ASBA 2024

ASBA TECHNICAL MEETING & TRADE SHOW

DECEMBER 3-6, 2024 | ORLANDO, FLORIDA

Irrigation Design to Utilization

AMERICAN SPORTS BUILDERS ASSOCIATION

Goals of the Irrigation System

- Grow Grass
    - Supplement Natural Precipitation
    - Efficient Water Distribution
- Moisture Management of Skinned material
- Cool Grass – Natural and Synthetic
- Moisten Grass for Speed of Play

Review of Design Basics

- WATER SOURCE
  - POTABLE
  - GREY
  - POND OR STREAM

- POTABLE & GREY
  - FLOW – AMOUNT
  - PRESSURE
  - DISTANCE
  - ELEVATION

- POND OR STREAM
  - LOCATION – HORIZONTAL & VERTICAL
  - SIZE

What Information do you need to start the design?

- WATER SOURCE
  - STATIC PRESSURE
    - TYPICALLY PROVIDED BY WATER PURVEYOR, I.E. CITY, COUNTY, STAND ALONE AGENCY.
    - PROVIDED BY DEVELOPMENT ENGINEER IF PART OF A LARGER DEVELOPMENT.
    - PUMP CAPABILITIES.
    - INFO IS ONLY PART OF THE EQUATION.
  - DYNAMIC PRESSURE
    - MEASURED AT OR CLOSE TO POINT OF CONNECTION WITH OTHER WATER RUNNING.
    - PRESSURE CAN VARY THROUGHOUT DAY OR YEAR. TOILET FLUSHES, FILLING WATER TOWERS, ETC.
    - PUMP MAY BE NEEDED TO INCREASE PRESSURE ON POTABLE WATER.
    - PUMP CAPABILITES FOR POND/STREAM/WELL SITUATIONS.
  - FLOW (GPM AVAILABLE)

What Information do you need to start the design?

Flow and Pressure Information

Information for 47th St & Chouteau St at assumed elevation of 796 ft

Fire Hydrant Information

Flow Hydrant No:	110019670	
Flow Hydrant Location:	47TH & CHOUTEAU ST SWC	
Residual Hydrant No:	110019672	
Residual Hydrant Location:	47th & Aminda St	
Approx. Residual Hydrant Elevation:	796	ft
Test Date:	8/2/2024	
Static Pressure:	117	psi
Residual Pressure:	104	psi
Flow:	1424	gpm

