base Flood Elevation = 0.00
$Q_{allowable}$ = 0.57   cfs
$\triangle h$ = minimum or HWL - Inv. - 1/2 Dia. Or HWL-BFE
$\triangle h$ = 10.65   ft.

$Q = C_D A(2gh)^{1/2}$

$A_{restrictor} = (Q_{allowable}) / (C_D(2gh)^{1/2})$
$A_{restrictor}$ = 5.11   in^2
$D_{restrictor}$ = 2.551   in

=> Restrictor diameter = 2.500   inches

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Release Rate Based on restrictor diameter

$D_{restrictor}$ = 2.500 in.
$A_{restrictor}$ = 5 in^2
$\triangle h$ = 10.65

$Q = C_D A(2gh)^{1/2}$

Q_{100} = 0.54 c.f.s.

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Release Rate Based on restrictor diameter

$D_{restrictor}$ = 2.500 in.
$A_{restrictor}$ = 5 in^2
$\triangle h$ = 10.65

$Q = C_D A(2gh)^{1/2}$

Q_{100} = 0.54 c.f.s.

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MWRD DETENTION PROVIDED IN REGIONAL BASIN
FOR DISTURBED AREA (PER 13-016)   EAST

Arlington Downs   04/02/18
Storm Water Master Plan

Total Tributary Area:	3.15	acre
Release Rate:	0.18	cfs/Acre
	0.57	cfs
Runoff Coefficient (C):	0.85	Per 13-016

100-Year Event (MWRD Method)

RUNOFF FACTOR	STORM DURATION (HRS)	RAINFALL INTENSITY (IN/HR)	DRAINAGE AREA (ACRES)	INFLOW RATE (CFS)	RELEASE RATE (CFS)	STORAGE RATE (CFS)	STORAGE REQUIRED (ACRE-FT)
0.85	0.17	7.60	3.15	20.35	0.57	19.78	0.27
0.85	0.33	5.50	3.15	14.73	0.57	14.16	0.39
0.85	0.42	5.00	3.15	13.39	0.57	12.82	0.44
0.85	0.50	4.40	3.15	11.78	0.57	11.21	0.46
0.85	0.67	3.70	3.15	9.91	0.57	9.34	0.51
0.85	0.75	3.50	3.15	9.37	0.57	8.80	0.55
0.85	0.83	3.20	3.15	8.57	0.57	8.00	0.55
0.85	0.92	3.01	3.15	8.06	0.57	7.49	0.57
0.85	1.00	2.80	3.15	7.50	0.57	6.93	0.57
0.85	1.50	2.10	3.15	5.62	0.57	5.06	0.63
0.85	2.00	1.70	3.15	4.55	0.57	3.98	0.66
0.85	3.00	1.25	3.15	3.35	0.57	2.78	0.69
0.85	4.00	1.00	3.15	2.68	0.57	2.11	0.70
0.85	5.00	0.84	3.15	2.25	0.57	1.68	0.70
0.85	6.00	0.73	3.15	1.95	0.57	1.39	0.69
0.85	8.00	0.58	3.15	1.55	0.57	0.99	0.65
0.85	10.00	0.49	3.15	1.31	0.57	0.74	0.62
0.85	12.00	0.43	3.15	1.15	0.57	0.58	0.58
0.85	18.00	0.31	3.15	0.83	0.57	0.26	0.39
0.85	24.00	0.25	3.15	0.67	0.57	0.10	0.20

Maximum Required Storage:	**0.70 acre-ft**

REQUIRED DETENTION 100-YEAR EVENT
TRIBUTARY AREA   EAST

Arlington Downs   04/02/18
Storm Water Master Plan

Total Tributary Area:	3.15	acre
Total Impervious Area	0.90	acre
Actual Release Rate:	0.54	cfs
Runoff Coefficient (C):	0.63	
100 Year Intensity:	7.00	in Bul 70 100yr - 24hr