Anticipated Static Pressure Range

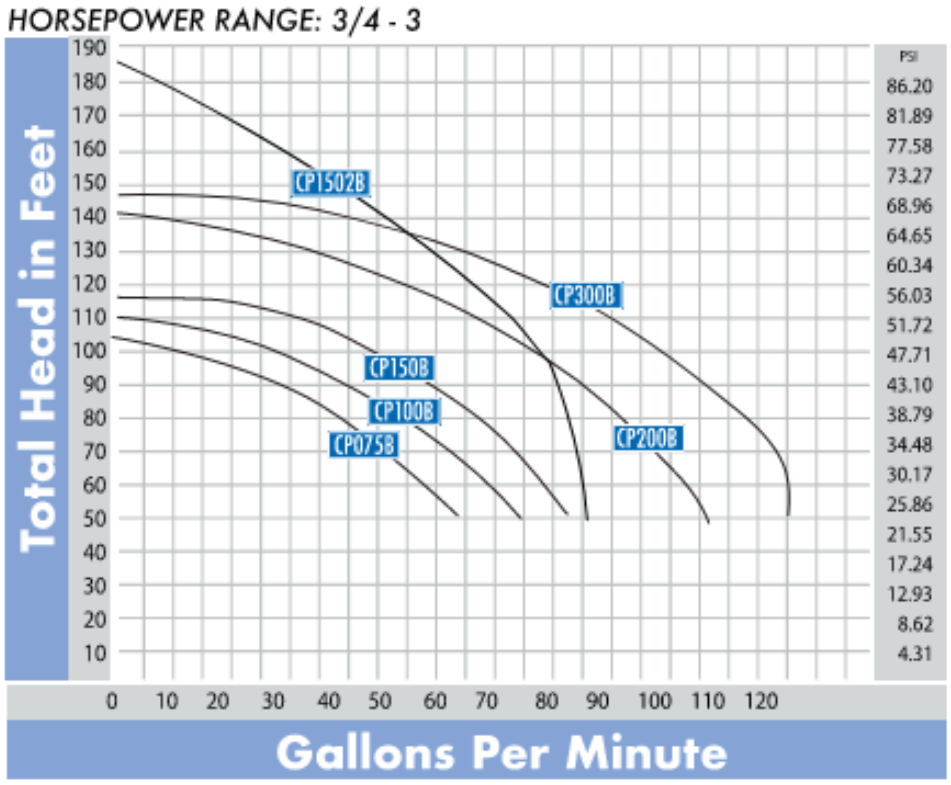
Using 2019 Average for NWRPA

Calculated Pressure Range for 47th St & Chouteau St at elevation 796 ft

Max:	119	psi
Avg:	113	psi
Min:	97	psi

Note: WaterOne doesn't guarantee the accuracy of this information due to the unlimited number of variables that can affect this pressure range.

Initial Report Date: 7/31/2024



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What Information do you need to start the design?

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What Information do you need to start the design?

- SOIL TYPE
  - INFILTRATION RATE/WATER HOLDING CAPACITY
- WATER SOURCE
  - METER REQUIREMENTS
    - STAND ALONE METER
    - SUB-METER
    - SUB METER FOR SEWER REDUCTION
  - BACKFLOW REQUIREMENTS
    - WATER PURVEYOR REQUIREMENTS – RPZ?
- DESIGN GOALS
  - NUMBER OF FIELDS
  - QUALITY EXPECTATION OF TURF
  - WATER WINDOW

What Information do you need to start the design?

- EQUIPMENT
  - HEADS, VALVES, PUMPS, CONTROLLERS, PIPE, QUICK COUPLERS.
  - DOES OWNER HAVE OTHER FACILITIES TO MATCH?
  - DOES TURF MANAGER HAVE A PREFERENCE.
- HEADS
  - MATCH CAPABILITIES OF HEADS WITH WATER SOURCE.
    - GREY AND RAW WATER VS. POTABLE
    - THROW DISTANCE VS PRESSURE AND FLOW AMOUNTS
    - WATER WINDOW
    - WHAT TYPE OF SOIL ENVIRONMENT DO YOU HAVE?
      - STAINLESS STEEL RISERS VS PLASTIC.
    - PHYSICAL CAP SIZE PER SPORT.
    - NOZZLE DIVERSITY

Design Principles

Pressure psi	Nozzle	Radius ft.	Flow gpm	Precip In/h	Precip In/h
30	●	39	2.9	0.37	0.42
	●	43	4.2	0.44	0.50
40	●	41	3.3	0.38	0.44
	●	45	4.9	0.47	0.54
	●	49	6.6	0.53	0.61
	●	51	8.1	0.60	0.69
	●	53	9.7	0.66	0.77
	●	55	11.3	0.72	0.83
	●	55	12.6	0.80	0.93
	●	59	13.7	0.76	0.87
50	●	41	3.7	0.42	0.49
	●	47	5.5	0.44	0.51
	●	51	7.4	0.55	0.63
	●	53	9.1	0.62	0.72
	●	55	11.0	0.70	0.81
	●	59	12.7	0.70	0.81
	●	61	14.3	0.74	0.85
	●	59	15.4	0.85	0.98
60	●	41	4.0	0.46	0.53
	●	47	6.0	0.52	0.60
	●	51	8.2	0.61	0.70
	●	55	10.0	0.64	0.73
	●	57	12.2	0.72	0.83
	●	61	14.0	0.72	0.84
	●	63	15.7	0.76	0.88
	●	63	17.1	0.83	0.96
70	●	41	4.4	0.50	0.58
	●	49	6.3	0.51	0.58
	●	51	8.9	0.66	0.76
	●	57	10.8	0.64	0.74
	●	59	13.2	0.73	0.84
	●	61	15.2	0.79	0.91
	●	63	16.9	0.82	0.95
	●	65	18.3	0.83	0.96
80	●	43	4.6	0.48	0.55
	●	49	6.9	0.55	0.64
	●	53	9.4	0.64	0.74
	●	55	11.6	0.74	0.85
	●	61	14.0	0.72	0.84
	●	61	16.2	0.84	0.97
	●	63	18.1	0.88	1.01
	●	65	19.6	0.89	1.03
90	●	65	21.7	0.99	1.14

Precipitation rates based on half-circle operation
■ *Square spacing based on 50% diameter of throw*
▲ *Triangular spacing based on 50% diameter of throw*

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What Information do you need to start the design?

- VALVES
  - DIRECT WIRE
  - TWO WIRE
  - PRESSURE COMPENSATING
  - DIRTY WATER
  - LOCATION
    - IN FIELD
    - OUTSIDE FIELD
    - CLUSTERED
  - ISOLATION VALVES
    - FUTURE MAINTENANCE CAPABILITIES

What Information do you need to start the design?

- CONTROLLER
  - CENTRAL CONTROL
  - DIRECT WIRE VS TWO WIRE
  - HAND HELD REMOTE CONTROL
  - DIRECT VISUAL LOCATION
  - SECURITY
- PIPE
  - PVC
  - HDPE
  - SWING JOINTS

Design Principles

- PRESSURE LOSS
- FLOW
- PIPE SIZING

PVC Class 200 IPS Plastic Pipe

(1120, 1220) SDR 21 C=150

psi Loss per 100 Feet of Pipe (psi/100 ft.)

Sizes 3/4" through 6" Flow 1 through 600 gpm

Nominal Size	3/4"		1"		1 1/4"		1 1/2"		2"		2 1/2"		3"		4"		6"	
Pipe OD	1.050		1.315		1.660		1.900		2.375		2.875		3.500		4.500		6.625	
Avg. ID	0.91		1.169		1.482		1.7		2.129		2.581		3.146		4.046		5.955	
Avg. Wall	0.070		0.073		0.089		0.100		0.123		0.147		0.177		0.227		0.335	
Tolerance	0.020		0.020		0.020		0.020		0.020		0.020		0.020		0.026		0.038	
Min. Wall	0.060		0.063		0.079		0.090		0.113		0.137		0.167		0.214		0.316	
Flow (gpm)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)
1	0.49	0.07	0.30	0.02	0.19	0.01	0.14	0.00	0.09	0.00	0.06	0.00	0.04	0.00	0.02	0.00	0.01	0.00
2	0.99	0.24	0.60	0.07	0.37	0.02	0.28	0.01	0.18	0.00	0.12	0.00	0.08	0.00	0.05	0.00	0.02	0.00
3	1.48	0.52	0.90	0.15	0.56	0.05	0.42	0.02	0.27	0.01	0.18	0.00	0.12	0.00	0.07	0.00	0.03	0.00
4	1.97	0.88	1.19	0.26	0.74	0.08	0.56	0.04	0.36	0.01	0.24	0.01	0.16	0.00	0.10	0.00	0.05	0.00
5	2.46	1.33	1.49	0.39	0.93	0.12	0.71	0.06	0.45	0.02	0.31	0.01	0.21	0.00	0.12	0.00	0.06	0.00
6	2.96	1.86	1.79	0.55	1.11	0.17	0.85	0.09	0.54	0.03	0.37	0.01	0.25	0.00	0.15	0.00	0.07	0.00
7	3.45	2.47	2.09	0.73	1.30	0.23	0.99	0.12	0.63	0.04	0.43	0.02	0.29	0.01	0.17	0.00	0.08	0.00
8	3.94	3.17	2.39	0.94	1.49	0.30	1.13	0.15	0.72	0.05	0.49	0.02	0.33	0.01	0.20	0.00	0.09	0.00
9	4.43	3.94	2.69	1.17	1.67	0.37	1.27	0.19	0.81	0.06	0.55	0.02	0.37	0.01	0.22	0.00	0.10	0.00
10	4.93	4.79	2.99	1.42	1.86	0.45	1.41	0.23	0.90	0.08	0.61	0.03	0.41	0.01	0.25	0.00	0.12	0.00
11	5.42	5.72	3.28	1.69	2.04	0.53	1.55	0.27	0.99	0.09	0.67	0.04	0.45	0.01	0.27	0.00	0.13	0.00
12	5.91	6.71	3.58	1.98	2.23	0.63	1.69	0.32	1.08	0.11	0.73	0.04	0.49	0.02	0.30	0.00	0.14	0.00
14	6.90	8.93	4.18	2.64	2.60	0.83	1.98	0.43	1.26	0.14	0.86	0.06	0.58	0.02	0.35	0.01	0.16	0.00
16	7.88	11.44	4.78	3.38	2.97	1.07	2.26	0.55	1.44	0.18	0.98	0.07	0.66	0.03	0.40	0.01	0.18	0.00
18	8.87	14.23	5.37	4.21	3.34	1.33	2.54	0.68	1.62	0.23	1.10	0.09	0.74	0.03	0.45	0.01	0.21	0.00
20	9.85	17.29	5.97	5.11	3.72	1.61	2.82	0.83	1.80	0.28	1.22	0.11	0.82	0.04	0.50	0.01	0.23	0.00
22	10.84	20.63	6.57	6.10	4.09	1.92	3.11	0.99	1.98	0.33	1.35	0.13	0.91	0.05	0.55	0.01	0.25	0.00