100-Year Event, Bulletin 70 Rainfall Data

RUNOFF FACTOR	STORM DURATION (HRS)	RAINFALL INTENSITY (IN/HR)	DRAINAGE AREA (ACRES)	INFLOW RATE (CFS)	RELEASE RATE (CFS)	STORAGE RATE (CFS)	STORAGE REQUIRED (ACRE-FT)
0.63	0.08	10.92	3.15	21.62	0.54	21.08	0.14
0.63	0.17	10.02	3.15	19.84	0.54	19.30	0.27
0.63	0.25	8.20	3.15	16.24	0.54	15.69	0.32
0.63	0.50	5.60	3.15	11.09	0.54	10.54	0.44
0.63	1.00	3.56	3.15	7.05	0.54	6.50	0.54
0.63	1.50	2.63	3.15	5.21	0.54	4.66	0.58
0.63	2.00	2.24	3.15	4.44	0.54	3.89	0.64
0.63	3.00	1.62	3.15	3.21	0.54	2.66	0.66
0.63	4.00	1.28	3.15	2.53	0.54	1.99	0.66
0.63	5.00	1.08	3.15	2.14	0.54	1.59	0.66
0.63	6.00	0.95	3.15	1.88	0.54	1.34	0.66
0.63	7.00	0.83	3.15	1.64	0.54	1.10	0.64
0.63	8.00	0.75	3.15	1.49	0.54	0.94	0.62
0.63	9.00	0.68	3.15	1.35	0.54	0.80	0.60
0.63	10.00	0.63	3.15	1.25	0.54	0.70	0.58
0.63	11.00	0.59	3.15	1.17	0.54	0.62	0.57
0.63	12.00	0.55	3.15	1.09	0.54	0.54	0.54
0.63	13.00	0.52	3.15	1.03	0.54	0.49	0.52
0.63	14.00	0.49	3.15	0.97	0.54	0.43	0.49
0.63	15.00	0.46	3.15	0.91	0.54	0.37	0.45
0.63	16.00	0.43	3.15	0.85	0.54	0.31	0.41
0.63	17.00	0.41	3.15	0.81	0.54	0.27	0.38
0.63	18.00	0.39	3.15	0.77	0.54	0.23	0.34

Required Storage:	**0.66 acre-ft**

REQUIRED DETENTION 100-YEAR EVENT
TRIBUTARY AREA   EAST

Arlington Downs   04/02/18
Storm Water Master Plan

Total Tributary Area:	3.15 acre	
Total Impervious Area	0.90 acre	
Actual Release Rate:	8.00 cfs	
Runoff Coefficient (C):	0.63	
100 Year Intensity:	7.00 in	Bul 70 100yr - 24hr

100-Year Event, Bulletin 70 Rainfall Data

RUNOFF FACTOR	STORM DURATION (HRS)	RAINFALL INTENSITY (IN/HR)	DRAINAGE AREA (ACRES)	INFLOW RATE (CFS)	RELEASE RATE (CFS)	STORAGE RATE (CFS)	STORAGE REQUIRED (ACRE-FT)
0.63	0.08	10.92	3.15	21.62	8.00	13.62	0.09
0.63	0.17	10.02	3.15	19.84	8.00	11.84	0.17
0.63	0.25	8.20	3.15	16.24	8.00	8.24	0.17
0.63	0.50	5.60	3.15	11.09	8.00	3.09	0.13
0.63	1.00	3.56	3.15	7.05	8.00	-0.95	-0.08
0.63	1.50	2.63	3.15	5.21	8.00	-2.79	-0.35
0.63	2.00	2.24	3.15	4.44	8.00	-3.56	-0.59
0.63	3.00	1.62	3.15	3.21	8.00	-4.79	-1.19
0.63	4.00	1.28	3.15	2.53	8.00	-5.47	-1.81
0.63	5.00	1.08	3.15	2.14	8.00	-5.86	-2.42
0.63	6.00	0.95	3.15	1.88	8.00	-6.12	-3.03
0.63	7.00	0.83	3.15	1.64	8.00	-6.36	-3.68
0.63	8.00	0.75	3.15	1.49	8.00	-6.52	-4.31
0.63	9.00	0.68	3.15	1.35	8.00	-6.65	-4.95
0.63	10.00	0.63	3.15	1.25	8.00	-6.75	-5.58
0.63	11.00	0.59	3.15	1.17	8.00	-6.83	-6.21
0.63	12.00	0.55	3.15	1.09	8.00	-6.91	-6.85
0.63	13.00	0.52	3.15	1.03	8.00	-6.97	-7.49
0.63	14.00	0.49	3.15	0.97	8.00	-7.03	-8.13
0.63	15.00	0.46	3.15	0.91	8.00	-7.09	-8.79
0.63	16.00	0.43	3.15	0.85	8.00	-7.15	-9.45
0.63	17.00	0.41	3.15	0.81	8.00	-7.19	-10.10
0.63	18.00	0.39	3.15	0.77	8.00	-7.23	-10.75

Minimum Required Storage:	**-0.03 acre-ft**
Maximum Release Rate:	**9.32 cfs**
Required Storage:	**0.17 acre-ft**