24	11.82	24.24	7.17	7.17	4.46	2.26	3.39	1.16	2.16	0.39	1.47	0.15	0.99	0.06	0.60	0.02	0.28	0.00
26	12.81	28.11	7.76	8.31	4.83	2.62	3.67	1.34	2.34	0.45	1.59	0.18	1.07	0.07	0.65	0.02	0.30	0.00
28	13.80	32.25	8.36	9.53	5.20	3.01	3.95	1.54	2.52	0.52	1.71	0.20	1.15	0.08	0.70	0.02	0.32	0.00
30	14.78	36.64	8.96	10.83	5.57	3.41	4.24	1.75	2.70	0.59	1.84	0.23	1.24	0.09	0.75	0.03	0.35	0.00
35			10.45	14.41	6.50	4.54	4.94	2.33	3.15	0.78	2.14	0.31	1.44	0.12	0.87	0.03	0.40	0.01
40			11.94	18.45	7.43	5.82	5.65	2.98	3.60	1.00	2.45	0.39	1.65	0.15	1.00	0.04	0.46	0.01
45			13.44	22.95	8.36	7.24	6.35	3.71	4.05	1.24	2.76	0.49	1.86	0.19	1.12	0.05	0.52	0.01
50			14.93	27.90	9.29	8.79	7.06	4.51	4.50	1.51	3.06	0.59	2.06	0.23	1.25	0.07	0.58	0.01
55					10.22	10.49	7.76	5.38	4.95	1.80	3.37	0.71	2.27	0.27	1.37	0.08	0.63	0.01
60					11.15	12.33	8.47	6.32	5.40	2.11	3.67	0.83	2.47	0.32	1.50	0.09	0.69	0.01
65					12.07	14.30	9.18	7.33	5.85	2.45	3.98	0.96	2.68	0.37	1.62	0.11	0.75	0.02
70					13.00	16.40	9.88	8.41	6.30	2.81	4.29	1.10	2.89	0.42	1.74	0.12	0.81	0.02
75					13.93	18.63	10.59	9.56	6.75	3.20	4.59	1.25	3.09	0.48	1.87	0.14	0.86	0.02
80					14.86	21.00	11.29	10.77	7.20	3.60	4.90	1.41	3.30	0.54	1.99	0.16	0.92	0.02
85							12.00	12.05	7.65	4.03	5.21	1.58	3.50	0.60	2.12	0.18	0.98	0.03
90							12.71	13.40	8.10	4.48	5.51	1.76	3.71	0.67	2.24	0.20	1.04	0.03
95							13.41	14.81	8.55	4.95	5.82	1.94	3.92	0.74	2.37	0.22	1.09	0.03
100							14.12	16.28	9.00	5.45	6.12	2.13	4.12	0.81	2.49	0.24	1.15	0.04
110									9.90	6.50	6.74	2.55	4.53	0.97	2.74	0.29	1.27	0.04
120									10.80	7.63	7.35	2.99	4.95	1.14	2.99	0.34	1.38	0.05
130									11.70	8.85	7.96	3.47	5.36	1.32	3.24	0.39	1.50	0.06
140									12.60	10.16	8.57	3.98	5.77	1.52	3.49	0.45	1.61	0.07
150									13.50	11.54	9.19	4.52	6.18	1.73	3.74	0.51	1.73	0.08
160									14.40	13.01	9.80	5.10	6.60	1.95	3.99	0.57	1.84	0.09
170											10.41	5.70	7.01	2.18	4.24	0.64	1.96	0.10
180											11.02	6.34	7.42	2.42	4.49	0.71	2.07	0.11
190											11.64	7.01	7.83	2.67	4.74	0.79	2.19	0.12
200											12.25	7.71	8.24	2.94	4.98	0.86	2.30	0.13
225											13.78	9.58	9.28	3.66	5.61	1.08	2.59	0.16
250											15.31	11.65	10.31	4.45	6.23	1.31	2.88	0.20
275													11.34	5.30	6.85	1.56	3.16	0.24
300													12.37	6.23	7.48	1.83	3.45	0.28
325													13.40	7.23	8.10	2.12	3.74	0.32
350													14.43	8.29	8.72	2.44	4.03	0.37
375															9.35	2.77	4.31	0.42
400															9.97	3.12	4.60	0.48
425															10.59	3.49	4.89	0.53
450															11.22	3.88	5.18	0.59
475															11.84	4.29	5.47	0.65
500															12.46	4.72	5.75	0.72
550															13.71	5.63	6.33	0.86
600															14.95	6.61	6.90	1.01

Pressure Loss Through Water Meters

Pressure Loss: psi
Nominal Size

Flow gpm	5/8"	3/4"	1"	1 1/2"	2"	3"	4"
1	0.2	0.1					
2	0.3	0.2					
3	0.4	0.3					
4	0.6	0.5	0.1				
5	0.9	0.6	0.2				
6	1.3	0.7	0.3				
7	1.8	0.8	0.4				
8	2.3	1.0	0.5				
9	3.0	1.3	0.6				
10	3.7	1.6	0.7				
11	4.4	1.9	0.8				
12	5.1	2.2	0.9				
13	6.1	2.6	1.0				
14	7.2	3.1	1.1				
15	8.3	3.6	1.2				
16	9.4	4.1	1.4	0.4			
17	10.7	4.6	1.6	0.5			
18	12.0	5.2	1.8	0.6			
19	13.4	5.8	2.0	0.7			
20	15.0	6.5	2.2	0.8			
22		7.9	2.8	1.0			
24		9.5	3.4	1.2			
26		11.2	4.0	1.4			
28		13.0	4.6	1.6			
30		15.0	5.3	1.8			
32			6.0	2.1	0.8		
34			6.9	2.4	0.9		
36			7.8	2.7	1.0		
38			8.7	3.0	1.2		
40			9.6	3.3	1.3		
42			10.6	3.6	1.4		
44			11.7	3.9	1.5		
46			12.8	4.2	1.6		
48			13.9	4.5	1.7		
50			15.0	4.9	1.9	0.7	
52				5.3	2.1		
54				5.7	2.2		
56				6.2	2.3		
58				6.7	2.5		
60				7.2	2.7		
65				8.3	3.2	1.1	
70				9.8	3.7	1.3	
75				11.2	4.3	1.5	
80				12.8	4.9	1.6	0.7
90				16.1	6.2	2.0	0.8
100				20.0	7.8	2.5	0.9
110					9.5	2.9	1.0
120					11.3	3.4	1.2
130					13.0	3.9	1.4
140					15.1	4.5	1.6
150					17.3	5.1	1.8
160					20.0	5.8	2.1
170						6.5	2.4
180						7.2	2.7
190						8.0	3.0
200						9.0	3.2
220						11.0	3.9
240						13.0	4.7
260						15.0	5.5
280						17.3	6.3
300						20.0	7.2
350							10.0
400							13.0
450							16.2
500							20.0

PRESSURE CALCULATIONS:

Dynamic Pressure:	40.00 psi
Loss through 2" meter	- 5.00 psi
Loss from elevation (12' x .433)	- 5.20
Loss from pipe friction (0.61 x 13) (PE SDR rated tube)	- 7.93
Loss through Backflow:	- 10.00
Loss Through RCV:	- 3.00
Distance to last head (.5 x 1.2)+(.5 x 0.8)+(.5 x 1.2)+(.5 x .52)=(5.85 x .46)=	-4.55
PSI at furthest head:	4.32

To operate efficiently, the system will need a 60 lb. boost.

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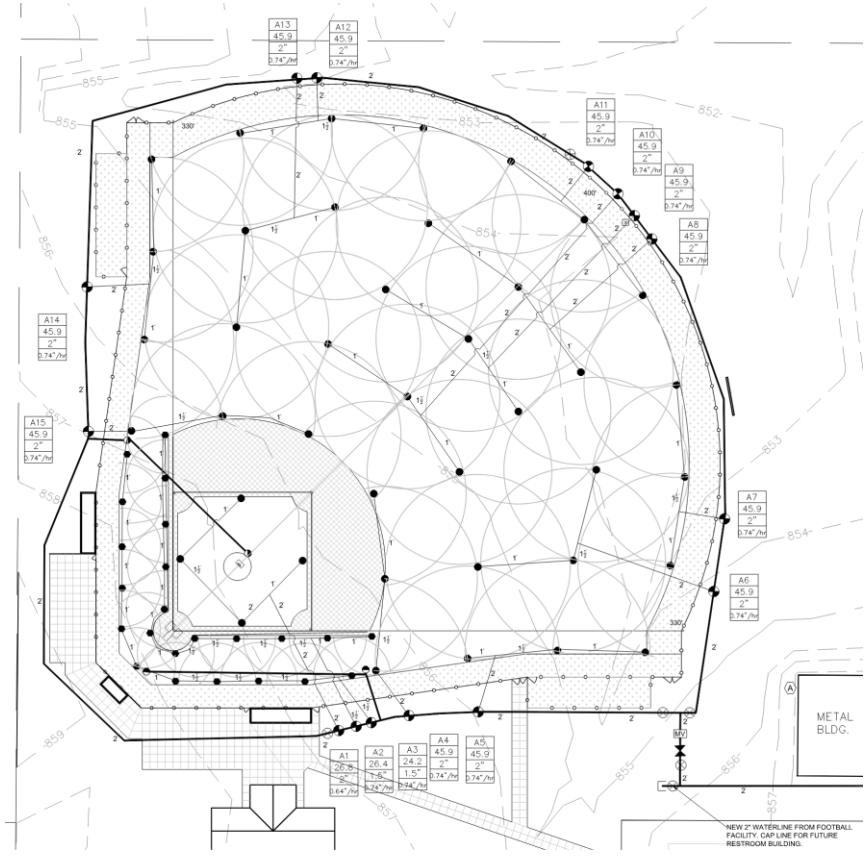
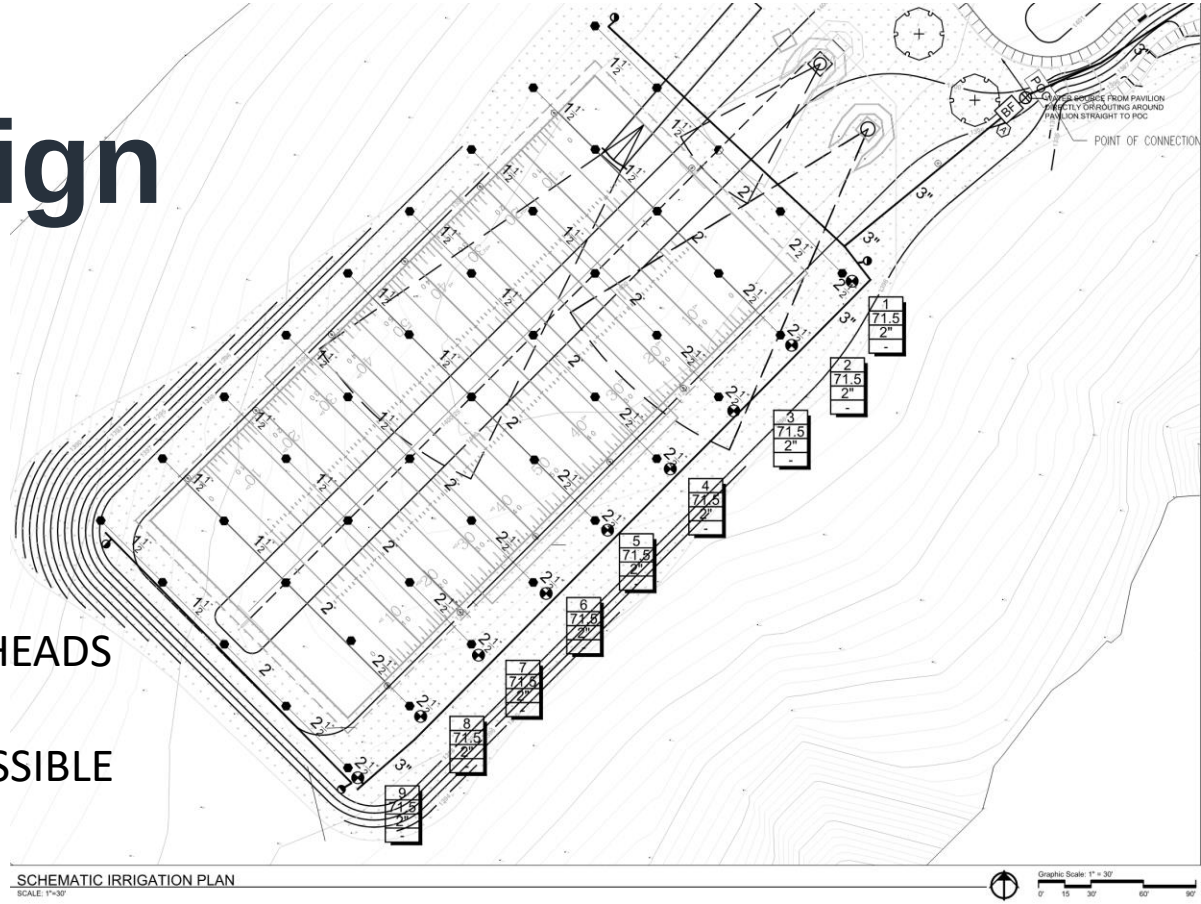
How to start your design

- HEAD LAYOUT
  - SQUARE VS TRIANGLE
  - RECTANGULAR VS RADIUS SHAPED FIELDS.
  - OVERSPRAY – GRASS @ SKIN, SOIL @ SAND.
- QUICK COUPLER LOCATIONS
  - GROUNDKEEPER PREFERENCE
  - HIGH WEAR AREAS



How to start your design

- ZONING
  - MAINTENANCE REQUIREMENTS/REQUESTS.
    - RE-SODDING BETWEEN HASH MARKS ON AMERICAN FOOTBALL.
    - ARRANGEMENT TO ALLOW SYSTEMATIC PAINTING.
    - WET DOWN FIELD AT HALFTIME.
  - CAPABILITY OF WATER SOURCE DETERMINES NUMBER OF HEADS PER ZONE.
  - KEEP PARTIAL AND FULL HEADS ON SEPARATE ZONES IF POSSIBLE (REDUCING THE NUMBER OF NOZZLES USED.
  - KEEP HIGH SPEED HEADS ON SEPARATE ZONES.



What to be careful of.

- HEAD LAYOUT
  - FOOTBALL GOAL POSTS
  - SOCCER GOALS
  - HIGH WEAR AREAS - EXTRA POINT, PENALTY KICK, CORNER KICK, PITCHERS MOUND, 1ST AND 3RD BASE.
- EQUIPMENT NEAR SEATING AREAS
  - LITTLE KIDS WILL PICK AND PROBE ANYTHING/EVERYTHING.

Troubleshooting

- NOT ENOUGH COVERAGE
  - VERIFY CORRECT NOZZLING
  - CLEAN HEADS/NOZZLES
  - CLEAN VALVES.
  - CHECK BACKFLOW.
  - CHECK PRESSURE AT SOURCE.
- HEADS STICKING
  - SCORED RISERS
  - VALVE NOT FULLY CLOSED
- ZONES NOT WORKING
  - DAMAGED WIRING
  - DAMAGED VALVE
  - DE-CODER MALFUNCTION

ASBA 2024

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Irrigation Design to Utilization

QUESTIONS?

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